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Prevalence and Pattern of Neurological Disorders amongst Children Attending the Neurology Clinic of a Private Paediatric Hospital in Southern Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author BAW conceived/designed the study, performed statistical analysis, literature search, wrote parts of the manuscript, and approved the final manuscript. Author JEA Literature search, wrote parts of the manuscript, and approved the final draft. Both authors read and approved the final manuscript.

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ABSTRACT

Aim: Neurologic disorders are a common cause of morbidity and disability in children worldwide. There is a dearth of knowledge of neurologic disorders in private health facilities thus this study was done to determine the prevalence and pattern of these disorders.
Study Design: It was a retrospective study.
Place and Duration of Study: This study was carried out in a private paediatric hospital in Southern Nigeria over 1-year between 1st January, 2023 and 31th December, 2023.

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Methodology: Data was extracted from the hospital's health management system and analysed.
Results: Of the 22,965 outpatient clinic visits during the study period, 203 had neurological disorders giving a prevalence rate of 0.9% with slight female predominance 107(52.7). Most common age group was 1 - < 5 years (43.4%).
Single neurologic disorders predominated 123 (63.4%). Commonest neurological disorders were seizure disorder (54.6%), autism spectrum disorder (24.3%) and attention deficit hyperactive disorder (11.3%) with the commonest risk factors for neurologic disorders being severe perinatal asphyxia (42.1%) and severe neonatal jaundice (42.1%). There were significantly more males than females with seizure disorder (*P* value .013) whereas cerebral palsy was significantly more in females (*P* value .002). Seizure disorder and learning disorder were significantly more in children ≥ 5years (*P* value of .001 & .030 respectively) whereas cerebral palsy and speech impairment were significantly more in children < 5years (*P* value of < .001 & .030 respectively).
Conclusion: The prevalence of neurologic disorders was low, being 0.9% with children under 5 years being mostly affected. Commonest neurologic disorders were seizure disorder, autism spectrum disorder and attention deficit hyperactive disorder while perinatal asphyxia and neonatal jaundice were the commonest risk factors.
Public enlightenment campaigns about neurologic disorders and the availability of care would improve the outcome of affected children.

Keywords: Neurologic disorders; prevalence; pattern; children; Southern Nigeria.

1. INTRODUCTION

Neurologic disorders are a common cause of morbidity and disability in children worldwide, with a greater proportion of affected children living in developing countries (Ejeliogu & Yiltok, 2017; Kawakatsu et al., 2012; Adejoh et al., 2023; Lagunju & Okafor, 2009). These disorders may arise from various factors such as genetic disorders, infections, hypoxia, injuries, neurotoxins, adverse perinatal events, malnutrition, chromosomal abnormalities and metabolic disorders (Adejoh et al., 2023; Lagunju & Okafor, 2009; Akodu et al., 2022). Ifezulike et al., (2023) reported birth asphyxia, neonatal jaundice and neonatal infections as being the commonest predisposing factors of neurologic disorders in children in Awka, Eastern Nigeria.

Neurologic disorders are characterized by dysfunction of the nervous system (Adejoh et al., 2023; Lagunju & Okafor, 2009). They may manifest as impairment in physical, cognitive, memory, motor or speech functions often resulting in chronic problems which have great impact on the child, the family and even the society at large (Adejoh et al., 2023; Lagunju & Okafor, 2009).

The prevalence rate and pattern of neurologic disorders vary depending on geographical location, variations over time as well as the level of advancement in obstetric, neonatal and paediatric care in the areas of both personnel and technological development (Ejeliogu & Yiltok, 2017; Akpan & Utuk, 2014). (Lagunju & Okafor, 2009) reported a prevalence rate of 21% among children attending the specialist paediatric clinic in Ibadan with epilepsy (seizure disorder) and cerebral palsy being the most common neurologic disorders seen. This was similar to the prevalence rate of 21.3% reported by (Ejeliogu & Yiltok, 2017) who also found epilepsy and cerebral palsy as the most common neurologic disorders in Jos, North central Nigeria. Akodu et al., (2022) however, reported a prevalence rate of 9.7% with the most common disorders being seizure disorders, cerebral palsy and central nervous system (CNS) infections with complications. The variation in the prevalence rates as reported by several authors may be due to differences in methodology, case definitions and sampling techniques (Ejeliogu & Yiltok, 2017).

