PREVALENCE, CORRELATES AND COMMON COMORBIDITIES OF ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD) IN PRIMARY SCHOOL CHILDREN IN FREETOWN

BY

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A RESEARCH PROJECT PROPOSAL SUBMITTED TO THE CENTRE FOR CHILD AND ADOLESCENT MENTAL HEALTH, UNIVERSITY OF IBADAN IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN CHILD AND ADOLESCENT MENTAL HEALTH OF THE UNIVERSITY OF IBADAN, NIGERIA

JUNE 2019

DECLARATION

I hereby declare that this dissertation is my original work and that it has not been submitted for any award in any other institution.

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SUPERVISORS CERTIFICATION

This is to certify that this study and preparation of the thesis was carried out by Samuel Adeyemi Williams in the Centre for Child and Adolescent Mental Health, University of Ibadan.

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ACKNOWLEDGEMENT

My profound gratitude goes to my supervisor's Dr Celia Yetunde Adeniyi and Dr Jibril Abdulmalik, who despite their very busy schedules found the time to supervise this work.

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Acronyms

WHO: World Health Organisation

ADHD: Attention Deficit Hyperactivity Disorder

DSM-V: Diagnostic and Statistical Manual V

MPH: Methylphenidate

DEX: Dextroamphetamine

K-SADS: Kiddie-Schedule for Affective Disorder and Schizophrenia

VADRS: Vanderbilt ADHD Diagnosing Rating Scale

ABSTRACT

Background

Attention deficit hyperactivity disorder (ADHD) is one of the most common neuro-developmental condition seen in children. Symptoms generally interfere with academic and behavioral functioning at school, and may also disrupt family and peer relationships. There is increasing interest and evidence supporting early identification and early intervention in children with ADHD. This is to ameliorate the burden on child and family as early as possible and thereby diminish the later development of social and academic impairments that are often associated with untreated cases of ADHD. However, there is lack of research opportunities and data evaluating the prevalence of common mental health problems especially among school children in Sierra Leone. This study therefore, aimed to determine the prevalence and correlates of ADHD and co-morbid conditions in a sample of primary school children in Freetown, Sierra Leone.

Methodology

Stratified random sampling was done to select eight schools, both private and public, from a total of 526 primary schools representing the eight administrative zones in Freetown municipality. Balloting was then carried out at the level of the school to select participants (N=300) by proportional sampling. Students were assessed using the KSADS-PL to screen for Attention Deficit Hyperactivity Disorder (ADHD). Students who screened positive where then further assessed using the KSADS supplements 1 and 4 to make a definitive diagnose of ADHD and other comorbid conditions. Data collected was entered and analyzed using SPSS Version 23. Categorical data was computed in frequencies and percentages and continuous data was summarized as mean and standard deviation. Associations were tested using Chi-square and significant associations were established using logistic regression model. Significant level was set at 0.05.

Results

The overall prevalence of ADHD was 3%. The prevalence of the predominantly inattentive subtypes was 1.7%, while the other subtypes; predominantly hyperactive/impulsive and combined had prevalence of 1% and 0.3% respectively. Females were more likely to be diagnosed with the predominantly inattentive subtype than the males giving a ratio of 3.2:0.6 while males had higher representation on the predominantly hyperactive and combined subtypes with male to female ratio of 1.1:0.8 and 1:0 respectively. The co-morbid conditions include oppositional defiant disorder (ODD – 33.3%) and conduct disorder (CD –11.1%). Maternal educational level and maternal use of psychoactive substance was found to be independently associated with ADHD. Quality of handwriting, repeating a class and poor academic performance were found to be significantly associated with the diagnosis of ADHD.

Conclusion

Our findings support the notion that ADHD occurs across cultures. Given the prevalence rate, efforts should be made to map out strategies for early identification and referral of these children for proper evaluation and treatment. In addition, the school health system should be strengthened to be able to support these affected children. This study can serve as a platform for future studies in Sierra Leone as well as for planning interventions for children with ADHD in Sierra Leone.

Key words: Attention Deficit hyperactivity disorder, Comorbidities, school children, Sierra Leone

CHAPTER ONE

INTRODUCTION

1.1: BACKGROUND OF THE STUDY

Attention deficit hyperactivity disorder (ADHD), is one of the most common neuro-developmental/ neuro-psychiatric condition seen in most child and adolescent mental health clinics (Homer, Baltz, & Hickson, 2000). It is characterized by a persistent pattern of inattention and or hyperactivity-impulsivity that occurs more frequently with greater severity in individuals at similar developmental stage, and especially affects children during the critical school age period. Children with ADHD are most frequently identified and treated in primary school. Population studies identify that approximately 5 percent of children worldwide show impaired levels of attention, as well as hyperactivity (Polanczyk, De Lima, Horta, Biederman, & Rohde, 2007)(Polanczyk et al., 2007). Boys are classified with ADHD approximately twice as frequently as girls, and younger children approximately twice as frequently as adolescents (American Psychiatric Association, 2013). ADHD symptoms exist on a continuum in the general population, and are considered as a 'disorder' to a greater or lesser degree depending on the source of identification (e.g., parent or teacher), including extent of functional impairment, diagnostic criteria, and the threshold chosen for defining a 'case' (Polanczyk et al., 2007). As alluded to in the DSM V, the cultural and situational context are also influential in case identification, largely through the responses of parents and teachers who answer the questions about symptoms and impaired functioning. Therefore, formal diagnostic criteria such as the DSM-V include presence of impairment across settings, for example both at home and at school. There is increasing interest in identifying and treating very young children, those in preschool, in order to ameliorate the burden on child and

family as early as possible and thereby diminish the later development of social and academic repercussions.

Clinically significant ADHD is often associated with concurrent oppositional and aggressive behaviors, anxiety, low self-esteem, and learning disabilities (APA, 2000). Symptoms generally interfere with academic and behavioral functioning at school, and may also disrupt family and peer relationships. ADHD begins before children enter school although it is most commonly identified and treated in primary school, at age 7 to 9 years (Pliszka, 2007). In the preschool age group, ADHD is characterized not only by impairment in attention span, excessive impulsivity, and over-activity, but also is frequently accompanied by additional disruptive behavior symptoms, including severe temper tantrums, demanding, uncooperative behavior, and aggressiveness (Greenhill, Posner, Vaughan, & Kratochvil, 2008). While levels of symptoms decrease with age, the majority of children with ADHD continue to show impairment relative to same-age peers throughout adolescence and into adulthood. Estimates of prevalence of ADHD among adults worldwide is 2.5 percent (Simon, Czobor, Bálint, Mészáros, & Bitter, 2009).

An important gap though in the current literature, relates to the identification and understanding of the risk factors associated with attention deficit hyperactivity disorder (ADHD) in low- and middle-income countries where there are cultural variations in attitudes towards or in interpreting children's behavior and in the symptom rating by informants. This study will therefore examine the prevalence, correlates and common comorbid conditions of ADHD among primary school children in Freetown, Sierra Leone.

1.2: JUSTIFICATION AND RELEVANCE OF THE STUDY

Sierra Leone has a predominantly young population with greater than 40% of the population below the age of 15years (SSL, 2015), with numerous studies showing that 50% of mental disorders starting before the end of Adolescence (Kessler et al., 2007) with prevalence of ADHD estimated to be about 6% worldwide (Polanczyk et al., 2007). ADHD can cause problems in how well children do in school, in their ability to make and keep friends, and in how they function in school and society.

Although there are treatments to improve ADHD symptoms, there is no available data about the prevalence of ADHD or any mechanism for the identification and referral for children with ADHD.

The information and data collected will improve knowledge about the factors associated with ADHD, as well as common comorbid conditions and give an idea about the burden (prevalence) of ADHD, and will aid the development of resources to help people living with ADHD so that children can learn and grow into adulthood without being impaired by their symptoms.

It is hoped that the findings from this study would serve as a baseline that would help inform policy and planning for health interventions for children, their families and the community. Information on child health and their correlates are key for health planning in this community.

1.3: AIM

The overall aim of this study is to assess the prevalence, correlates and comorbidities of Attention Deficit Hyperactivity Disorder (ADHD) amongst primary school children in Freetown, Sierra Leone.

1.4: SPECIFIC OBJECTIVES

The specific objectives of the study are to determine:

- The prevalence of Attention Deficit Hyperactivity Disorder amongst primary school children in Freetown, Sierra Leone.
- The correlates of ADHD among school going children in Freetown, Sierra Leone.
- The common comorbid conditions associated with ADHD amongst primary school children in Freetown, Sierra Leone.
- To assess the effect of ADHD on school performance.

1.5: RESEARCH QUESTIONS AND HYPOTHESES

Research Question 1:

- What is the prevalence of Attention Deficit Hyperactivity Disorder in school children amongst school children in Freetown, Sierra Leone?
- What are the correlates of ADHD?
- What the common comorbid conditions associated with ADHD?

1.6: PRIMARY OUTCOME MEASURES

The primary outcome measures of the study will be the prevalence rate, correlates and common comorbid conditions in primary school going children in Freetown, Sierra Leone.

CHAPTER TWO

LITERATURE REVIEW

2.1: Overview

Attention-deficit hyperactivity disorder (ADHD) is a mental disorder of the neurodevelopmental type (Sroubek, Kelly, & Li, 2013). It is characterized by problems paying attention, excessive activity, or difficulty controlling behavior which is not appropriate for a person's age (American Psychiatric Association, 2013). The symptoms appear before a person is twelve years old, are present for more than six months, and cause problems in at least two settings (such as school, home, or recreational activities) (Dulcan & Lake, 2012). In children, problems paying attention may result in poor school performance. Although it causes impairment, particularly in modern society, many children with ADHD have a good attention span for tasks they find interesting (Walitza, Drechsler, & Ball, 2012).

Despite being the most commonly studied and diagnosed mental disorder in children and adolescents, the exact cause is unknown in the majority of cases. It affects about 5–7% of children when diagnosed via the DSM-V criteria (Willcutt, 2012) and 1–2% when diagnosed via the ICD-10 criteria (Cowen, Harrison, & Burns, 2012). As of 2015 it is estimated to affect about 51.1 million people globally (Vos et al., 2016). ADHD is diagnosed approximately three times more often in boys than in girls, although the disorder is often overlooked in girls because their symptoms differ from those of boys (Emond, Joyal, & Poissant, 2009). About 30–50% of people diagnosed in childhood continue to have symptoms into adulthood and between 2–5% of adults have the condition (Ginsberg, Quintero, Anand, Casillas, & Upadhyaya, 2014). The condition can be difficult to tell apart from other conditions, as well as to distinguish from high levels of activity that are still within the range of normative behaviors (Dulcan & Lake, 2012).

Thousands of studies have been conducted on attention deficit hyperactivity disorder (ADHD) and its various predecessors in diagnostic nomenclatures prior to the Diagnostic and Statistical Manual of Mental Disorders-V (DSM-V). Despite this long research history, ADHD is not necessarily well understood among the lay public, given the many controversies and public misconceptions concerning the disorder. (Peter S Jensen, 2000). Longitudinal evidence suggests that childhood ADHD persists into young adulthood in 60-70% of the cases when defined relative to same-age peers and in 58% of the cases when DSM-V criteria and parental reports are used (Burke, Rowe, & Boylan, 2014). These early studies of childhood hyperactivity excluded many children that would currently meet the DSM criteria for ADHD, particularly the inactive sub-type(McGough & Barkley, 2004).

2.2: History of ADHD

Attention deficit hyperactivity disorder (ADHD) is a common neurodevelopmental disorder most commonly diagnosed in children. According to the Centers for Disease Control and Prevention, the average age at diagnosis is 7. Boys are more than twice as likely to be diagnosed with ADHD as girls. Adults can demonstrate symptoms and be diagnosed as well.

