

## Original Research Article

# Socio-demographic and environmental determinants of attention deficit hyperactivity disorder in primary school children in Ikot Ekpene, Nigeria

Ekemini Joseph Hogan\*, Mkpouto Udeme Akpan, Echey Ijezie, Kevin Bassey Edem

Department of Pediatrics, University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria

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**\*Correspondence:**

Dr. Ekemini Joseph Hogan,  
E-mail: Kemj95@gmail.com

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### ABSTRACT

**Background:** Attention deficit hyperactivity disorder (ADHD) is one of the most common neuro-behavioural disorders of childhood. Environmental influences have been reported to be important in its aetiopathogenesis. There is a paucity of publications assessing the socio-demographic and environmental determinants of ADHD in Sub Saharan Africa. The aim was to determine the socio-demographic and environmental determinants of ADHD in primary school children in Ikot Ekpene, Nigeria.

**Methods:** Vanderbilt ADHD diagnostic teacher rating scale for ADHD was administered on 1174 pupils aged 6-12 years drawn from twelve primary schools in Ikot-Ekpene, Akwa-Ibom State, Nigeria. Parents of the selected pupils completed a proforma on their socio-demographics and environmental factors.

**Results:** The mean age of the study population was 9.32 years with a male preponderance. ADHD was significantly associated with lower socio-economic status, being a product of multiple gestations, having parents with financial difficulty during the first few years of child's life among others.

**Conclusions:** ADHD is associated with common socio-demographic and environmental risk factors. Some of these factors such as low income and low socio-economic status are modifiable. Poverty alleviation, job security and empowerment of parents of children living in resource-poor settings is critical to reducing the prevalence of ADHD.

**Keywords:** Socio-demographic, ADHD, Children, Nigeria

### INTRODUCTION

ADHD is the most common neuro-behavioural disorder of childhood with a global prevalence of between 2% and 7%.<sup>1,2</sup> The aetiology of ADHD complex and multifactorial involving genetic, environmental and psychosocial factors.<sup>3</sup> The exact cause of ADHD is unknown, however, the dopaminergic system has been said to play an important role in the pathogenesis of many neuropsychological illnesses including ADHD.<sup>4</sup> Gene association studies have also implicated several genes within the dopamine signaling pathway in the ADHD

pathogenesis.<sup>3,4</sup> Twin and adoption studies have provided further evidence that ADHD has a genetic basis and the heritability is about 0.76, which is the highest among psychiatric disorders.<sup>5-7</sup> A study by Levy et al of a COHORT of 1,938 families with twins and siblings aged 4-12 years using a DSM (diagnostic and statistical manual) III-R based maternal rating scale, reported 82% concordance rate for ADHD in identical twins compared to 38% discordance rate for non-identical twins.<sup>7</sup>

Environmental influences have also been reported to be important in the aetiopathogenesis of ADHD. This

relationship is complex and these environmental factors tend to co-occur and gives rise to different outcomes, for example, a young, single and unemployed mother is more likely to have financial difficulties and all the above factors have been reported to influence the prevalence of ADHD.<sup>8</sup> A study of socioeconomic associations with ADHD by Russel et al reported that some socioeconomic factors influence the prevalence of ADHD including financial difficulties in the parents, poor housing, young maternal age and single-parent status.<sup>8</sup> Financial difficulty faced by the parents especially during the early years of the child's life from 0-2 years was reported to confer 2.2 times more chance of the child developing ADHD later in life.<sup>8</sup> The presence of family conflicts which could be determined by how involved both parents were with their child also influence the risk of developing ADHD. A child who receives less attention from his/her parents was more likely to be diagnosed with ADHD.<sup>8</sup> Other extreme challenging home environments like neglect, abuse, violence, crime, substance abuse, single parenthood and young mothers, all increases the chances of ADHD.<sup>8</sup> However, parental education, married parents and cohabiting parents were not found to be risk factors in the development of ADHD in this study.