Children with neurologic disorders in this part of the world are often faced with the problem of delay in diagnosis, proper management and inadequate supportive care due to poverty, ignorance, inadequate health facilities, poor community services and lack of rehabilitative facilities (Ejeliogu & Yiltok, 2017; Adejoh et al., 2023; Lagunju & Okafor, 2009). They often require treatment for long periods and so parents and caregivers may become frustrated and thus, would require adequate counselling and support to cope (Ejeliogu & Yiltok, 2017; Adejoh et al., 2023; Lagunju & Okafor, 2009). The prolonged care which often includes medications and various therapy sessions are often costly, time consuming and hence impose a great burden on the family, society and the government (Ejeliogu

& Yiltok, 2017; Adejoh et al., 2023; Lagunju & Okafor, 2009; Wonodi & Okari, 2023). Parents of these children are therefore highly stressed, they may have anxiety and depressive symptoms and may in addition, face stigmatization (Adejoh et al., 2023). Hence, the need for social, educational, psychologic, speech and occupational therapy and occasionally financial support (where possible) for the child and also for the family cannot be overemphasized as part of the management of affected children.

Neuro-epidemiologic studies are important to ensure that children with neurologic disorders get adequate access to care (Wonodi & Okari, 2023; Komolafe et al., 2018; Gabriel-Job & Wobo, 2023). These studies are important for understanding characteristics and trends of neurologic disorders in children, thus facilitating early diagnosis and prompt treatment as well as providing data base for development of preventive health policies (Ejeliogu & Yiltok, 2017; Wonodi & Okari, 2023; Komolafe et al., 2018; Gabriel-Job & Wobo, 2023). Several studies have been carried out in the public/tertiary health facilities worldwide including Nigeria but there is a dearth of knowledge in the private health facilities thus, this preliminary study was carried out to determine the prevalence and pattern of neurologic disorders in children attending a neurology clinic of a private paediatric hospital in Southern Nigeria. It is noteworthy that not many private health facilities in this part of the country operate a functional paediatric neurology clinic. Data obtained from this preliminary study would thus serve as a basis for further multicentre research, as well as provide a rationale for advocacy for the establishment of functional neurology clinics in more private paediatric hospitals in the state.

2. MATERIALS AND METHODS

This was a retrospective study involving all children who attended the neurology clinic in a private paediatric hospital in Port Harcourt, Rivers State, over 1-year from 1st January 2023 to 31st December, 2023.

The study centre, a 38-bedded private hospital, is well-equipped with 5 consulting rooms, an emergency room, a neonatal unit, children's wards, a fully functional radiology unit, an electroencephalography (EEG) room, physiotherapy unit, speech, occupational therapy units and medical laboratory. Age group seen was 0-17 years with an average monthly out-patient attendance rate of 1250-1500 children (both general and specialist clinics) and an average monthly admission rate of 80-90 children per month. The hospital has 7 paediatricians including a paediatric neurologist, paediatric dermatologist, surgeons as well as physiotherapist, speech therapist, occupational therapists, as well as other support staff including nurses.

A research assistant was recruited, trained thoroughly on the proforma including the inclusion and exclusion criteria. Data of all children aged 0-17 years referred to the neurology clinic for a detailed review by the paediatric neurologist during the study period were retrieved from the clinic records of the hospitals' Health Management System (HMS). Information obtained included age, sex, detailed history, clinical features, diagnosis, results of investigations and treatment.

All children with a definitive diagnosis of a neurologic disorder were included in the study whereas all children without a definitive diagnosis of neurologic disorder were excluded from the study. All Children with incomplete clinical or laboratory data were also excluded from the study.