Although still classified as Hyperkinetic Disorder by the WHO, it was originally called hyperkinetic impulse disorder. It wasn't until the late 1960s that the American Psychiatric Association (APA DSM II) formally recognized ADHD as a mental disorder.

ADHD has long been described in the medical literature. Heinrich Hoffmann (1809-1894), a German psychiatrist, was the first to describe children whose behavior was marked by impulsivity and hyperactivity. He named this behavioral problem "impulsive insanity" or "defective inhibition". In 1902, British pediatrician, Sir George Still, described in the Lancet "an abnormal defect of moral control in children". He found that some affected children could not control their

behavior the way a typical child would, motor agitation, attention problems, difficulty in controlling impulses and need for immediate reward although they were still intelligent (Still, 1902).

Observing that the sequelae in some survivors of the Spanish influenza epidemic included agitation, in 1922, Tredgold (Tredgold, 1922) postulated the source of what we now term ADHD as neurologically based and called it 'minimal brain damage,' although in fact only a few children displayed this post-influenza reaction. The assumption of a causal connection between brain damage and symptoms of hyperactivity and distractibility was important to the further conceptualization of ADHD (Rafalovich, 2001; Rothenberger & Neumärker, 2005) this theory set the stage for interpreting ADHD as a neurological condition for the next half century, until subsequent scientific discoveries, classification models, and social events nudged theoretical constructs toward some combination of genetic, biological, social, and evolutionary explanations (Williams & Taylor, 2006).

Later it was recognized that not all children had physical observable lesions and thus it was renamed minimal brain dysfunction (Millman & Ferry, 1970).

In 1932, the German physicians Franz Kramer and Hans Pollnow reported "On a hyperkinetic disease of infancy". The most characteristic symptom of affected children was a marked motor restlessness (Kramer & Pollnow, 1932). They point out that the symptoms of this "hyperkinetic disease" had previously been observed and described by several authors, but the disorder had not been distinguished from other diseases with similar symptoms, such as the residual effects of the encephalitis lethargica epidemic. In contrast to the post-encephalitic motor drive, the restlessness observed in the cases of Kramer and Pollnow could be observed only by day (Kramer & Pollnow,

1932). The main symptoms of the "hyperkinetic disease" as described by Kramer and Pollnow are very similar to the current concept of ADHD.

Hyperactivity was the symptom used to name the disorder when first included in the World Health Organization's International Classification of Diseases, 9th edition (ICD-9) as "hyperkinetic syndrome of childhood" (subsequently called "hyperkinetic disorder" in ICD-10) and in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders second edition (DSM2) ("hyperkinetic reaction of childhood"). It is only since 1980 that inattention was also emphasized and the disorder was re-conceptualized as "attention-deficit disorder with or without hyperactivity" (DSM-III) and subsequently "attention deficit hyperactivity disorder" (DSM-III-R and DSM-IV).

The APA issued the first "Diagnostic and Statistical Manual of Mental Disorders" (DSM) in 1952. This manual listed all of the recognized mental disorders. It also included known causes, risk factors, and treatments for each condition but however failed to recognize ADHD in the first edition. A second edition of DSM was published in 1968. This edition included hyperkinetic impulse disorder for the first time.

The APA released a third edition of the DSM (DSM-III) in 1980. They changed the name of the disorder from hyperkinetic impulse disorder to attention deficit disorder (ADD). Scientists believed hyperactivity was not a common symptom of the disorder. This listing created two subtypes of ADD: ADD with hyperactivity, and ADD without hyperactivity. The APA released a revised version of the DSM-III in 1987. They removed the hyperactivity distinction and changed the name to attention deficit hyperactivity disorder (ADHD). The APA combined the three symptoms (inattentiveness, impulsivity, and hyperactivity) into a single type and did not identify subtypes of the disorder.

The APA released the fourth edition of the DSM in 2000. The fourth edition established the three subtypes of ADHD used by healthcare professionals today: combined type ADHD, predominantly inattentive type ADHD, predominantly hyperactive-impulsive type ADHD.

ADHD cases began to climb significantly in the 1990s. There may be a few factors behind the rise in diagnoses: doctors were able to diagnose ADHD more efficiently, more parents were aware of ADHD and are reporting their children's symptoms, and more children were actually developing ADHD. Today, scientists are still trying to identify the causes of ADHD as well as possible treatments. Research points to a very strong genetic link. Children who have parents or siblings with the disorder are more likely to have the disorder.

It's not currently clear what role environmental factors play in determining who develops ADHD. Researchers are dedicated to finding the underlying cause of the disorder. They're aiming to make treatments more effective and to help find cures.

Helping these young patients was initially a challenge, and it was not until Charles Bradley identified d,l-amphetamine in 1932 and discovered it worked 'paradoxically' for some among the inpatient children under his care, did doctors have an effective treatment strategy. The impact of this development has been such that once an apparently effective pharmacological solution appeared, widespread dependence on it as a model for treatment has persisted, even though 50 years later, in 1980, Rapoport observed that the calming and focusing effects of stimulants were apparent in both normal and ADHD children and that age, rather than susceptibility, was likely the defining feature of the drug effect (Eisenberg, 2007). Parallel to these pharmacological developments, creation of diagnostic categories, psychometric instruments, and definitions were proceeding, both deriving from and shaping our understanding of this heterogeneous disorder (Döpfner, Breuer, Wille, Erhart, & Ravens-Sieberer, 2008). The controversy around accurate

diagnosis is particularly heightened with documented increases in diagnosis of younger children and associated increases in treatment with psychoactive medications.

The U.S. Food and Drug Administration (FDA) approved Benzedrine as a medicine in 1936. Dr. Charles Bradley stumbled across some unexpected side effects of this medicine the next year when he found that young patients' behavior and performance in school improved when he gave it to them. However, these findings were largely ignored. Doctors and researchers began to recognize the benefit of what Bradley had discovered many years later.

The FDA approved the psycho-stimulant Ritalin (methylphenidate) in 1955. It became more popular as an ADHD treatment as the disorder became better understood and diagnoses increased. The medicine is still used to treat ADHD today.

More and more medications to treat the disorder became available as the number of ADHD cases rose. The medications also became more effective at treating ADHD. Many have long-acting benefits for patients who need relief from symptoms for longer periods.

The development of the international classification systems appears to reflect a growing consensus regarding the clinical entity of ADHD. Evidence has been presented (SV Faraone, 2005) to show that ADHD meets the criteria established by Robins and Guze (Robins & Guze, 1970) for the validation of psychiatric diagnoses. Patients with ADHD show a characteristic pattern of hyperactivity, inattention, and impulsivity that lead to adverse outcomes. ADHD can be distinguished from other psychiatric disorders including those with which it is frequently comorbid. Longitudinal studies have demonstrated that ADHD is invariably chronic and not an episodic disorder. Twin studies show that ADHD is a highly heritable disorder. Molecular genetic studies have found genes that explain some of the disorder's genetic transmission. Neuroimaging

studies show that ADHD patients have abnormalities in frontal-subcortical-cerebellar systems involved in the regulation of attention, motor behavior, and inhibition. Many individuals with ADHD show a therapeutic response to medications that block the dopamine or noradrenaline transporter. This evidence as reviewed by Faraone (SV Faraone, 2005) supports the hypothesis of ADHD being a clinical entity and fulfilling the Robins and Guze (Robins & Guze, 1970) validity criteria.

However, there has been considerable debate about this issue. Critics have described ADHD as a diagnosis used to label difficult children who are not ill but whose behavior is at the extreme end of the normal range. Concerns have been raised that "ADHD is not a disease per se but rather a group of symptoms representing a final common behavioral pathway for a gamut of emotional, psychological, and/or learning problems" (Furman, 2005). Most of the research studies available rely on clinically referred cases, i.e. severely ill or narrowly diagnosed patients. The generalization of the research findings to non-referred cases in the community is therefore not necessarily valid.

2.3: DEFINITION

2.4: DIAGNOSIS AND CLASSIFICATION

The diagnosis of ADHD is exclusively made on clinical grounds and can follow either DSM-V(American Psychiatric Association, 2013) or ICD-10 (World Health Organization, 1993) criteria. The child's developmental stage must be considered in clinical evaluation as well as symptom pervasiveness (occurrence in more than one environment, like home and school) and clear evidence of clinically significant impairment in social, academic, or occupational functioning. In younger children it is essential to assess the family environment; where there is chaotic or inconsistent parenting, abuse or neglect, children often respond behaving in ways very similar to those of ADHD. Ignoring this can easily lead to misdiagnosis(Daniel et al., 2012) . Symptoms

listed in the two classification systems are equivalent. However, to fulfill ICD-10 criteria, symptoms must be present in all three dimensions (attention, hyperactivity and impulsivity) while DSM-V includes hyperactivity and impulsivity symptoms in the same dimension and states that individuals may present symptoms in only one (out of two) dimension. DSM-V requires at least 6 out of 9 symptoms of inattention or at least 6 out of 9 symptoms of hyperactivity/ impulsivity for the diagnosis of ADHD. In both classifications' symptoms need to persist for at least 6 months to a degree that is maladaptive and inconsistent with the developmental stage. According to DSM-V, there are three possible subtypes based on the presence or absence of specific symptoms in the past 6 months:

- Combined (if criteria for inattention and hyperactivity/impulsivity are met)
- Predominantly inattentive (if criteria for attention deficit are met but criteria for hyperactivity/impulsivity are not met)
- Predominantly hyperactive-impulsive (if criteria for hyperactivity/ impulsivity are met but criteria for inattention are not met).

The predominantly inattentive subtype is more frequent among girls and less common in clinic settings because children are less often referred for treatment due to inattention than hyperactivity. This subtype is commonly associated with poor academic performance, cognitive deficits and delayed development. Predominantly inattentive patients are commonly described as disorganized, quiet, dreamers, and as "staring off into space". The predominantly hyperactive-impulsive subtype is less common both in clinic and community settings. The combined subtype is the most commonly diagnosed subtype in clinic settings. Although all subtypes of ADHD are associated with oppositional defiant behaviors, this association is stronger for the combined subtype, making

treatment more challenging. Furthermore, the combined subtype is associated with higher functional impairment than the other two types.

Irrespective of the pervasiveness criterion (presence of symptoms in at least two different settings), it is necessary to have more than one source of information, usually parents and teachers. This is because informants (either parents or teachers) observe the child in different contexts, which may influence the occurrence of symptoms, and informants are susceptible to a variety of biases. Parents have a longitudinal view and can give valuable information on their child's neurodevelopmental trajectory. However, they tend to have more difficulties admitting their children's problems. Teachers, on the other hand, are in constant contact with a large number of children of the same age, which allow them to easily identify deviant behaviors, and are aware of objective measures of children's academic performance, which make them more able to detect academic deficits. Apart from obtaining information from parents and teachers, clinicians should also examine the child, even though symptoms are often absent during the assessment interview. It would be unrealistic to expect observing a child demolishing or running amok in the doctor's office to make a diagnosis of ADHD. Furthermore, examining the child is important in order to exclude other diagnoses. Adolescents should be asked to report symptoms they experienced during childhood. Adolescents often deny symptoms in the past, interpreting such symptoms as normal behaviors or minimizing their impact. Parents' information and school reports may help to determine age of onset of symptoms. The clinical interview with parents is also important to gather detailed information on peer and family relationships, medical history and investigation for other mental disorders that can co-exist with ADHD. It is important to ascertain whether there is inconsistent or chaotic parenting, abuse or neglect which may lead children to behave similarly to children with ADHD.