A study by Langley et al to determine the possible effect of environmental risk in the aetiology of ADHD recruited 356 children, aged 6 and 7 years diagnosed with ADHD.<sup>9</sup> It reported that 46% of the mothers smoked during pregnancy, 21% of the mothers were of high social class, 29% were of the middle social class, while 50% were of low socioeconomic class. The mean birth weight was 3.2 kgs. They concluded that maternal smoking during pregnancy, low family income and low social class were associated with ADHD which agrees with other studies.<sup>9-11</sup> Birth weight was not found to be a risk factor for ADHD in this study.<sup>9</sup> Another study by Galera et al reported a positive correlation between low birth weight, prenatal tobacco exposure, young maternal age at birth of index child, a non-intact family, a paternal history of anti-social behaviour and maternal depression and having ADHD.<sup>10</sup> Kotima et al reported maternal smoking, low socioeconomic class, maternal alcohol use and young maternal age as risk factors for ADHD.<sup>11</sup> Environmental contaminants like lead have also been implicated in the aetiology of hyperactivity. A study by Surkan et al in Boston, Massachusetts recruited 534 children aged 6-10 years.<sup>12</sup> The study reported that blood levels of 5-10 micrograms/dl of lead in school age children were associated with deficits in intelligence, achievement and attention.

There is a paucity of publications assessing the socio-demographic and environmental determinants of ADHD in Sub Saharan Africa. However, Kashala et al reported, in a study of children in the democratic republic of Congo that a health challenge in the family, good nutritional status, poor academic performance and a younger age of starting primary school were positively associated with

ADHD symptoms.<sup>13</sup> These factors differed from the common factors identified in developed countries.

This study aimed to identify the socio-demographic and environmental risk factors associated with ADHD in Ikot Ekpene, a semi-urban area in Southern Nigeria.

## METHODS

This descriptive cross-sectional study was conducted among primary school pupils in Ikot Ekpene local government area (LGA) a semi-urban area in Akwa Ibom State, Nigeria. The period of the study spanned 4 months, from April 2018 to July 2018. All the pupils recruited for the study were aged 6-12 years and were recruited by a multi-stage random sampling method. Only pupils who had been in the class from the beginning of the school year and those whose parents gave consent were recruited into the study. Ethical approval to conduct the study was obtained from the health research and ethics committee of the University of Uyo teaching hospital, Uyo. Written consent was obtained from the parents of the participants and older participants (>7 years of age) gave assent also.

### Sample size estimation

The minimum sample size was calculated from the formula,<sup>14</sup>

$$n = \frac{Z^2 (p) (1-p)}{d^2}$$

where,

n=minimum sample size,

Z=the normal deviate, set at 1.96 corresponding to the 95 percent confidence level,

p=prevalence of ADHD assumed to be 50%, due to the absence of studies in Akwa Ibom State,

d<sup>2</sup>=total width of the expected confidence interval, set at 0.03

$$n = \frac{(1.96)^2 (0.5)(0.5)}{(0.03)^2} = 1067.$$

With projected attrition of 10%, calculated to be 107, the minimum sample size was summed up to 1174.<sup>15</sup>

### Sampling method

A multi-stage sampling method was used.

In the first stage, 12 schools were selected from the 60 primary schools in the LGA by purposive sampling. Seven public schools and five private schools were selected representing proportionately in a ratio of 11:9 the

number of public (33) and private (27) schools in the study area.

In the second stage, the number of pupils to be selected from each school was determined by proportionate sampling. This was based on a total school population of 10,760 pupils in the 12 schools, out of whom 8,185 met the inclusion criteria.

The number of pupils recruited from each school was determined by the formula,

$$n = \frac{N}{M} \times \text{sample size (1174)},$$

where,

N=total population that met the inclusion criteria in a school,

M=total population that met the inclusion criteria in the 12 selected schools (8,185 pupils),

the sample size of the study being 1,174,

n=number of subjects expected from a school.