Children referred to the neurology clinic were thoroughly clerked and examined by the paediatric neurologist. Where indicated, confirmatory radiologic, laboratory and other supportive investigations were carried out. An EEG was done when required.

All patients diagnosed with various neurologic disorders were treated according to standard protocols on out-patient basis or on admission depending on the severity and presence of other illnesses. Patients were referred, when required, for the various types of therapy (speech, occupational, behavioural and physiotherapy) available within the hospital.

Informed consent was not necessary as there was no direct contact with the patients. However, information obtained was kept confidential.

Data was recorded in an Excel spreadsheet and analysed using SPSS version 23. Results were presented as frequency, percentages, pie and bar charts. Test of association was done using Chi (χ^2) test and Fishers' Exact test. Statistical significance was set at P value < .05 at 95% confidence intervals.

3. RESULTS

3.1 Sex and Age Distribution

There were 22,965 outpatient clinic visits during the period of study out of which 203 had neurological disorders giving a prevalence rate of 0.9%. Females predominated 107 (52.7%) with a Male: Female ratio of 1: 1.1. Children aged 1 - < 5 years were mostly seen 88 (43.4%) with mean age of 5.90 ± 4.19 years, Table 1.

3.2 Pattern of Neurological Disorders

There were 123 (63.4%) patients with single disorders while 71 (36.6%) had multiple disorders. The commonest neurological disorder was seizure disorder 106 (54.6%) followed by autism spectrum disorder 48 (24.3%) and attention deficit hyperactive disorder 22 (11.3%).

3.3 Types of Seizure Disorder

The commonest type of seizure disorder seen was generalized type (89.7%) while the least was myoclonic (0.9%), Fig. 1.

3.4 Types of Cerebral Palsy

Most of the patients with cerebral palsy were unclassified (35.4%) followed by spastic cerebral palsy (Spastic quadriplegia – 17.6% and spastic diplegia – 17.6%), while the least was dyskinetic cerebral palsy (11.8%), Fig. 2.

Table 1. Sex and Age distribution

Variables	Frequency, n = 203	%
Sex		
Male	96	47.3
Female	107	52.7
Age group (years)		
< 1	9	4.4
1 - < 5	88	43.4
5 - < 10	56	27.6
10 - 16	50	24.6