Questions have emerged regarding the classification of ADHD(Rohde, 2008) . One relates to the validity and utility of differentiating ADHD into subtypes: subtypes are unstable over time, familial liability seems unspecific, and all subtypes respond to the same drug treatments (Benjamin B Lahey & Willcutt, 2010). Another refers to the need to include functional impairment as a diagnostic criterion because many children with ADHD will have reduced or no impairment because of compensatory skills or extra effort. On the other hand, not including functional impairment as a criterion may lead to over-diagnosis and treatment of children who do not have deficits.

2.5: PREVALENCE

The relative prevalence of the disorder is high, affecting approximately 5% of all children, although estimates vary widely from 3% to 11% or more (Sheppard et al., 2010). The disorder usually begins in early childhood and is characterized by excessive activity, even when developmental level and limited behavioral control are taken into consideration (Elia, Ambrosini, & Rapoport, 1999; Szatmari, 1992). The prevalence found in these studies ranged from a low of 2% to a high of 6.3%, with most falling within the range of 4.2% to 6.3%. Other studies have found similar prevalence rates in elementary school-age children (4-5.5%; in Breton et al. (Breton et al., 1999), 7.9% in Briggs-Gowan et al. (Briggs-Gowan, Horwitz, Schwab-Stone, Leventhal, & Leaf, 2000), 5-6% in DuPaul (G. J. DuPaul, 1991), and 2.5-4% in Pelham et al (Pelham, Gnagy, Greenslade, & Milich, 1992). Lower rates result from using complete DSM criteria and parent reports (2-6% in Breton et al. (Breton et al., 1999), and higher ones if just a cutoff on teacher ratings is used (up to 23% in DuPaul (G. J. DuPaul, 1991), 15.8% in Nolan etal. (Nolan, Gadow, & Sprafkin, 2001), 14.3% in Trites et al. (Trites, Dugas, Lynch, & Ferguson, 1979). Sex and age differences in prevalence are routinely found in research. For instance, prevalence rates may be

4% in girls and 8% in boys in the preschool age group (Nolan et al., 2001), yet fall to 2-4% in girls and 6-9% in boys during the 6- to 12-year-old age period based on parent reports (Breton et al., 1999). The prevalence decreases again to 0.9-2% in girls and 1-5.6% in boys by adolescence (Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993; Romano, Tremblay, Vitaro, Zoccolillo, & Pagani, 2001). Overall ADHD affects 2% to 9% in school age children.

The review of ADHD in sub-Saharan Africa reported a prevalence range of 5.4% to 8.7% among children.(Bakare, 2012) There is no or very little information on prevalence rates of mental health problems amongst children and adolescent, especially ADHD, in Sierra Leone.

Over the past several decades, rates of identification and treatment for people with ADHD have increased as documented by population-based studies using health administrative databases (Miller, Lalonde, McGrail, & Armstrong, 2001; Safer, Zito, & Fine, 1996). In some cases, small-area variation in prescriptions has been linked to specific physicians, in USA for example, suggesting that increases in identification may be linked with changes in practice patterns rather than an increase in the underlying endemic prevalence of the disorder (Brownell & Yogendran, 2001). In fact, the underlying prevalence of the disorder in children appears to have been relatively stable since the 1980s, to the extent that it has been measured using identical research methods (Achenbach, Dumenci, & Rescorla, 2003). In the past 10 years, increases in identification and treatment have occurred primarily among girls and older children consistent with changes in clinical guidelines (Charach, Cao, Schachar, & To, 2006).

2.6: CORRELATES AND COMORBIDITIES

ADHD is a familial disorder with a strong genetic component. Its heritability (the proportion of variance attributed to additive genetic factors) has been estimated as 76% (Stephen V. Faraone et al., 2005) , one of the highest among the mental disorders. Nevertheless, genetic factors alone do

not explain the disorder's occurrence. The etiology of ADHD is considered to be multifactorial, that is, multiple environmental, genetic and biological factors play a role in increasing the risk for the disorder. A number of candidate genes have been associated with ADHD, particularly genes related to catecholaminergic systems, but each gene seems to be responsible for only a small increase in the risk of developing the disorder (Stephen V. Faraone et al., 2005). Furthermore, studies that scan the whole genome without an a priori hypothesis, the so called genome-wide association studies, did not add new polymorphisms to the current knowledge (Neale et al., 2010). This apparent contradiction between a high heritability and negative results from genome-wide association studies has encouraged research for alternative etiological hypotheses. One possibility is that the disorder emerges from the interaction between genetic and environmental factors (Nigg, Nikolas, & Burt, 2010). In fact, gene-environment interactions have been reported for the interaction between intra-utero tobacco exposure and variations of DAT1 and DAT4 genes (Nigg et al., 2010). A number of environmental risk factors have been tested for their association with ADHD (Banerjee, Middleton, & Faraone, 2007).

Prematurity seems to be the factor most consistently associated with ADHD (Bhutta, Cleves, Casey, Cradock, & Anand, 2002). Limited evidence also points to intra-utero exposure to tobacco (Langley, Rice, van den Bree, & Thapar, 2005; Umar, Obindo, & Omigbodun, 2018), low birth weight (Hack, 2004) and prolonged labor (Ndukuba, Odinka, Muomah, Obindo, & Omigbodun, 2017) as possible risk factors. More studies are needed to assess the impact of intra-utero exposure to alcohol and drugs, maternal psychological problems during pregnancy, perinatal and pre-natal complications, traumatic brain injury, duration of breastfeeding, early deprivation and familial and psychosocial factors as well as intrauterine exposure to caffeine (Linnet et al., 2003) and birth in

specific seasons of the year (Atladóttir et al., 2007). It is also prudent to remember that no conclusive data exist linking ADHD to food additives, environmental toxins and computer games.

ADHD appears to be associated with a wide variety of other psychiatry problems, which are often co-morbid with it. ADHD co-occurs with other childhood disorders far more often than it appears alone (Eigenmann & Haenggeli, 2004). Notable associations exist with Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), tic disorder, mood disorder, autism spectrum disorder, specific learning disorder such as dyslexia (Copeland, Angold, Costello, & Egger, 2013), depression and anxiety. About 50-60% of children with ADHD meet criteria for ODD, even in the pre-school period (Rappley, 2005). ADHD children in primary care settings were significantly more likely than non-ADHD clinic controls to demonstrate mood disorders (57%) such as depression, multiple anxiety disorders (31%), and substance use disorders (11.5%) (Busch et al., 2002). However, in the recent British Child Mental Health Survey (Ford, Goodman, & Meltzer, 2003), anxiety was not associated with ADHD when adjustment was made for the presence of a third disorder. It is widely accepted that ADHD is a co-morbid disorder (Singh, Yeh, Verma, & Das, 2015). Copeland et al (Copeland et al., 2013), point out that co-morbidity can mean a common underlying etiology which leads to two or more different disorders, or that one disorder leads to another, or even that two unrelated disorders co-occur. The term co-morbid also implies that their entities are morbid conditions, i.e. diseases. High rates of comorbidity with either other neurodevelopmental disorders (e.g., mental retardation, and learning disabilities) or psychiatric disorders (e.g., anxiety) make delineation of the phenotype difficult (Ford et al., 2003). Some studies found that 47% of children with ADHD have co-morbid ODD, 38% of children were found to have CD, 27% have anxiety disorder, 13% have depression , and 7% have mood disorder (Larson, Russ, Kahn, & Halfon, 2011; van Lier, van der Ende, Koot, & Verhulst, 2007). In fact,

the vast majority of co-morbidities with ADHD represent functional impairments and symptoms, which are not rooted in specific diseases (Copeland et al., 2013). Studies of clinic-referred children with ADHD find that between 54% and 67% will meet criteria for a diagnosis of ODD by 7 years of age or later (Singh et al., 2015). ODD is a frequent precursor to CD, a more severe and often (though not always) later occurring stage of ODD (Loeber, Burke, Lahey, Winters, & Zera, 2000). The co-occurrence of CD with ADHD may be 20-50% in children and 44-50% in adolescence with ADHD (B B Lahey, McBurnett, & Loeber, 2000). By adulthood, up to 26% may continue to have CD, while 12–21% will qualify for a diagnosis of antisocial personality disorder (ASPD). In addition to associations with other psychiatric disorders children with ADHD are also more likely than their non-ADHD counterparts to experience a substantial array of developmental, social and health risks. It therefore seems important to discuss associated problems along with co-morbidity (Singh et al., 2015).

2.6.1: Motor coordination

Children with ADHD often demonstrate poor motor co-ordination or motor performance and balance (Emck, Bosscher, van Wieringen, Doreleijers, & Beek, 2012; Fliers et al., 2008). Substantial evidences have been observed for problems in motor development and motor execution children with ADHD (Rajendran et al., 2013). Clinical and epidemiological studies report that 30% to 50% of children with ADHD suffer from motor coordination problems (Fliers et al., 2008). These percentage are dependent of the type of motor assessment, referral sources and the cut-off points used (Kadesjö & Gillberg, 2001; Wilson, 2005). As noted by Needleman et al. (Needleman, Schell, Bellinger, Leviton, & Allred, 1990), children with ADHD display greater difficulties with the development of motor coordination, planning and execution of complex, lengthy tasks, and novel chains of goal directed responses.

2.6.2: Academic functioning

Children with ADHD have an impaired academic functioning and are usually at an educational disadvantage upon school entry (Hale et al., 2011). ADHD children are more likely than their non-ADHD peers to demonstrate difficulties with basic mathematics and pre-reading skills during their first year at school (Das, Gichuru, & Singh, 2013; C Gillberg, 1998). Executive academic functions were found to be core deficits specific to ADHD. Girls with ADHD were found to be less impaired than boys with ADHD (Rucklidge & Tannock, 2002). Even pre-school children with ADHD demonstrate educational disadvantage, DuPaul et al.(G. J. DuPaul, McGoey, Eckert, & VanBrakle, 2001), demonstrated that their sample of pre-school ADHD children demonstrated deficits in pre-academic skills even prior to formal school entry. The pre-school ADHD children in their sample scored on average one standard deviation lower on the Battelle Developmental Index (Berls & McEwen, 1999) than did their non-ADHD control group. Researchers emphasized the importance of look away behavior (inattention) as a major reason for poor academic achievement (Börger & van der Meere, 2000). Clinic-referred children with ADHD often present with lower scores on intelligence tests than control groups, specifically verbal intelligence with differences ranging from 7 to 10 standard score points (McGee, Williams, & Feehan, 1992). Studies with community samples of ADHD children have also demonstrated negative associations between ADHD and intelligence (Peterson, Pine, Cohen, & Brook, 2001). Children with ADHD demonstrate serious difficulties with psychosocial functioning. Social adjustment is often given little attention on assessment protocols, given its designation as an associated feature of ADHD (American Psychiatric Association, 2013). However, the high levels of disruptive behavior demonstrated by ADHD children increases the likelihood of negative reactions from parent, teachers and also peers (C E Cunningham, Bremner, & Boyle, 1995). In addition, negative social interactions with peers

ultimately lead to peer's rejection (Olson & Brodfeld, 1991) because these social difficulties are often resistant to psychosocial and pharmacological treatment (Pelham, Wheeler, & Chronis, 1998), they are expected to continue into adolescence, and even adulthood when criteria for the disorder may no longer be met (Slomkowski, Klein, & Mannuzza, 1995). The patterns of disruptive, intrusive, excessive, negative, and emotional social interactions that have been found between children with ADHD and their parents, have also been found to occur in the children's interactions with teachers and peers (G. J. DuPaul et al., 2001; Whalen, Henker, & Dotemoto, 1980). It should come as no surprise, then, that those with ADHD receive more correction, punishment, censure, and criticism than other children from their teachers, as well as more school suspensions and expulsions, particularly if they have ODD/CD (Barkley, Fischer, Edelbrock, & Smallish, 1990; Whalen et al., 1980).

