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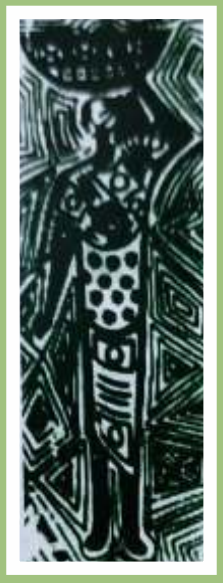

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Prevalence and Factors Associated with Intellectual Disability Among African Children with Epilepsy

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Abstract

Background: Sub-Saharan Africa contributes significantly to the people living with disability, including epilepsy and intellectual disability (ID) in Low- and middle-income countries (LMIC). Epilepsy is already associated with treatment gaps, stigma and poor Health-Related Quality of Life (HRQoL) in sub-Saharan Africa. Still, the impact is more significant when children living with epilepsy also have ID.

Objective: To assess the prevalence and factors associated with intellectual disability among children with epilepsy (CWE).

Methods: This cross-sectional study was conducted among CWE aged 15 months to 18 years compared to 100 age and sex-matched controls without epilepsy. The Vineland Adaptive Behavioural Scale II was used to detect intellectual disability.

Results: Each group consisted of 55 males and 45 females with median (IQR) ages of 8 (4-13) and 9 (5-13) years in CWE and controls, respectively. The prevalence of intellectual disability among CWE (36%) was significantly higher than the prevalence of epilepsy in the control group (2%) ($p<0.001$). Factors associated with the presence of ID among CWE include the onset of epileptic seizures before the age of one year ($X^2 = 16.07$, $p = 0.001$), polytherapy ($X^2 = 8.375$, $p = 0.004$), severe seizures ($X^2 = 4.63$, $p = 0.031$), non-school enrolment ($X^2 =31.62$, $p = <0.001$).

Conclusion: The prevalence of ID is high among children with epilepsy. Those with early seizure onset or severe seizures and those on polytherapy deserve closer attention, and screening for ID should be routinely conducted in CWE.

Keywords: Children, Epilepsy, Health-Related Quality of Life, Intellectual disability, Mental retardation, Seizure disorder.

Introduction

It is estimated that fifty million people are living with epilepsy globally, while 80% of these are in the LMIC, predominantly in sub-Saharan Africa.[1-3] This is largely due to the high prevalence of preventable risk factors such as perinatal asphyxia, intracranial infections and neonatal jaundice in this part of the world.[4-7]

Epilepsy is associated with stigma, poor social outcomes, reduced Health-related Quality of Life (HRQoL), [8-10] poor treatment, and poor educational achievement, especially in Africa.[11] Attention is usually given to addressing seizure control, hoping to mitigate these challenges; however, it has also been shown that epilepsy is associated with other comorbid conditions.[4, 12-14]

Intellectual disability (ID), as well as other comorbidities of epilepsy, can be more burdensome than the seizures. ID further worsens the outcome of CWE, [15, 16] affecting epilepsy itself and its treatment[17] while seizures and its treatment may also worsen cognition.[18]

ID in epilepsy may occur due to shared aetiology such as birth asphyxia or precede the development of epilepsy. [19, 20] Prolonged exposure to abnormal neural activity during the critical period of cerebral maturation can lead to structural and functional changes that can temporarily or permanently impair the capacity of the brain to carry out its cognitive function.[21]This may occur through oxidative stress, neuronal loss, impaired neurogenesis, altered growth factors and brain inflammation.[22]

ID is so common in children with epilepsy that it is almost a rule that these children will have some form of it.[23] A 2004 cognitive function survey showed that 44% of people with epilepsy had difficulty learning, 45% were slow in thinking, 59% had mental fog, and 63% could not achieve activities or goals.[24] The highest prevalence is thought to be seen in children with focal epilepsy due to focal cortical dysplasia, where up to 80% of the children had cognitive impairment and in children with infantile spasms because of the wide range of cerebral insults associated with the condition.[25-27] In Africa, the prevalence of ID ranges from as low as 3.7% in East Africa (Kenya)[28] to as high as 73.3% in Central Africa.[29] In Nigeria, which is in West Africa, the prevalence of ID varies from 18% in Enugu[26], 20% in Ile-Ife, [and 27] to 47.5% in Ibadan. [30] The reason for this variation is unclear but may be attributed to the selection of the study population and the assessment tools used in the different studies.