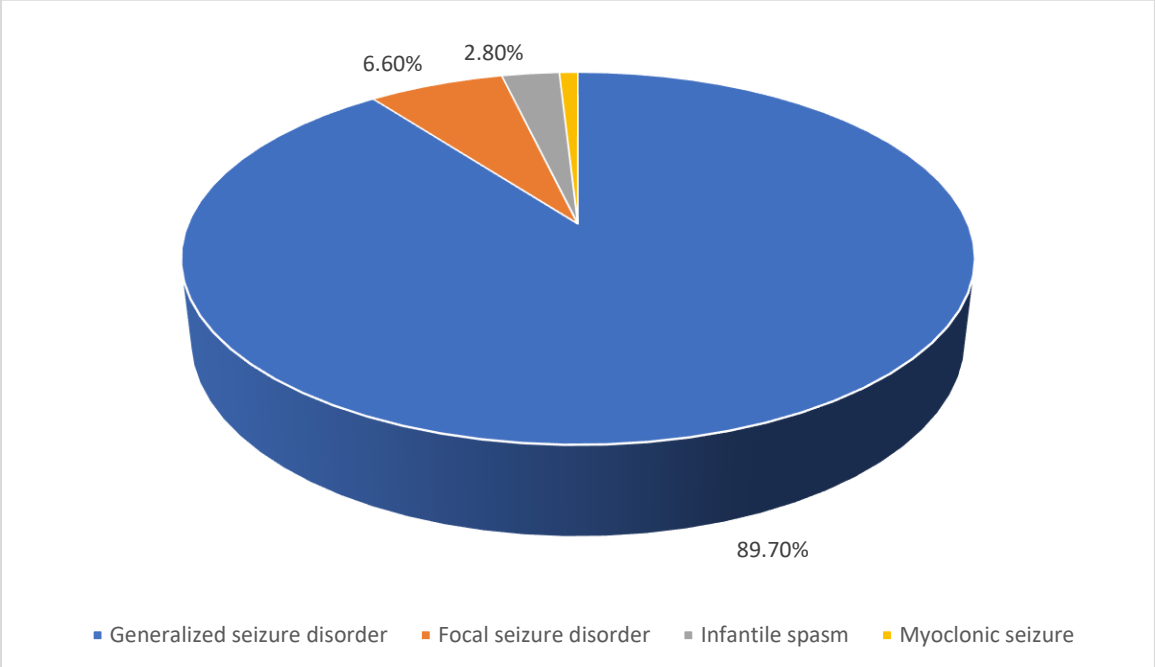

Fig. 1. Types of seizure disorder

Table 2. Pattern of neurological disorders

Pattern of disease	Frequency	%
Seizure disorder	106	54.6
Autism spectrum disorder	48	24.3
Attention deficit hyperactive disorder	22	11.3
Speech impairment	18	9.3
Cerebral palsy	17	8.8
Movement disorder	17	8.8
Learning disorder	6	3.1
Chromosomal abnormality	6	3.1
Hydrocephalus	5	2.6
Visual impairment	4	2.1
Hemiplegia	4	2.1
Intellectual disability	4	2.1
Facial nerve palsy	4	2.1
Narcolepsy	2	1.0
Others	8	4.1

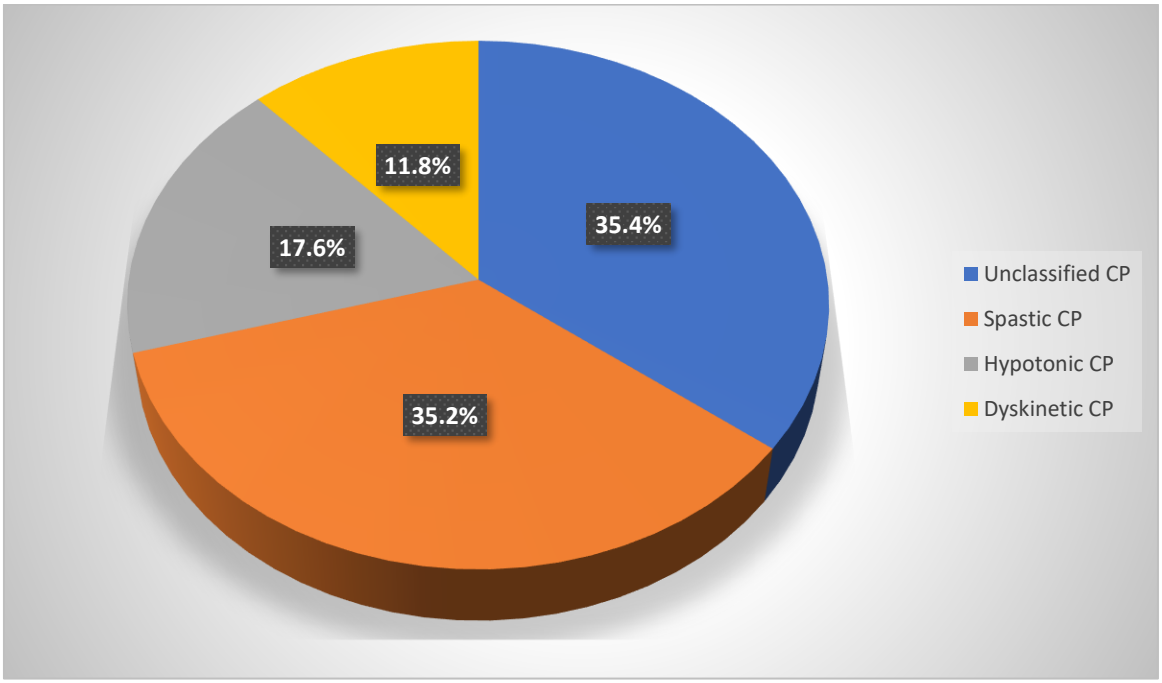

Fig. 2. Types of cerebral palsy
CP: Cerebral palsy

3.5 Risk Factors of Neurological Disorders

The commonest risk factors were severe perinatal asphyxia (42.1%) and severe neonatal jaundice (42.1%), Fig. 3.