In their social relationships, children with ADHD are less liked by other children, have fewer friends, and are overwhelmingly rejected as a consequence (Erhardt & Hinshaw, 1994), particularly if they have comorbid conduct problems (Gresham, MacMillan, Bocian, Ward, & Forness, 1998; Larsson, Larsson, & Lichtenstein, 2004). Another research study demonstrated that the co-occurrence of conduct disorder and anxiety disorder with ADHD in childhood predicted a more severe course for ADHD in adolescence(Newcorn et al., 2004).

2.6.3: Unintentional physical injury

Children with ADHD appear to be at a greater risk for unintentional physical injury and accidental poisoning (G. J. DuPaul et al., 2001; Kendrick et al., 2013). In one of the first studies of the issue, Stewart and colleagues found that four times as many hyperactive children as control children (43% vs. 11%) were described by parents as accident prone. Later studies have also identified such risks; up to 57% of children with hyperactivity or ADHD are said to be accident-prone by parents,

relative to 11% or fewer of control children (Mitchell, Aman, Turbott, & Manku, 1987). Most studies find that children with ADHD experience more injuries of various sorts than control children. In one study, 16% of the hyperactive sample had at least four or more serious accidental injuries (broken bones, lacerations, head injuries, severe bruises, lost teeth, etc.), compared to just 5% of control children (P S Jensen, Shervette, Xenakis, & Bain, 1988; Peter S Jensen, 2000), found that 68% of children with DSM-IV-TR ADD, compared to 39% of control children, had experienced physical trauma sufficient to warrant sutures, hospitalization, or extensive/painful procedures. Several other studies likewise found a greater frequency of accidental injuries than among control children. Researchers found that children with ADHD were at a greater risk for suffering fractures (Rowe, Maughan, & Goodman, 2004), most likely as a result of hyperactive and impulsive behavior. Children with AD/HD are also more likely than their non-ADHD counterparts to be injured as pedestrians, to inflict injuries to themselves, to sustain injuries to multiple body regions and to experience head injury (DiScala, Lescohier, Barthel, & Li, 1998). Knowledge about safety does not appear to be lower in these children; implying interventions aimed at increasing knowledge about safety may have little impact (Mori & Peterson, 1995).

2.6.4: Sleep disturbances

Studies report an association between ADHD and sleep disturbances, they found that sleep problems occurred twice as often in ADHD as in control children (Cao et al., 2010; Lam & Yang, 2008). The problems are mainly more behavioral and include settling difficulties, a longer time to fall asleep, and instability of sleep duration, tiredness at awakening or frequent night waking. The direction of effect, between ADHD and sleep problems is unclear. It is possible that sleep difficulties increase ADHD symptoms during the daytime, as the research on normal children implies (Needleman et al., 1990). Yet some research finds that the sleep problems of children with

ADHD are not associated with the severity of their symptoms; this suggests that the disorder, not the impaired sleeping, is what contributes to impaired daytime alertness, inattention, and behavioral problems (Lam & Yang, 2008; Lecendreux, Konofal, Bouvard, Falissard, & Mouren-Siméoni, 2000). While knowledge about the associations between ADHD and other related variables is useful in terms of diagnostic profiles, less is known about the impact of related variables on the long-term outcome for the disorder (Singh et al., 2015). Even less is known about the specificity of these associated problems to ADHD. In the preschool years, a wealth of evidence now exists comparing the symptoms of pre-school ADHD symptoms to its school-aged counterpart. Children with a pre-school variant of ADHD present with the same symptom structure (Daley, Jones, Hutchings, & Thompson, 2009), similar associated impairment and developmental risk (Gadow & Nolan, 2002), and similar patterns of neuropsychology (Sonuga-Barke, Dalen, & Remington, 2003). Despite the similarities between pre-school ADHD and school-aged ADHD, little is known about what constitutes impairment during the pre-school years although school readiness should be what clinicians focus on. And even less is known about the relationship between early hyperactivity and later expression of the ADHD disorder (Sonuga-Barke, Auerbach, Campbell, Daley, & Thompson, 2005). While originally conceived of as a disorder of childhood and adolescence, evidence suggests scientific merit and clinical value in examining ADHD in adulthood, as well as the pre-school period (Sonuga-Barke et al., 2005). ADHD symptoms have been shown to persist into later life with up to 40% of childhood cases continuing to meet full criteria in the adult years (Hill, 2000). Adult ADHD appears to share many characteristics of the childhood disorder. Similar to their childhood counterparts, adults with ADHD display impairment in the interpersonal, vocational and cognitive domains (Depue et al., 2010). The adult and

childhood disorders also appear to share a common neuropathology (Hesslinger, Thiel, Tebartz van Elst, Hennig, & Ebert, 2001) and demonstrate a similar response to treatment (Sachdev, 1999).

2.7: MANAGEMENT INTERVENTIONS

Interventions for ADHD include a range of medication and non-medication options. Many children, teens, and families receive nonspecific psychosocial support, counseling, and advice, as well as academic tutoring and coaching, both in school and out. Complementary and alternative medicine options, including dietary supplements, are also available. Few of these interventions have been systematically evaluated, and fewer still have been examined for their long-term effectiveness. One area of careful study has been the efficacy of pharmacological agents on the core symptoms of ADHD and more recently on several aspects of overall functional impairment.

Non-pharmacological interventions, especially behavior training with parents and teachers, have been studied most extensively for treatment of DBD, primarily ODD and CD. These conditions often co-occur with ADHD, especially hyperactive impulsive subtype, and in community practice can be hard to distinguish from one another. The well-known Multimodal Treatment Study of ADHD (MTA Study) funded by the U.S. National Institutes of Mental Health (NIMH) remains the best source of information regarding the comparative effectiveness of pharmacological versus non pharmacological interventions for ADHD over an extended period of time.

Following the initial results, published in 1999 (MTA Coperative group, 1999), behavioral interventions for children age 6 and up generally target ODD and CD symptoms, with MPH and other psycho-stimulants used for core symptoms of ADHD, inattention, impulsivity, distractibility, and over-activity.

2.7.1: Non-pharmacological Interventions

In the area of non-pharmacologic interventions, behavior training has been found to be helpful, primarily for disruptive behaviors that frequently coincide with ADHD (Kern et al., 2007). Since ADHD may begin before school age, using the precedent of older children, increasing numbers of preschoolers are being identified and treated, sometimes with medications. However, the most commonly used psycho-stimulant, MPH, does not yet have regulatory approval for use in children less than 3 years of age. Recent reviews of treatments for preschoolers with ADHD emphasize the use of parenting interventions prior to medication based on general clinical consensus (Ghuman, Arnold, & Anthony, 2008).

Indeed, the Preschool ADHD Treatment Study (PATS), funded by the U.S. National Institute for Mental Health (NIMH), included parent behavior training (PBT) as the first phase for all children recruited into the study prior to randomization for the purpose of evaluating efficacy and safety of psycho-stimulant medication (Kollins et al., 2006). While the few studies available suggest stimulant medications are effective for the core symptoms of inattention, hyperactivity, and impulsiveness in very young children, psycho-stimulants also appear to cause more adverse events in preschool children than in older children (Wigal et al., 2006). Beyond the PATS, little information exists to document effectiveness of either medication or non-medication interventions specifically for ADHD in this age group. Part of the difficulty has been lack of clarity regarding reliability and validity of diagnostic criteria and therefore lack of widespread application of the ADHD diagnosis for children under 6 years (Greenhill et al., 2008).

Research has accumulated regarding PBT for preschoolers with disruptive behavior in the past decade, but many of the studies do not recruit based on an ADHD diagnosis, but rather based on clinically significant disruptive behavior. However, ADHD in preschoolers is commonly identified

in the context of comorbid oppositional and aggressive behavior (Charles E Cunningham & Boyle, 2002).

ADHD interferes with multiple areas of functioning, such as behavior at home, in social situations, school performance; treatment should seek to improve functioning in all these areas. Multimodal interventions with different treatment targets are theoretically optimal, although few studies have directly compared multimodal treatment with pharmacotherapy alone (Abikoff et al., 2004). Many targets for intervention can be enumerated: ADHD symptoms, cognitive deficits and associated behaviors, academic performance, comorbid conditions, parental psychopathology, family and school-based problems. Following assessment, clinicians should decide about targets for intervention and formulate a treatment plan integrating the different modalities needed to achieve all the treatment goals. Treatment plans should be individually tailored to each patient and constantly reviewed and updated according to emerging needs and previous response. A close monitoring of treatment response is required and should include data from different sources, including parents', patients' and teachers' reports of perceived changes following interventions (Pliszka, 2007). The literature is consistent on the effectiveness of stimulant medications and behavioral interventions in the management of the core symptoms of ADHD (American Academy of Pediatrics, 2011). Pharmacotherapy is effective for most children.

Behavioral interventions are also valuable as primary treatment or as an adjunct treatment for many children, depending on the nature of coexisting conditions, outcomes targeted and family circumstances (American Academy of Pediatrics, 2011). Treatment plans should include at least one of these two treatment modalities. The decision to use non-pharmacological versus pharmacological intervention should be based on patient's age, profile of symptoms and disease severity, individual risk for side effects, treatment adherence issues, comorbid disorders, parents'

and child's preference, cost, access to medication, and availability of trained therapists. Education Clinicians should give adequate information to patients and their families using a language they can understand.

The main aims of psycho-education are to:

• Ensure that patients and their family understand what ADHD is

• Enhance treatment adherence by involving patients and parents in the treatment plan and making sure that they understand the benefits and risks, such as side effects of medication

• Identify barriers to treatment. Education may also involve school staff; whenever possible clinicians should contact and educate schoolteachers.

2.7.1.1: Behavior therapy

The effect size of behavioral interventions on ADHD symptoms is smaller than that of stimulant medications (Fabiano et al., 2009). Many guidelines for behavior therapy in ADHD are available (Bauermeister, So, Jensen, Krispin, & El Din, 2006). In general terms, the therapist identifies problem behaviors and collects detailed data on the circumstances that precede and follow such behaviors. Usually behaviors become ingrained when reinforced. After the identification of reinforcing consequences a detailed plan on how to deal with problematic situations is drawn up and a different set of techniques to stop reinforcing unwanted behaviors or extinguish them is implemented (Antshel & Barkley, 2008). Behavior therapy for ADHD almost always involves parents and teachers as well as the child.

2.7.2: Pharmacological Interventions

Many medications have been shown to be effective and safe for children with ADHD. Multiple short-term studies document that psychostimulant medications, either methylphenidate

(MPH), dextroamphetamine (DEX), or mixed amphetamine salts (MAS), effectively decrease the core symptoms of ADHD and associated impairment. Some preparations last only a few hours, with symptoms returning as the medication wears off. Many families choose to use medication primarily on school days, and these medications have primarily been studied in school-aged children and youth aged 6 years and older. Psycho-stimulants, most commonly MPH and DEX, are generally safe and well tolerated. Common side effects include poor appetite, insomnia, headaches, stomachaches, and increased blood pressure and heart rate. Prolonged use may result in a decreased rate of growth (Charach et al., 2011), generally considered clinically insignificant (Pliszka, 2007). Concerns have been raised from post marketing surveillance suggesting a rare incidence of sudden death, perhaps associated with pre-existing cardiac defects, however, the rate does not appear to exceed that of the base rate of sudden death in the population (Pliszka, 2007).