The number of pupils to be sampled per class arm was determined using the following formula,

$$Z = \frac{a \times n}{N},$$

where,

Z=number of pupils to be sampled in a class arm,

a=number of pupils that met the inclusion criteria in the class arm,

N=total population that met the inclusion criteria in a school,

n=number of subjects expected from a school.

### **Assessment of ADHD using the Vanderbilt assessment scales**

#### *Administration of the Vanderbilt assessment scale-teacher informant*

A structured questionnaire, the Vanderbilt ADHD diagnostic teacher rating scale was administered by the classroom teacher of each child on the child, after adequate training of the teachers (two sessions) on the questionnaire to be administered.<sup>16</sup> Uniformity of administration of the Vanderbilt teacher rating scale administered by the teachers was assessed class by class, if wrong marking was done, the teacher was retrained and a new questionnaire was administered. All the selected pupils in the class were identified by the class teacher and

each pupil's name, class and grade level were filled in the questionnaire. The Vanderbilt rating scales followed closely the criteria outlined in the DSM-IV and have been customized to observations made in the home and classroom environments.

The Vanderbilt assessment scale-teacher informant is a frequency-based instrument that rates the subscale items according to the frequency of occurrence. Listed on the left column of each subscale were 35 symptoms, three academic performance ratings and five classroom behavior ratings. On the right side of the scale, against each of the 35 symptoms are the four specified types of rating (scored 0-3) depending on the frequency of the symptom assessed corresponding to symptoms never observed (0), occasionally observed (1), often observed (2) and very often observed (3).

The academic performance and classroom behavior scale rates the pupil's performance from 1-5 with 1 corresponding to excellent, 2 to above average, 3 to average, 4 to being somewhat of a problem and 5 to being problematic.

#### **Scoring of the teacher assessment scale<sup>16</sup>**

Among the behavior, items numbered 1-35, the number of questions in each section 1-9, 10-18, 19-28 and 29-35 in which there is a score of 2 or 3 was counted. Then the performance items 36-43 were checked to determine whether at least one item has a score of 4-5. Then the diagnostic subtype of ADHD was determined. A child was adjudged to have ADHD predominantly inattentive subtype if the individual scored 2 or 3 in 6 out of 9 items in question 1-9 and score 4 or 5 in any of the performance questions in items 36-43. For the hyperactive/impulsive subtype ADHD, a child scored 2 or 3 in 6 out of 9 items on questions 10-18 and score 4 or 5 on any of the performance questions 36-43. A diagnosis of combined inattention/hyperactivity subtype was made when the pupil met the criteria in both inattention and hyperactivity/impulsivity subtypes.

#### **Socio-demographic characteristics**

The social class of all the selected pupils used in the study was determined using the scheme proposed by Oyediji, which has been used among Nigerian children.<sup>17,18</sup> Other socio-demographic variables of all the selected pupils used in the study and the controls were captured using a self-structured questionnaire. This proforma included basic identifying information such as the name, age and gender of the pupil, age of parents and gender of primary guardian. The marital status of parents was classified into single, married, divorced or separated. The relationship to the child was classified as biological parents, grandparents, foster parents, relatives and others. The father's and mother's occupation, father and mother's highest educational attainment were classified into none, primary, secondary and tertiary. The average

monthly income was classified as <18,000 Naira and >18,000 Naira. The child’s birth order was categorized into, an only child, first child, 2nd child, last child and others (stating the order). The father’s number of wives, classified as one, two or more wives. Also, if the child was a product of multiple gestations, it was classified with a yes or no answer. Financial difficulty experienced by the parents in the first two years of the child’s life was answered with the option of a yes or a no.

**Data analysis**

Statistical analysis was performed using statistical package for social science (SPSS) version 20.0.<sup>19</sup> Frequencies and percentages were calculated for categorical data. Student t test was used for the

comparison of means and chi square for comparison of proportions.