3.6 Association between Sex of the Patients and Neurological Disorders

There were significantly more males with seizure disorder than females, (*P* value = .013) while cerebral palsy was significantly more in females (*P* = .002), Table 3.

3.7 Association between Age Groups of Patients and Neurological Disorders

Seizure disorder and learning disorder was significantly more in children ≥ 5 years (*P* value = < .001, .030 respectively) while cerebral palsy and speech impairment was significantly more in children less than 5 years old (*P* value < .001, .030 respectively), Table 4.

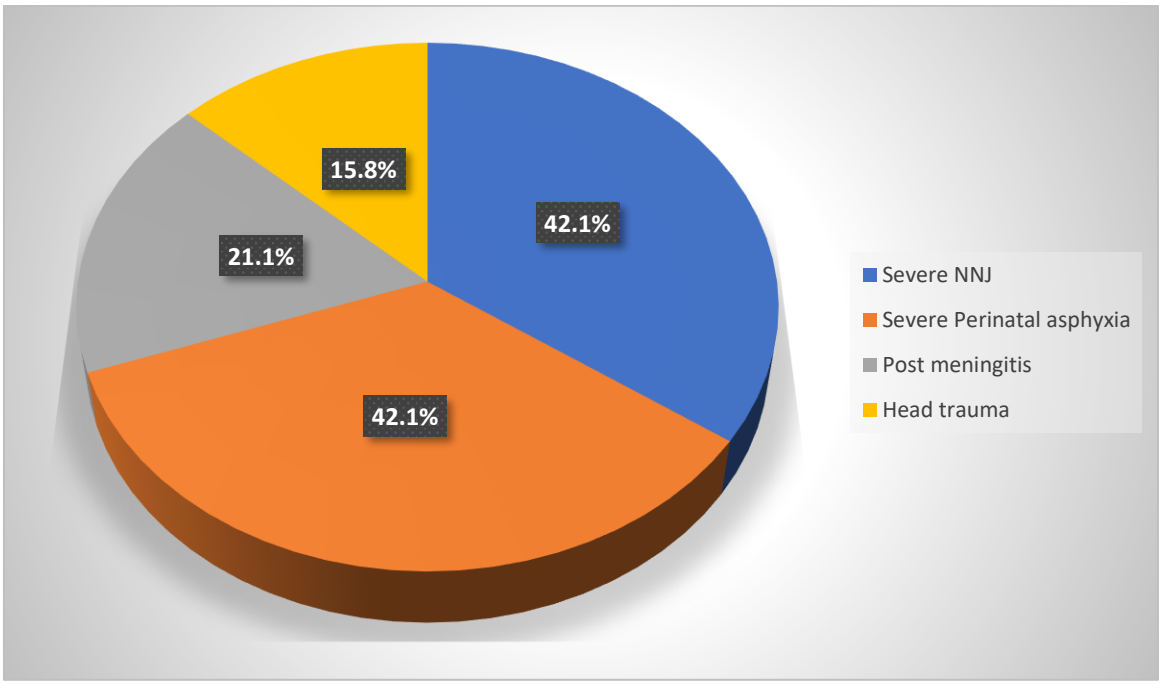

Fig. 3. Risk factors of neurological disorders
NNJ: Neonatal jaundice

Table 3. Association between sex of the patients and neurological disorders

Variables	Sex of Male,n=96 (%)	Patients Female,n=107(%)	Chi-square *P* value
Seizure disorder	59 (61.5)	47 (43.9)	6.23 **(0.013)**
Autism spectrum disorder	23 (24.0)	25 (23.4)	0.01 (0.921)
ADHD	10 (10.4)	12 (11.2)	0.03 (0.855)
Cerebral palsy	2 (2.1)	15 (14.0)	**0.002***
Speech impairment	12 (12.5)	6 (5.6)	2.98 (0.085)
Visual impairment	0	4 (3.7)	0.123*
Hydrocephalus	1 (1.0)	4 (3.7)	0.073*
Hemiplegia	1 (1.0)	3 (2.8)	0.624*
Intellectual disability	1 (1.1)	3 (2.8)	0.624*
Movement disorder	5 (5.2)	12 (11.2)	2.38 (0.123)
Facial nerve palsy	0	4 (3.7)	0.123*
Narcolepsy	2 (2.1)	0	0.222*
Learning disorder	4 (4.2)	2 (1s.9)	0.425*
Chromosomal abnormality	1 (1.0)	5 (4.7)	0.216*

*ADHD = Attention deficit hyperactive disorder; *=Fisher's Exact Test P value*

Table 4. Association between age groups of patients and neurological disorders

Variables	Age Groups (years) < 5, n = 97, (%)	≥ 5, n = 106 (%)	Chi-square *P* value
Seizure disorder	35 (36.1)	71 (67.0)	19.38 **(< 0.001)**
Autism spectrum disorder	27 (27.8)	21 (19.8)	1.81 (0.179)

Variables	Age Groups (years)		Chi-square
	< 5, n = 97, (%)	≥ 5, n = 106 (%)	*P* value