Several extended release preparations of psycho-stimulants have been developed in recent years aimed at improved adherence and symptom control throughout the day as well as decreased abuse potential (Chavez et al., 2009).

2.7.2.1: Stimulant medications

Stimulant medications have been used for decades in the treatment of ADHD and are licensed for this purpose in many countries. The efficacy and safety of these drugs have been extensively examined in numerous clinical trials as well as in systematic reviews and meta-analyses (Biederman & Spencer, 2008; Stephen V Faraone & Glatt, 2010). Trials consistently show that stimulants are more effective than placebo, with effect-sizes varying from 0.8 to 1.1 and a positive early clinical response in approximately 70% of cases.

Most commonly used stimulant medications include methylphenidate, dexmethilphenidate, dextroamphetamine and mixed amphetamine salts. Other agents such as methamphetamine are available in certain countries. Medications are available in different presentations, including short-acting, long-acting and sustained-release. The main advantage of long-acting and sustained-release preparations is that one dose in the morning may sustain effect during the whole day, increasing adherence. However, they are more expensive, which limits their use. No conclusive evidence exists favoring any of the stimulants over others in terms of efficacy and side effect profile. Stimulant dosage is not weight dependent. Clinicians should begin with a low dose and titrate upward to achieve optimal response. The best dose is the one that leads to maximum benefit with minimal side effects. Although controlled studies that compare different dosing schedules are lacking, some clinicians believe that interrupting medication during weekends and holidays may compromise its efficacy. Methylphenidate is available in immediate release and sustained release preparations. Immediate release methylphenidate reaches plasma peak levels in 1 to 3 hours after ingestion. Effects last approximately 4 hours; thus a two- or three-times-a-day schedule is necessary for symptom coverage. Methylphenidate SODAS® is a long-acting formulation in which half the amount is immediately released and the other half is released after 4 hours. Methylphenidate OROS® releases about one quarter of the amount immediately and the rest during the next 9 hours. The two later preparations only require a once-a-day dosage schedule.

There are different amphetamine preparations for ADHD but availability varies between countries. Lisdexamphetamine has been recently approved for the treatment of children and adults with ADHD in the US, Canada and Brazil. Lisdexamphetamine is an inactive component (prodrug) that is gradually converted into an active form of dextro-amphetamine in the body. Due to its gradual conversion, effect of Lisdexamphetamine is prolonged − up to 13 hours − thus not needing

repeated doses during the day. Another common form of amphetamine approved in some countries for the treatment of ADHD is a preparation of mixed amphetamine salts. It is intermediate-acting and can be taken once or twice a day.

2.7.2.2: Non stimulants

Non-stimulant medications are considered second line treatments in case of intolerance, contra-indications or treatment failure. Evidence of effectiveness of these drugs, although not as strong as for stimulants, is good for atomoxetine, extended-release guanfacine, and extended-release clonidine (in that order) (American Academy of Pediatrics, 2011).

Non-stimulants (e.g., alpha adrenergic agents and atomoxetine (ATX)) have also been found to be helpful in controlling symptoms with few adverse events (Ipser & Stein, 2007). However, in general, the benefits of medications wear off when they are discontinued. Since ADHD is a chronic disorder, many children, teens, and adults stay on medications for years at a time. Given the possibility of cumulative effects over time, a review of evidence regarding benefits and risks of prolonged medication use for ADHD is indicated.

CHAPTER THREE

METHODOLOGY

This chapter presents the research methodology and the basis of the study design to answer the specific research questions in the study. It also explains the study instrumentation and how the study population is selected. It further describes the data collection process and analysis within ethical standard requirements.

3.1: Study Location

Sierra Leone is located on the west coast of Africa and covers an area of about 72.3 square kilometres. It extends from latitude 7degrees north to 10 degrees north, and from longitude 10 degrees west to 14 degrees west.

It is bounded on the north and northeast by Guinea, the south and southeast by Liberia and on the west by the Atlantic Ocean (See Figure 3.1). It has four distinct geographical regions - coastal belt of mangrove swamps, wooded hill country, upland plateaus and the eastern mountains – and four provincial regions: The Northern Province, the Southern Province, the Eastern Province and the Western Area (CIA, 2016). According to Statistics Sierra Leone, the climate is tropical with two seasons. The rainy season lasts from May to October and the dry season from November to April and this includes the period of the harmattan winds. The average temperature ranges from 26°C to 36°C. Sierra Leone has a variety of natural resources such as diamonds, bauxite, iron ore and gold, a population of about 7 million people (Statistics Sierra Leone, 2015) and the major religions being Islam and Christianity. There are about sixteen ethnic groups but the four major ethnic groups are Mende, Temne, Limba and Creole. The official language of Sierra Leone is English. There are a range of local languages but Krio (pidgin English) is the primary language of communication.

The capital Freetown, located in the Western Area, is the largest city in Sierra Leone, a major port city on the Atlantic Ocean and mostly known for its historical role in the transatlantic slave trade and its centuries-old Cotton Tree, which is its symbol of emancipation. Freetown is Sierra Leone's major urban, economic, financial, cultural, educational and political center with a population of about 951,000 people (Statistics Sierra Leone, 2015). The city's economy revolves largely around its harbor, which occupies a part of the estuary of the Sierra Leone River. Freetown is the seat of government of Sierra Leone and is home to the State House, the House of Parliament and the Supreme Court. The municipality of Freetown is ethnically, culturally, and religiously diverse and is divided into the East End, Central and West End, locally governed by a directly elected city council, headed by a mayor.

According to Statistics Sierra Leone (SSL), the published results of the 2015 national population and housing census shows that Sierra Leone's population has grown from 4,976,871 million in 2004 to 7,092,113 million in 2015. The proportion of the populations under 19 years was found to be 53.1%.

3.2: Study Design

The study is a cross-sectional quantitative study to examine the prevalence, correlates and common comorbidities of Attention Deficit Hyperactivity Disorder amongst children attending primary schools in Freetown.

3.3: Study Population

The study participants are children attending primary schools in Freetown Sierra Leone. Eight schools were randomly selected from a sample frame containing a list of all schools in Freetown (526). Six schools were chosen from the Government assisted schools (72.6%) and two school chosen from a list of non-assisted private schools (27.4%) (Tooley & Longfield, 2013).

3.4: Sample Size Calculation

The sample size for the study was calculated using the formula for cross-sectional studies:

$$n = \frac{(Z \propto)^2 pq}{d^2}$$

Where,

n = sample size;

Zα = standard normal deviation corresponding to a two-tailed 5% level of significance = 1.96;

p = 0.2315

p is the estimate of the prevalence of ADHD in primary school children of Benin Metropolis which is 23.15% from a study carried out by Egbochuku E (Egbochuku & Abikwi, 2007) in Edo State, Nigeria

q = 1- p = 1 – 0.2315 = 0.785;

d = the precision of the estimate (relative or absolute) = 5% = 0.05;

$$\frac{1.96(1.96) * 0.2315 * 0.785}{(0.05)^2}$$

Therefore **n= 273.38**

Adjusting for non-response at 10%; $q = \frac{1}{1-p}$

$$q = \frac{1}{1-0.1} = 1.1$$

Adjusted sample size = calculated sample size * q

= 273.38*1.1

= 300.718

Adjusting for non-response rate the final sample size is 300

3.5: Sampling Technique

A multistage sampling was used to get to the unit of inquiry. Firstly, a list of all primary schools in the Freetown was gotten from the Ministry of basic and primary Education in Sierra Leone. Schools were then separated into 2 clusters: one cluster representing the non-assisted private schools and another cluster representing the government assisted schools (both public and private schools). Due to the disparity in the number of schools in the public (72.6%) and private (27.4%) sectors (Tooley & Longfield, 2013), six (6) schools were taken from the government assisted schools and two (2) school from the private sector by stratified random sampling.

One school was chosen from the eight different administrative zones in the Freetown Municipality each. At the level of the schools, a list of all registered students from class 1 to 6 was obtained from the school principal to generate a total sampling frame.

Proportional sampling was then used to determine the number of students from each school to participate in the study from the total number of students in the sampled schools.

3.6: Study Instruments

Study data was collected using the following standardized public domain instruments:

- Socio-Demographic Questionnaire;
- Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-PL)
- K-SADS DSM-V Supplements 1 and 4

3.6.1: Socio-demographic Questionnaire

This was adapted from the Socio demographic Questionnaire by Omigbodun (2008) which was then modified and utilized by the investigator to collect data on individual, family, social and antenatal history. It is an interviewer- administered structured questionnaire.

3.6.2: Kiddie schedule for affective disorders and schizophrenia-PL (KSADS supplement #1 &4)

The K-SADS is used to measure previous and current symptoms of affective, anxiety, psychotic, and disruptive behavior disorders. The K-SADS is now the most widely used diagnostic interviews in research.

3.7: Study Procedure

Meetings were held with the head teacher and the other school teachers. In the first meeting, the roles of the teachers in the study was explained and their consent to participate was obtained. The teachers also practiced how to fill the questionnaire with the right information about their pupils, and clarifications was given on areas that were not clear to them. This exercise was to ensure that they understand the items on the questionnaire very well so that they can respond appropriately to the questions. In this meeting, the total number of students enrolled in the schools were also collected from the Principal.

In another meeting, the children to be enrolled into the study were selected through balloting. In this process, “yes” or “no”, reflecting the total number of students to be sampled in the particular school, was written on small pieces of papers that was folded and pooled into an open-ended sack for them to pick from. Only those who picked the papers marked yes were enrolled and assigned codes.

Letters requesting parental consent and participation was then distributed to the selected school children, following which the socio-demographic details were captured from the parents.

The screening version of the KSADS was then used to assess the children for ADHD and those who met the criteria were noted.

Children who had met the criteria on the screening section for ADHD were then clinically evaluated in the presence of their parents/guardians using the first and fourth supplement of the Kiddie Schedule for Affective Disorder and Schizophrenia (K-SADS) on Neurodevelopmental, Disruptive, and Conduct Disorder for the definitive diagnosis of ADHD and comorbid conditions. Home visits was done to reach those parents who did not turn up for the school visits.

3.8: Ethical Considerations and Confidentiality of Data

Permission to conduct the study was obtained from the Sierra Leone Ethics and Scientific Review Committee.

Information collected from participants was secured and kept confidential. The data provided by the participants was coded using study numbers in order to ensure confidentiality and to facilitate data analysis. No names were recorded and no form of personal identification was used in the questionnaires.

The purpose of the study was clearly explained to the participants in simple language in order to facilitate informed decision making. They had the liberty to decide whether to participate in the study or not and they had the free will to withdraw from the study at any time with no consequences and were informed as such.

3.10: Beneficence to the Participants

During the course of data collection, participants who were screened positive and diagnosed with ADHD given free psychological intervention, and referred to a mental health professional and/ hospital. Small cookies (sweet/biscuits) and a "Thank You Card" was given to participants as a form of encouragement for participation in the study.

In addition, the findings of this study will be reported to the Ministry of Health and Sanitation in Sierra Leone so that they can adequately plan for the health needs of young children in the community

3.11: Non- maleficence to Participants

The participants were only obliged to respond to questions on the questionnaires. The risks and inconveniences to the participants in this study were minimized by ensuring that the time of data

collection was most convenient for them and data collection from the participants did not involve any invasive process or collection of physical biological samples.

3.12: Voluntary Participation

Participation in this study was absolutely voluntary and participants were informed they had the right to withdraw at any time during the course of the study without any penalty. Participants were not required to answer questions they are not comfortable with or did not want to answer.