**RESULTS**

One thousand one hundred and seventy four (1174) children aged 6 -12 years were recruited into this study. The mean age was 9.32 years. About 69% of the children were in the 8-11 years age group 34% were aged 8-9 years, while 34.6% were aged 10-11. Males made up 53.7% and 46.3% were females. Forty eight point five percent of the participants were from the lower socioeconomic class. Table 1 highlights the socio-demographic characteristics of the study population.

Tables 2 and 3 show the association between socio-demographic/environmental factors and ADHD.

**Table 1: Socio-demographic characteristics of study population.**

Characteristics	Frequency (N=1174)	Percentage (%)
<b>Age (in years)</b>		
6-7	190	16.2
8-9	409	34.8
10-11	406	34.6
12	169	14.4
Total	276	100.0
<b>Gender</b>		
Male	630	53.7
Female	544	46.3
Total	1174	100.0
<b>Social class</b>		
Upper	284	24.2
Middle	321	27.3
Lower	569	48.5
Total	1174	100.0

**Table 2: Association between socio-demographic/environmental factors and ADHD.**

Variables	ADHD status N (%)		Total (N=1174)	Statistical indices
	Yes (N=146)	No (N=1028)		
<b>Age (in years)</b>				
Mean (SD)	9.3 (1.7)	9.3 (1.8)	9.3 (1.8)	Tt=-0.0308; Df=1; p=0.96
<b>Sex</b>				
Male	82 (56.2)	544 (52.9)	626 (53.3)	Df=1; $\chi^2=0.5412$ ; p=0.46
Female	64 (43.8)	484 (47.1)	548 (46.7)	
<b>Gestational status</b>				
Multiple gestation	23 (15.7)	98 (9.5)	121 (10.3)	Df=1; $\chi^2=5.3509$ ; p=0.021+
Single gestation	123 (84.3)	930 (90.5)	1053 (89.7)	
<b>Birth order</b>				
Last	41 (28.1)	216 (21.0)	257 (21.9)	Df=4; $\chi^2=12.7113$ ; p=0.013+
1st	55 (37.7)	434 (42.2)	489 (41.6)	
2nd-4th	24 (16.4)	258 (25.1)	282 (24.0)	
5th-8th	2 (1.4)	18 (1.7)	20 (1.7)	
Only	24 (16.4)	102 (9.9)	126 (10.7)	

+Significant p value.

**Table 3: Association between socio-demographic/environmental factors and ADHD.**

Variables	ADHD status N (%)		Total (N=1174)	Statistical indices
	Yes (N=146)	No (N=1028)		
<b>SES</b>				
Upper class	10 (6.9)	275 (26.8)	285 (24.3)	Df=2; $\chi^2=0.5412$ ; p<0.0001*
Middle class	39 (26.7)	280 (27.2)	319 (27.2)	
Lower class	97 (66.4)	473 (46.0)	570 (48.5)	
<b>Marital status of primary caregiver (s)</b>				
Single	17 (11.6)	99 (9.6)	116 (9.9)	Df=1; $\chi^2=0.5821$ ; p=0.44
Married	129 (88.4)	929 (90.4)	1058 (90.1)	
<b>Relationship of primary caregiver(s) with participants</b>				
Biological	98 (67.1)	871 (84.7)	969 (82.5)	Df=2; p<0.0001+*
Foster	48 (32.9)	150 (14.6)	198 (16.9)	
Others (relatives and grandparents)	0 (0.0)	7 (0.7)	7 (0.6)	
<b>Number of wives</b>				
0	0 (0.0)	8 (0.8)	8 (0.7)	Df=3; p=0.004+*
1	128 (87.7)	972 (94.5)	1100 (93.7)	
2	14 (9.6)	38 (3.7)	52 (4.4)	
3	4 (2.7)	10 (1.0)	14 (1.2)	
<b>Average family income (dollar equivalent)</b>				
<18,000 (<\$44)	72 (49.3)	480 (46.7)	552 (47.0)	Df=1; $\chi^2=0.3529$ ; p=0.55
>18,000 (>\$44)	74 (50.7)	548 (53.3)	622 (53.0)	
<b>Financial difficulty in child's early years</b>				
Yes	83 (56.9)	413 (40.2)	496 (42.2)	Df=1; $\chi^2=14.5678$ ; p<0.0001+
No	63 (43.1)	615 (59.8)	678 (57.8)	