ADHD	10 (10.3)	12 (11.3)	0.05 (0.817)
Cerebral palsy	15 (15.5)	2 (1.9)	**<0.001***
Speech impairment	13 (13.4)	5 (4.7)	4.73 **(0.030)**
Visual impairment	4 (4.1)	0	0.050*
Hydrocephalus	4 (4.1)	1 (0.9)	0.195*
Hemiplegia	0	4 (3.8)	0.123*
Intellectual disability	0	4 (3.8)	0.123*
Movement disorder	9 (9.3)	8 (7.5)	0.19 (0.656)
Facial nerve palsy	4 (4.1)	0	0.050*
Narcolepsy	0	2 (1.9)	0.499*
Learning disorder	0	6 (5.7)	**0.030***
Chromosomal abnormality	5 (5.2)	1 (0.9)	0.106*

*ADHD = Attention deficit hyperactive disorder; *=Fisher's Exact Test P value*

4. DISCUSSION

The prevalence of neurological disorders amongst outpatient clinic visits in the present study centre was 0.9% which was similar to the 1.04% and 1.4% reported in India (Kumar et al., 2022) and Port Harcourt, (West & Onubogu, 2019) Nigeria but higher than the 6.7%, 9.67%, 10.7% and 21.0% reported in a previous study in Port Harcourt (Frank-Briggs & Alikor, 2011), Sagamu (Akodu et al., 2022), Ado Ekiti (Oke et al., 2023) and Ibadan (Lagunju & Okafor, 2009) respectively. The very low prevalence in the present study could be because it was a private health facility unlike the others which were public/tertiary centres. The low prevalence in the Indian (Kumar et al., 2022) study could be because the study was in a semi-urban area while the Port Harcourt (West & Onubogu, 2019) study, although in an urban area, was a newly established neurology clinic. It is pertinent to note that the very high prevalence in the Ibadan (Lagunju & Okafor, 2009) study could be because it was done about two decades ago unlike the other studies which were more recent. Over time better obstetric and neonatal/paediatric care could have been responsible for the reduced prevalence rates reported. The varying study designs, sample sizes, geographic locations and variation over time could also account for these differences.