3.13: Inclusion Criteria

1) Children enrolled in class 1 to 6

2) Children who gave assent to be part of the study coupled with valid consent from parents

3.14: Exclusion Criteria

1) Children below 5 years of age because they did not meet the age criteria for the KSADS.

3.15: Proposed Data Management and Analysis

Data collected was cleaned and summarised in tables, percentages, and charts. The Statistical Package for Social Sciences (SPSS) was used to analyse the data. The first part of the data analysis involved a descriptive statistical computation (mean, standard deviation, and frequency) of the participants' demographic characteristics to provide an overall description of the study sample. Associations were tested using Chi-square and significant associations were established using logistic regression model. Significant level was set at 0.05.

CHAPTER 4

RESULTS

4.1 Sociodemographic characteristics of respondents and their children

There were 300 participants. The mean age of the study participants was 8.98 ± 2.04 years, with the age ranging from 5 to 13 years. Majority of the children were older than 6 years (84%). Distribution of participants according to classes was almost equal with 56.3% being in the senior primary classes (class 4-6). More than half of the children were male, representing a total of 58.3%. Half of the participants were from Christian families (50.3%) and more than half were from a monogamous family setting (67.7%). In this sample, majority of the participants had less than 4 siblings and 44% were first born. The majority of the parents of the adolescents were married (69.3%) and the provision of care for the majority was by both parents (64.3%).

Table 1:Sociodemographic Characteristics of Respondents and their Children N= 300

Characteristics	Categories	Frequency	Percentage (%)
Gender	Male	175	58.3
	Female	125	41.7
Age (in years)	≤ 6	48	16
	>6	252	84
Type of Family	Monogamous	203	67.7
	polygamous	97	32.3
Living condition	Lives with both parents	193	64.3
	Lives with mother alone	63	21.0
	Lives with father alone	22	7.3
	Lives with grand parents	21	7.0
	Others	1	0.3
Family size	Small (<4 siblings)	236	78.7
	Large (4 or more siblings)	64	21.3
Birth order	First born	132	44
	Other positions	168	56
Fathers educational level	Low (No + koranic+ primary)	35	11.7
	High (Secondary + university)	265	88.3
Mothers educational level	Low (No + koranic+ primary)	64	21.3
	High (Secondary + university)	236	78.7
Marital status	Married	208	69.3
	Others	92	30.7
Care provider	Parents	193	64.3
	Others	107	35.7

4.2: Prevalence of ADHD and gender distribution

Of the 300 children who were interviewed, 20 (7.3%) screened positive for ADHD. However, only 9 out of the 300 children (3%) met the criteria for diagnosis of ADHD. The most frequent subtype was inattentive accounting for 1.7% of the cases. The second most common was the hyperactive subtype accounting for 1% of the cases while only 0.3% of the participants had the combined subtype. (see figure 1).

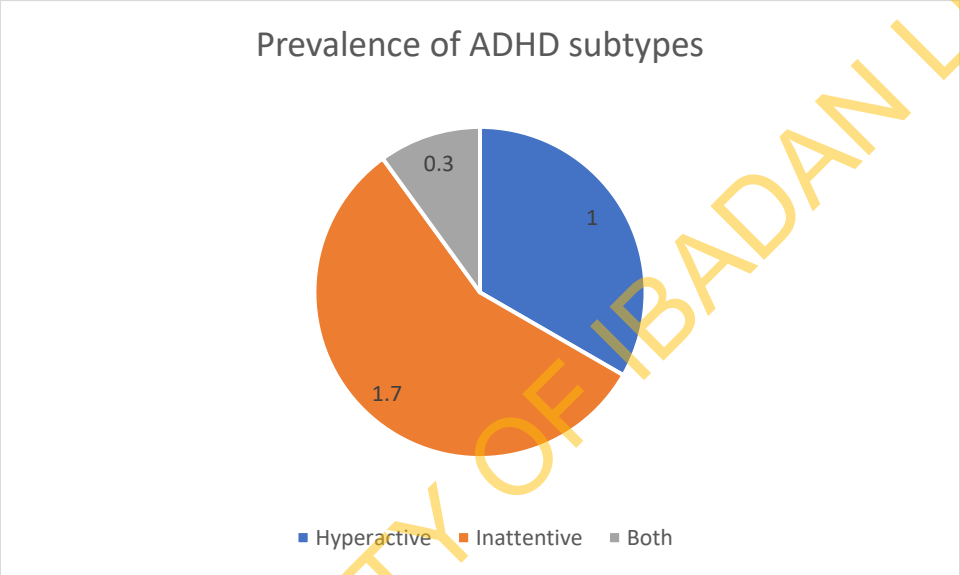

Figure 1: Prevalence of ADHD subtypes

Females were more likely to be diagnosed with the predominantly inattentive subtype than the males giving a ratio of 3.2:0.6. While for the predominantly hyperactive and combined subtypes,

males had higher representation with male to female ratio of 1.1:0.8 and 1:0 respectively. (See figure 2)

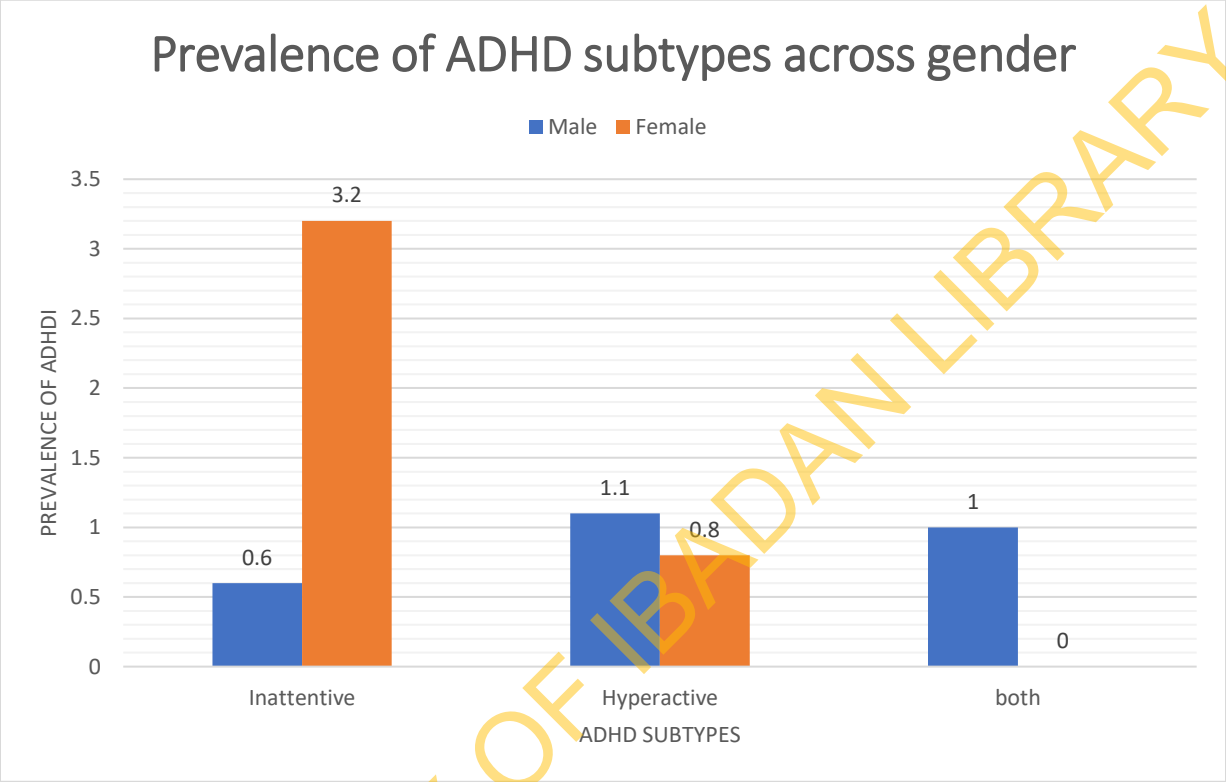

Figure 2: prevalence of ADHD subtypes across gender

4.3: Prevalence of Comorbidities

From the sample diagnosed with having ADHD (n=9), 1 (11.1%) was diagnosed with having comorbid Conduct Disorder and 3 (33.3%) with Oppositional Defiant Disorder. None of the children were found to be having comorbid Depression or Generalized Anxiety disorder.

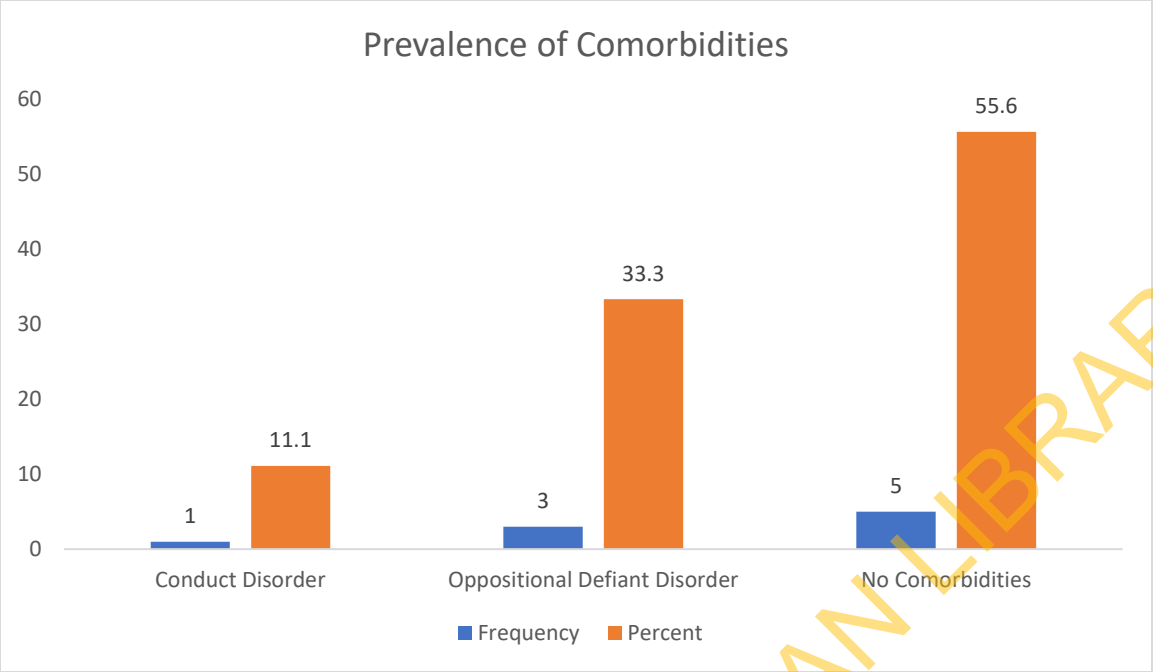

Figure 3: Prevalence of Comorbidities

4.4: Sociodemographic correlates of ADHD: Personal

Of the 9 children who met the diagnostic criteria for ADHD, 4 (2.3%) were males and 5 (4.0%) were females. This represents a male to female ratio of approximately 1:1. This difference was not statistically significant (p=0.50).

Four (4.2%) of the children below 7 years were diagnosed of ADHD compared with 2.8% of children above 6 years. This difference was however not statistically significant.

Furthermore, 3 out of the 9 (2.3%) children diagnosed with ADHD were first born compared to 3.6% who were of other birth orders. This difference was also not statistically significant (p=0.74).