\*Fischer's exact test, +significant p value.

## DISCUSSION

The study observed a lower prevalence rate in the younger age groups and this may reflect the teacher's perception of inattention and hyperactivity as normal variants of behaviour for younger children. Other studies have however noted a similar pattern of prevalence trends of ADHD with age with symptoms being most likely in the 9-11 year old similar to this study.<sup>20-22</sup>

This study found a higher prevalence of ADHD among pupils whose parents were married, the prevalence rate was also slightly less in children who lived with single parents. This was contrary to an earlier report that the prevalence of ADHD was higher in children raised by a single parent or children in situations of divorce or non-intact families.<sup>9,23,24</sup> This difference may be explained by cultural differences. Especially since another Nigerian study conducted in a nearby city to the study area by Ndukuba et al reported similar findings to the current study.<sup>25</sup> Conversely, another study from Northern Nigeria reported that children with ADHD were more likely to be of single or divorced parents.<sup>26</sup>

This study found that living in foster care showed a statistically significant relationship with ADHD. Although fostering was not well established in Nigeria, care by non-relatives occurred commonly with such

children living with guardians as helps. This finding compared well with some studies from developed countries reported a higher frequency of ADHD in children in foster care. A study in Poland also reported a high prevalence of ADHD symptoms among children in foster care.<sup>27</sup> Steven et al in Romania also reported a high rate of ADHD among children in foster care.<sup>28</sup> This study demonstrated that ADHD was more prevalent in children who were products of twin gestations. This observation compared well with previous reports that ADHD was more prevalent among twins.<sup>7,29</sup> Parents of most children with ADHD reported financial difficulty in the first few years of the child's life. This was similar to a report by Russel et al that ADHD was more prevalent in children whose parents had financial difficulty in the first few years of the child's life.<sup>23</sup>

This study found that ADHD was more prevalent in children whose parents had a low income of less than 18,000 Naira per month, below the prevailing national minimum wage at the time. Our finding was similar to that reported by Russel et al and Langley et al who reported low family income to be associated with ADHD.<sup>8,9</sup> Though it may not be a direct cause of ADHD, evidence suggested that there could be a higher rate of potential causes that affect those living in poverty. This included low socioeconomic class, low income, environmental exposure like lead exposure, alcohol and

tobacco use in pregnancy, premature delivery and low birth weight.<sup>30</sup>

This study reported a higher prevalence of ADHD in firstborn children. A similar finding was reported by Ndokuba et al who reported that first to third-born children had a higher prevalence of ADHD than fourth-born and higher birth order.<sup>25</sup> Marin et al in Spain reported similar findings among firstborns.<sup>31</sup> Reimelt et al, noted that firstborn children receive simultaneously less parental care and more responsibilities if younger children were born.<sup>30</sup> This tends to happen during the vulnerable period of ADHD. Furthermore, as a result of higher levels of insecurity, parents were assumed to focus more on potential physical and psychological abnormalities in their firstborn children. This may result in diagnostic bias in firstborn children.<sup>30</sup>

## CONCLUSION

The study found significant associations between ADHD and common socio-demographic and environmental risk factors. Some of these factors like low income and low socio-economic status, foster care are modifiable. Poverty alleviation, job security and empowerment of parents of children living in resource-poor settings is critical to reducing the prevalence and bettering the outcomes of ADHD.

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