There was slight female preponderance in the present study which was contrary to most other studies (Akodu et al., 2022; Ifezulike et al., 2023; Kumar et al., 2022; West & Onubogu, 2019; Frank-Briggs & Alikor, 2011; Oke et al., 2023; Wammanda et al., 2007; Ogbe et al., 2006; Banoo et al., 2022; Mohamed et al., 2016; Muges et al., 2017; Okeke et al., 2023; Ibrahim et al., 2023). The present study was carried out in a private health facility which was different from all the others.

In the present study, age group 1 - < 5years were mostly affected as also reported in previous studies in Port Harcourt (West & Onubogu, 2019; Frank-Briggs & Alikor, 2011), Awka (Ifezulike et al., 2023; Okeke et al., 2023) Anambra State, Ibadan (Lagunju & Okafor, 2009) and Zaria (Wammanda et al., 2007) Nigeria. This finding was not surprising as the brain is most fragile in the early years of life when its' development is at its' peak predisposing it to damage. Morbidities such as infection is highest in the first 5 years of life due to their reduced immunity with high mortalities when compared to older children. In addition, risk factors in the perinatal and postnatal periods predispose this age group to be most affected. In contrast, children 1 year or less predominated in Sagamu (Akodu et al., 2022), and Kashmir (Banoo et al., 2022), India whereas 5-10year-olds were commonest in north western India (Kumar et al., 2022) and Asmara (Ogbe et al., 2006) Eritrea. These differences could be attributable to the different geographic locations and their prevalent pattern of morbidity which could be age dependent.

The commonest neurologic disorder observed in this study was seizure disorder (54.6%) followed by autism spectrum disorder (24.3%) and ADHD (11.3%). Seizure disorder being the commonest neurologic disorder was also documented in the studies carried out at different times in the two tertiary centres in Port Harcourt (West &

Onubogu, 2019; Frank-Briggs & Alikor, 2011), other parts of Nigeria (Lagunju & Okafor, 2009; Oke et al., 2023), India (Kumar et al., 2022; Banoo et al., 2022), Asmara(Ogbe et al., 2006) Eritrea, Sudan (Mohamed et al., 2016) and Pakistan (Ibrahim et al., 2023; Chand et al., 2023) but was second commonest in some other parts of Nigeria (Ifezulike et al., 2023; Akodu et al., 2022; Wammanda et al., 2007; Okeke et al., 2023). Generalized seizure disorder was the commonest type of seizure disorder in the present study as also documented in other studies (Ifezulike et al., 2023; Wammanda et al., 2007; Ogbe et al., 2006). Seizure disorder being the commonest neurologic condition could be because of the increased awareness of epilepsy/seizure disorder and the fact that it is now known to be a treatable medical condition unlike in the past when it was perceived to be due to spiritual and witchcraft manipulations (Jallon, 1997). The reason may not be far-fetched as there has been vigorous mass enlightenment campaigns/education all over the world including Nigeria especially during the yearly World Epilepsy Day celebrated every 26th March. Autism spectrum disorder which was rare in most other studies was second commonest in the present study. Frank-Briggs & Alikor (2011) reported a prevalence of 0.4% in a previous study in Port Harcourt carried out about two decades ago whereas Oke et al., (2023) reported 0.8% in Ado Ekiti, Nigeria. It is pertinent to note that there has also been an increased awareness of this condition globally including Nigeria via public enlightenment campaigns especially during the yearly celebrated World Autism Awareness Day every 2nd April. This high prevalence in the present study could be attributable also to variation in geographic location as well as over time. Attention deficit hyperactive disorder was the third commonest in the present study as also reported in Awka (Ifezulike et al., 2023) Nigeria but the fourth commonest in a study in India (Kumar et al., 2022) whereas in some other studies (Oke et al., 2023; Okeke et al., 2023), it accounted for one of the least. In contrast, cerebral palsy was reported as the commonest neurologic disorder in other parts of Nigeria (Ifezulike et al., 2023; Akodu et al., 2022; Wammanda et al., 2007) and Ethiopia (Muges et al., 2017) while in the present study, cerebral palsy was the fifth commonest and accounted for 8.8%. It was not unexpected that cerebral palsy was not very common in the present study. This could be because the present study was a private paediatric health facility and do not carry out deliveries unlike most of the other studies which were tertiary health facilities with various clinical departments including Obstetrics. Also, the present study centre being a private health facility possibly attract populations with higher socioeconomic class as against the public/tertiary health facilities with more clients of lower socioeconomic class who are more likely to have home & traditional birth attendants' deliveries that usually predispose babies to cerebral palsy. The differences in the pattern of neurologic disorders could also be explained by the variations in geographic locations, socioeconomic and cultural differences as well as variation over time.