Table 2: Sociodemographic correlates of ADHD: Personal n= 9

Variables	Categories	ADHD Diagnosis		χ^2	P- value
		Yes	No		
		Number (%)	Number (%)		
Gender	Male	4 (2.3%)	171 (97.7%)	0.74	0.50[f]
	Female	5 (4.0%)	120 (96.0%		
Age	≤ 6 years	2 (4.2%)	46 (95.8%)	0.27	0.64[f]
	>6 years	7 (2.8%)	245 (97.5%)		
Birth order	First Born	3 (2.3%)	129 (97.7%)	0.43	0.74[f]
	Others	6 (3.6%)	162 (96.4%)		

F= Fischer's exact correction

4.5: Family related correlates of ADHD

Our results showed that 8.6% of children whose mothers had low education were diagnosed of ADHD compared to 1.3% of children whose mothers had high education. This difference was statistically significant (p=0.006)

Three (1.0%) of the children whose fathers had low education were diagnosed of ADHD compared to 2.3% of children whose fathers had high education. This tended towards statistical significance (p=0.07).

Family size (p=0.10), primary care provider (p=0.83) and marital status (p=0.73) were not also significantly associated with diagnosis of ADHD.

Table 3: Family related correlates of ADHD n= 9

Variables	Categories	ADHD Diagnosis		χ^2	P- value
		Yes	No		
		Number (%)	Number (%)		
Mothers Educational status	Low	6 (8.6%)	64 (91.4%)	9.74	**<0.05**[f*]
	High	3 (1.3%)	227 (98.7)		
Fathers Educational status	Low	3 (1.0%)	32 (91.4%)	4.22	0.07[f]
	High	6 (2.3%)	259 (97.7%)		
Family size	Small	5 (2.1%)	231 (97.9%)	2.95	0.10[f]
	Large	4 (6.3%)	60 (93.8%)		
Marital status	Married	5 (2.4%)	203 (97.6%)	0.83	0.46[f]
	Unmarried	4 (4.3%)	88 (95.7%)		
Care Provider	Parents	5 (2.6%)	188 (97.4%)	0.31	0.73[f]
	Others	4 (3.7%)	103 (96.3)		

f=Fischers exact correction

4.6: Clinical correlates of ADHD

Our results showed that 5 (9.4%) of 53 children who had a history of neonatal asphyxia were diagnosed with ADHD compared to 4 (1.6%) of children who did not have a history of neonatal asphyxia. This difference was statistically significant (p=0.01)

Seven out of 45 (15.6%) children whose mothers reported to have used psychoactive substances during pregnancy were diagnosed of ADHD compared to 2 (0.8%) of children whose mothers did not use psychoactive substance during pregnancy. This difference was statistically significant (p=0.000)

There was no association between ADHD and maternal attendance of ANC (p=0.06)

Table 4: clinical correlates of ADHD n=9

Variables	**Categories**	**ADHD Diagnosis**		χ^2	**P- value**
		Yes	**No**		
		Number (%)	Number (%)		
History of neonatal	NO	4 (1.6%)	243 (98.4%)	9.16	**0.01**[f*]
Asphyxia	Yes	5 (9.4%)	48 (90.6%)		
Maternal use of	Yes	7 (15.6%)	38 (84.5%)	28.6	**<0.05**[f*]
psychoactive substance	NO	2 (0.8%)	253 (99.2%)		
ANC Attendance	Yes	5 (2.0%)	239 (98.0%)	4.06	0.06[f]
	No	4 (7.1%)	52 (92.9%)		

f=Fischers exact correction

4.7: Independent predictors of ADHD

Variables that were significant from the cross tabulations were put in a logistic regression model. Mothers' educational level and maternal use of psychoactive substance was found to be independently associated with ADHD.

Children whose mothers had low level of education were 6 time more likely to be diagnosed of ADHD compared to children whose mothers had high education

Children whose mothers consumed psychoactive substances during pregnancy were 19 times more likely to be diagnosed of ADHD compared to children whose mothers did not use psychoactive substances during pregnancy.

History of neonatal asphyxia was no longer associated with diagnosis of ADHD

Table 5: Independent predictors of ADHD

Predictors	Odds Ratio	95% CI	P-value
Mothers educational level			
High	1		
Low	6.85	1.50-31.08	**0.01***
Use of psychoactive substance during pregnancy	1		
No	19.37	3.27-114.87	**<0.05***
Yes			
History of Neonatal Asphyxia	1		
No	0.64	0.13-3.16	0.59
Yes			

4.8: Association between School performance and diagnosis of ADHD

Out of the 48 children who had repeated a class, 5 (10.4%) were diagnosed with ADHD compared to 4 (1.6%) of the children who had never repeated a class. This difference was statistically significant (p=0.007).

Seven (7.4%) of children who had poor academic performance were diagnosed with ADHD compared to 2 (1.0%) of children who did not have poor academic performance. This difference was also statistically significant (p=0.005).

Table 6: **Association between School performance and diagnosis of ADHD n=9**

Variables	**Categories**	**ADHD Diagnosis**		χ^2	**P- value**
		Yes	**No**		
		Number (%)	Number (%)		
Quality of handwriting	Poor	8 (9.5%)	76 (90.5%)	17.1	**<0.05**[f*]
	Good	1 (0.5%)	215 (99.5%)		
Repeating a class	≥1	5 (10.4%)	43 (89.6%)	10.8	**<0.05**[f*]
	Nil	4 (1.6%)	248 (98.4%)		
Academic performance	Poor	7 (7.4%)	87 (92.6%)	9.3	**<0.05**[f*]
	Good	2 (1.0%)	204 (99.0%)		

f=Fischers exact correction

CHAPTER FIVE

DISCUSSION, CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

This study examined the prevalence, correlates and looked to identify the common comorbid conditions associated with children diagnosed with ADHD attending primary school in Freetown Municipality, Sierra Leone. A sample of 300 school children with ages ranging from 5 to 13 years were recruited into the study.

The results showed that the prevalence of ADHD among school going children in Freetown was 3%. The most prevalent subtype was the predominant inattentive, followed by hyperactive subtype, with the combined type being the least prevalent. The predictors of ADHD were: mothers' educational level, history of neonatal asphyxia and psychoactive substance use by mother during pregnancy. The comorbid conditions diagnosed were oppositional defiant disorder and conduct disorder.

The discussion of findings from this study is presented under the following headings:

5.1: Socio-demographic characteristics

5.2: Prevalence of ADHD and common comorbid conditions

5.3: Correlates of ADHD

5.4: Association between school performance and ADHD

5.1: Socio-Demographic Characteristics of Study Population

The mean age of the study participants 8.98 with age ranging from 5 to 13 years. This is similar to study carried out by Adewuya et al in 2006. They also examined the prevalence of ADHD in

primary school going children. In their study, the age range was 7-12 years with mean of 8.94years. The reason for this similarity is probable because the educational system of Sierra Leone and Nigeria are similar with a minimum of six years spent in primary school with most children starting school at 6years of age (WAEC).

The proportion of boys and girls examined in this study was almost equal with 58.3% and 41.7% respectively. The roughly equal proportions of boys and girls are similar to the rates found in Sierra Leone's national estimates of 0-14years, where 50.7% are girls and 49.3% males, although the national estimate has a preponderance of females (SSL, 2015). The proportion of boys to girls in this study is also similar to that obtained in a study to investigate the prevalence of ADHD conducted in Osun State, Western Nigeria where the boys to girls proportion was found to be 61.3% and 38.7% respectively (Adewuya & Famuyiwa, 2007). The proportion of males in this study was however higher than another study which investigated the prevalence of ADHD in Jos, Nigeria where a much lower male proportion of 51.5% was obtained (Umar et al., 2018). The slight variations in these studies are likely due to sampling differences in the various studies.

Half of the students interviewed in this study reported that they were Christians (50.3%), this is in contrast to national estimates in Sierra Leone which showed a distribution of 77.0% Muslim and 21.9% Christian (SSL, 2015). This might be due to the fact that most of the schools in Freetown are run by Christian missionaries and also reflect, at least up until recently, the population in Freetown which was predominantly Christian while the other provinces were mostly Muslim, but during the 10 year civil war in Sierra Leone, there was a massive migration of people fleeing the conflict regions from the provincial areas into Freetown.

More than two thirds (69.3%) of the mothers in this study were married which is a similar finding to the Sierra Leone national estimate of 63.0% married women (SLDHS, 2013). However, it is

important to note that over a third of mothers were single, divorced or separated and a quarter were single parents. Studies have revealed that single mothers are more likely to have mental health problems due to the stresses of managing their homes alone and a lack of intimacy and support from partners and this has implications for children's growth and development (Adewuya *et al*, 2009).

Over two thirds of the households had 1 or 2 children, about a quarter had 3 children and just 21.3% had 4 or more children. The relatively high proportion of households with one or two children may be attributed to the fact that living in the capital city of Sierra Leone, Freetown would have made for increased awareness about family planning practices. National estimates in Sierra Leone reveal a family planning knowledge rate of 95% with 17% of married women using at least a method of contraception (SLDHS, 2013). Studies have revealed that the greater the number of children in the household, the more difficult it is to cater for their needs effectively resulting in nutritional problems, developmental problems, and other deficiencies (Dwivedi *et al*, 1992; Mahgoub *et al*, 2006; Amsalu and Tigabu, 2008). It has also been reported that the greater the number of children in the home the more likely it is for the mother to be depressed (Rahman *et al*, 2004).

5.2: Prevalence of ADHD and common comorbid conditions

The prevalence of ADHD in our sample of primary school children aged 5 to 13 years old was 3%. This falls within the world wide prevalence range of 3-7% reported by American psychiatric association in school aged children. However, Our finding does not fall within the range of 5.4 to 8.7% documented in studies conducted among primary school children in South Africa, Nigeria, and Democratic republic of Congo (Kashala, Tylleskar, Elgen, Kayembe, & Sommerfelt, 2005; A

Meyer, 1998; Anneke Meyer, Eilertsen, Sundet, Tshifularo, & Sagvolden, 2004; Umar et al., 2018). Several methodological factors could explain these disparities in the prevalence recorded. Firstly, most of the studies that recorded higher prevalence used the rating scales instead of diagnostic scales (A Meyer, 1998; Anneke Meyer et al., 2004; Umar et al., 2018). Secondly in our study majority of the reports were gotten from the teachers only because most parents were not available. Authors have postulated that multiple reports are critical because DSM-IV emphasizes that impairment from ADHD symptoms must be present in at least 2 settings(APA, 2000), also reports from teachers and parents often differ(Offord et al., 1996). This might have underestimated the prevalence in our study. Lastly some authors have postulated that ADHD is a cultural construct and diagnosis of this disorder may also vary across different cultures(S V Faraone, Sergeant, Gillberg, & Biederman, 2003). The expectation and tolerance behaviours vary in different cultural groups and differing altitudes of parents, clinicians and society around the world towards acceptable behaviours may influence diagnosis of ADHD (Dwivedi & Banhatti, 2005).

Our finding was also contrary to many other studies around the world which have reported higher prevalence rates among adolescent population such as 9.2% in Russia, 7.7% in Japan, 8.8% in Nigeria and 8.1% in Turkey (Erşan, Doğan, Doğan, & Sümer, 2004; Khaleghi et al., 2018; Ruchkin, Lorberg, Koposov, Schwab-Stone, & Sukhodolsky, 2008; Umar et al., 2018). Some studies have shown even higher prevalence. In 2001, Pineda et al found a prevalence of 18% in Columbia while in 2018 a prevalence of up to 18% was reported by Baumgaertel et al in Germany. The higher prevalence in these studies could be explained by the fact that most of them collected data from both children and adolescents, whereas this study was focused mostly children.

The most prevalent subtype in our study was the inattentive subtype accounting for 1.7% of the cases. This is consistent with studies that have been carried out in school based settings in Nigeria

that reported a preponderance of the inattentive subtype with the combine type having the least prevalence (Adewuya & Famuyiwa, 2007; Amuabunos, Ofovwe, & Ibadin, 2011; Umar et al., 2018). Studies in US (Wolraich, Hannah, Baumgaertal, & Feurer, 1998), Australia (Graetz, Sawyer, Hazell, Arney, & Baghurst, 2001)and Israel (Brook & Boaz, 2005) have also reported similar findings. However some other studies have reported contrast findings with the combined hyperactive-inattentive subtype being the most prevalent (Cornejo et al., 2005; Dwivedi & Banhatti, 2005). These studies were carried out in clinical settings and therefore more likely to have referral bias (Ndukuba et al., 2017). Some authors have also postulated that cultural factors may play a role in modulating he clinical manifestations and therefore may account for these differences(Adewuya & Famuyiwa, 2007).

In our study the most common comorbid disorder was oppositional defiant disorder with a prevalence of 33.3% and the second most common comorbid disorder being conduct disorder (11.1%). There was no comorbid Anxiety or depressive disorder. This is similar to study carried out by Adewuya et al in Nigeria in 2006, who also reported ODD as the most prevalent comorbid disorder though they also recorded depressive and anxiety disorders as comorbid conditions(Adewuya & Famuyiwa, 2007).

5.3: Correlates of ADHD

In this study, students whose mothers had no or low formal education (8.6%) reported higher rates of ADHD compared to 1.3% of children whose mother had formal education. This difference was statistically significant (p=0.006). This is similar to a study from the United States which reported that low maternal and paternal educational levels increased the risk of ADHD (Sauver et al., 2004). It had been reported that low parental education is associated with low income and low socio-economic class which in turn correlates with ADHD (Hjern, Weitoft, & Lindblad, 2010).

In this study, mothers of children with ADHD had a higher rate of use of psychoactive substances than children without ADHD. This finding is in keeping with various studies that showed a positive correlation between parental use of psychoactive substances such as alcohol, cigarettes, and caffeine-containing drinks, and ADHD (Clark, Cornelius, Wood, & Vanyukov, 2004; Kheradmand, Hedayati, Parvaresh, Ziaaddini, & Bayati, 2010). The mechanism behind psychoactive substance use, especially alcohol and caffeine, and overactivity is suggested to operate through enhanced dopamine induced changes in motor behavior (Mill & Petronis, 2008).

A significant association was observed in this study between low level of maternal education, use of psychoactive medications of mothers during pregnancy and ADHD. Mothers with low level of education were 6.85 times more likely to develop ADHD than mothers who had formal education.

Mothers who use psychoactive substances during pregnancy were 19.37 times more likely to develop ADHD than mothers who did not use any psychoactive substance during pregnancy.

5.4: Association between school performance and ADHD

Although an objective assessment using scales or checking a sample of handwriting was not done, the students were asked to do a self-appraisal of their handwriting. It has been documented that individuals with ADHD are more likely to exaggerate their competence (Hoza, Pelham, Dobbs, Owens, & Pillow, 2002). Hence, the student's assessment is more likely to be a true reflection of their handwriting. The reason for this impairment appears to be the high prevalence of motor impairment in individuals with ADHD (Christopher Gillberg, 2003; Kaiser, Schoemaker, Albaret, & Geuze, 2015). There appears to be comorbidity between ADHD and developmental coordination disorder (Christopher Gillberg, 2003).

Children with ADHD in this study reported having a poorer handwriting (p=0.001) when compared with other students without a diagnosis of ADHD. 88.9% of the students diagnosed with ADHD in this study reported having a poorer handwriting. This finding is similar to that of other studies which suggested that individuals with ADHD have impaired handwriting performance, characterized by illegible written material and inappropriate speed of execution, compared with youths without ADHD (Racine, Majnemer, Shevell, & Snider, 2008).

The overall rate of having to repeat a class for individuals with ADHD in this study was higher than students without ADHD. 10.4% of students who have failed or repeated a class have an associated diagnosis of ADHD compared to 1.6% of students without a diagnosis of ADHD. This association was statistically significant with $p<0.05$. Various studies have also reported higher rates of repeating a class and poor academic performance in students with ADHD (Daley & Birchwood, 2010; Ibadin, Ambuabunos, & Ofovwe, 2011).

ADHD is associated with impaired academic functioning, a higher risk of placement in special education classrooms, school failure, and dropout (G. DuPaul, 2007) which frequently signifies a chronic course that is viewed as a lifelong disorder requiring developmental and academic intervention (G. DuPaul, 2007).

When parents were asked whether their children do well academically, 7.4% of parents with children diagnosed with ADHD said that their children do not perform well academically compared to 1.0% who said their children do well academically.

The lower academic performance in individuals with ADHD has been linked to the core symptoms of the disorder in the form of inattention, hyperactivity, and impulsiveness (Daley & Birchwood,

2010). However, cofounders like transfer of parents, family conflicts, and active failure were not controlled for in this study.

5.5: Limitations and Strengths

The results of this study cannot be generalized or assume to be representative of the entire country. The number of children with ADHD is relatively small. The use of only one instrument for the assessment of ADHD in the children is also a limitation in this study. However, assessing both parents and teachers is strength of the study. Another limitation is that this study was school-based, there is the possibility that children with the severe type of ADHD might be out of school and hence were not assessed.

5.6: Conclusions

The study revealed the existence of ADHD among pupils in the primary schools studied. It also showed a prevalence of 3% of ADHD among the primary school pupils. The results of the study revealed that more girls are diagnosed with ADHD than boys. The prevalence among boys is 2.3% while that of girls is 4%. The findings of this study have implication for parents, teachers' curriculum planners and government.

Overall, these findings suggest that the prevalence of ADHD and the criteria used for its assessment are not affected by cultural variables. The estimates for prevalence found in this study are consistent with those reported in the literature, which suggests that ADHD is a valid diagnosis for primary school pupils in the sampled population.

This study will be most useful to parents and educators as well as other stakeholders to establish the importance of the knowledge of ADHD in identification, making referral for treatment and the education of pupils with this disorder. The information generated from this study will also help educators to draw conclusions pertaining to the present knowledge of ADHD and use this information to determine the appropriate steps to provide more training and education on the identification of this disorder. It is hoped that this study will bring about programs with which government agencies and reputable health organizations will educate parents and education stakeholders on Attention Deficit Hyperactivity Disorder.

Finally, it is hoped that this study will give impetus to the ministries and stakeholders to provide teachers, parents/guardians and other health providers enough information to assist children with Attention Deficit Hyperactivity Disorder.

5.7: Recommendations

- Based on the findings of this study, a large community-based study group would be needed to validate the findings of this study, as well as the use of observation and other methods of assessments to improve the quality of the study
- It is also recommended that there should be an update of the knowledge of teachers and parents through organized workshops on how and what to do when their pupils' manifest defiant behavior. This will help the teacher to properly assess the pupils and recognize those that manifest the symptoms of ADHD. Pupils who manifest ADHD symptoms should not be punished or bullied by the teachers or parents' rather special attention is required to making learning less difficult for ADHD pupils. The Ministry of Education and Universities should organize programs on ADHD and include such program in the school curriculum.

- Counselling units should be established in primary schools. This will reduce most of the problems ADHD pupils face during learning tasks.
- The ministry should adopt rules and regulations that are pupil friendly and provide flexible approaches to placement of those with learning disabilities especially ADHD.
- It was therefore recommended that parents and teachers should be adequately educated about the nature of ADHD so that adequate motivation will be given to make the child learn. Curriculum planners should make provisions for possible curriculum adaptations for children with ADHD and other learning disorders in the classroom.

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APPENDIX

Appendix 1: ADAPTED SCHOOL HEALTH QUESTIONNAIRE

Serial Number: __ __ __ __ **Today's Date: __ __/__ __/__ __**

ADAPTED SCHOOL HEALTH QUESTIONNAIRE

Please write the answers to the questions or draw a circle where it applies to you. This is not an examination it is only to find out about your child's health.

SECTION I

Personal Information

1. Class:

……

2. Where do you live? (Address of Present Abode):

…….

3. How old are you?

……

4. Is child a boy or a girl?

(a) boy (b) girl

5. What religion does child belong to

(a) Islam (b) Christian (c) Traditional religion (d) Other (e) None

Family Information

6. Family Type:

(a) Monogamous (b) Polygamous

7. Number of Mother's Children:

8. Number of Father's Children:

9. What is the child's position among the father's children?

10. What is the child's position among the mother's children?

11. Marital Status of Parents:

(a) Single (b) Married (c)Separated/Divorced (d) Father is dead (e) Mother is dead

(f) Mother & Father are dead

12. Who does the child live with presently?

(a) Parents (b) Mother (c) Father (d) Grandparents (e) Other [please specify] _____

13. Who brought the child up from childhood?

(a) Parents (b) Mother (c) Father (d) Grandparent (e) Other [please specify] _____

14. How many different people has child lived with from childhood? ____

15. If more than one person, list the people, time spent and whether experience was good or bad?

Person lived with	From which age to which age	Experience (good or bad)
_____	_____	_____
_____	_____	_____
_____	_____	_____

16. Level of Father's Education

(a) No Formal Education (b) Koranic School (c) Primary School (d) Secondary School

(e) Post-Secondary (Non-University) (f) University Degree and above (e) I do not know

17. Level of Mother's Education

(a) No Formal Education (b) Koranic School (c) Primary School (d) Secondary School

(e) Post-Secondary (Non-University) (f) University Degree and above (e) I do not know

School-Related Questions

18. Do you like your school?

(a) Yes (b) No

19. How many children are there in your class? ___

20. Does child do well academically?

(a) Yes (b) No

21. If Yes, explain_____

22. Is the child having difficulties with teachers?

(a) Yes (b) No

23. If yes, what sort of difficulties?

_____

24. Has the child ever repeated a class

(a) Yes (b) No

25. How would you grade the child's handwriting?

(a) Good (b) Bad

Pregnancy and birth related questions

26. Did the mother attend ante natal care?

(a) Yes (b) No

27. Did the mother use any alcohol or other drugs like cannabis during pregnancy?

(a) Yes (b) No

28. Did the child cry immediately after birth?

Yes (b) No

Appendix 2: Ethical Approval

GOVERNMENT OF SIERRA LEONE
Office of the Sierra Leone Ethics and Scientific Review Committee
Directorate of Policy, Planning and Information
5th Floor, Youyi Building Brookfields, Freetown
Ministry of Health and Sanitation

28th February, 2019

TO: **Dr. Samuel Adeyemi Williams (M.Sc. Candidate)** **Principal Investigator**
Centre for Child and Adolescent Mental Health
University of Ibadan
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+232-78-618-944

Study Title: **Prevalence, Correlates and Common Comorbid conditions of Attention Deficit Hyperactivity Disorder (ADHD) in Primary School Children in Freetown, Sierra Leone**.

Version: 10th January 2019

Supervisor: Dr. Celia Yetunde Adeniyi
Department of Psychiatry
University of Ibadan

Submission Type: First protocol version submitted for review

Committee Action: Expedited Review

Approval Date: 25th February, 2019

The Sierra Leone Ethics and Scientific Review Committee (**SLESRC**) having conducted an expedited review of the above study proposal and determined that it presents minimal risk to subjects, **hereby grants ethical and scientific approval for it to be conducted in Sierra Leone**. The approval is valid for the period, **25th February,2019 – 26th March, 2019.** It is your responsibility to obtain approval for any on-going research prior to its expiration date. The request for re-approval must be supported by a progress report.

For further enquiries please contact **efoday@health.gov.sl**