Perinatal asphyxia and severe neonatal jaundice were the commonest risk factors reported in the present study followed by post meningitis sequelae. Perinatal asphyxia was the commonest risk factor also documented in other studies in Nigeria (Lagunju & Okafor, 2009; Ifezulike et al., 2023; West & Onubogu, 2019; Okeke et al., 2023) and Asmara (Ogbe et al., 2006), Eritrea. This was not surprising as perinatal asphyxia is one of the commonest causes of brain damage with consequent neurologic complications. It is pertinent to note that unconjugated bilirubin in newborns with neonatal jaundice gets deposited in the deep nuclei of the developing brain especially in the basal ganglia leading to toxicity and damage. In some studies (Lagunju & Okafor, 2009; Ifezulike et al., 2023; Okeke et al., 2023), severe neonatal jaundice was the second commonest predisposing factor. Post meningitis sequelae was reported as the third commonest in other studies in Nigeria (Akodu et al., 2022; Ifezulike et al., 2023; Okeke et al., 2023). It is worthy of note that these factors are preventable causes attributable mainly to lack of or poor obstetric care, poverty, ignorance and inadequate immunity (De Myer, 2003; Rasheed, 1999; Wolf et al., 1999). Meningitis, the second commonest predisposing factor in the present study, is common in underdeveloped countries due to poor vaccine coverage, poor sanitation and prevalent tuberculosis infection.

The present study showed a significant difference in sex amongst children with seizure disorder as also reported by Ibrahim et al., (2023) and Chand et al., (2023) in Pakistan. Significant difference in sex amongst children with cerebral palsy observed in the present study was consistent with findings by Chand et al., (2023) (P = .009). In addition, the latter researcher (Chand et al., 2023) documented

significant association between the sex and children with movement disorders ($P < .001$) and behavioural disorders ($P < .001$). The Pakistan study (Chand et al., 2023) was a cross sectional study carried out in 3 tertiary care centres unlike the present study which was done in a private health facility and may have accounted for the differences observed.

There was significant difference in age groups < 5years and those ≥ 5years amongst children with seizure disorder, cerebral palsy and speech disorder in the present study. Similarly, Chand et al., (2023) reported a significant difference in same age groups amongst children with cerebral palsy ($P < .001$) as well as those with behavioural disorders ($P < .001$). This was in contrast with the present study which did not show any significant association amongst children with autism spectrum disorders and ADHD. This could be because both disorders were grouped as one in the latter study (Chand et al., 2023).

5. CONCLUSION

The prevalence of neurologic disorders in this private paediatric health facility was 0.9% thus establishment of neurologic clinics with paediatric neurologist in attendance in private health facilities would bring about early diagnosis and better quality of life.

There was slight female preponderance with under 5 years being mostly affected. Seizure disorder, autism spectrum disorder and attention deficit hyperactive disorder were the commonest neurologic disorders with severe neonatal jaundice, perinatal asphyxia and post meningitis sequelae being the commonest predisposing factors of these disorders. Thus, education of the public especially women of child bearing ages on the importance of antenatal care, improved obstetric, neonatal and paediatric care will go a long way in the prevention of most neurologic disorders. Public enlightenment campaigns on the availability of care would improve the quality of life of affected children.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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