The extent to which a person cannot cope with the demands established by the society for the individual's age group defines the varying degrees of ID as mild, moderate, severe and profound.[31-32] Mild, moderate, severe, and profound ID affects about 85%, 10%, 4%, and 2% of those with ID in the general population, respectively.[33]In contrast, half of the CWE that have cognitive impairment usually have borderline impairment compared to 22% who are mildly impaired and 28% who are severely impaired.[34] Factors that may contribute to having a more severe form of cognitive impairment in this population include stress associated with excessive social, family and school demands.[34]

The exact cause of cognitive impairment in epilepsy is not entirely understood. Still, current evidence points in the direction of age at onset of epilepsy < 5 years, aetiology of epilepsy, the type of epilepsy, interictal epileptic dysfunction, epileptic encephalopathy, chronicity of epilepsy, seizure frequency and severity, remission status, resistant seizures, treatment effects and current AED use.[35-39] These factors are thought to contribute to cognitive impairment in varying degrees; hence, they should all be considered when evaluating CWE. Lifelong impacts of having epilepsy and comorbid ID include poor psychosocial outcomes, poor educational achievement and poor prospects of marriage.[40] In addition, 26% of those with epilepsy and ID have other neurologic problems, [40] while two-thirds of them do not respond to current antiepileptic medications.[17] Mortality rate, seizure intractability and severity of ID are worse among CWE with comorbid ID.[28] Intellectual disability with epilepsy can further impact brain development negatively. More studies are required in Africa to highlight the prevalence and find possible factors that may enhance screening for ID among CWE. This may enhance better care and eventual outcomes of CWE.

This study aimed to describe the prevalence and factors associated with intellectual disability

among CWE at the paediatric neurology clinic of Jos University Teaching Hospital (JUTH), Jos.

Methods

This study was carried out at the Paediatric Neurology Clinic of Jos University Teaching Hospital (JUTH), Jos, the capital of Plateau State, in the north-central part of Nigeria. The cases were children with epilepsy aged 15 months to 18 years recruited from the paediatric neurology clinic of JUTH, while the controls were apparently healthy children matched for age and sex who had no epilepsy or other chronic disorders. Controls for the cases attending schools were recruited from their schools, while the controls for children who were out of school were recruited from the environment where they lived. The cases were selected if they had confirmed diagnosis of epilepsy, defined according to the International League Against Epilepsy, as having two or more unprovoked seizures greater than 24 hours apart. Severe seizure was defined as a seizure frequency of at least one seizure attack per month.[5] Those with other chronic diseases, such as cardiac and renal diseases, sickle cell disease, or the presence of symptoms and signs of acute illness, were excluded.

The sample size was determined using the formula for comparing two proportions, with the intention of detecting a difference of 20% in the prevalence of neurological conditions between children with epilepsy and the controls. The power was set at 80%, and the previously reported prevalence of neurological disorders among the cases and controls in a similar study was 68.3% and 48.3%, respectively,[6] and making allowance for a 10% non-response. The calculated minimum sample size was 100 in each group.

A predesigned proforma was used to obtain data while screening for intellectual disability was done for both the cases and the control group. Each subject's Intelligence Quotient (IQ) was assessed using the Vineland Adaptive Behavioural Scale (VABS) II. Four domains were evaluated: communication, daily living skills, socialisation and motor skills. Each child was assessed in a quiet room with the parent/caregiver present. The parent-type questionnaire was used. The composite score that summarised the individual's performance across the domains was recorded. Intelligence was graded as normal (above 70), mild intellectual disability (55 to 70), moderate ID (40 to 54), severe ID (25 to 39), profound ID (20-24) and unspecified if unable to assess.[41]

Data management

The data was analysed using IBM-SPSS for Windows, version 22.0. Chicago, SPSS Inc. Continuous variables like age were expressed as median and interquartile range. In contrast, categorical variables, such as sex, socioeconomic class, school history, presence or absence of risk factors and presence or absence of neurologic comorbidities, were presented as proportions. Comparison between continuous variables was made using the student's t-test, while those between categorical variables were done using the Chi-square test and Fisher's exact where the variables were less than five in a cell. Predictors of neurological comorbidities in the cohort were identified by logistic regression analysis. The level of significance was set at $p< 0.05$.

Ethical considerations

Ethical approval for this study was obtained from the Ethics Committee of the Jos University Teaching Hospital, and informed consent was obtained after educating the parents/ caregivers of the cases about the study. Relevant approvals were also obtained from the Ministry of Education of Plateau State, and permissions were obtained from the Headteachers and Principals of schools. Confidentiality was strictly maintained during data collection and data processing.

Results

The study enrolled 100 children aged between 15 months and 18 years with epilepsy and matched them with 100 age and sex-matched apparently healthy controls. There were 55 males and 45 females in each group, giving a total of 110 (55%) males and 90 (45%) females (M: F = 1.2:1). The cases ranged from 15 months to 18 years of age with median (interquartile range) of 8 (4-13) years while the controls also ranged from 15months to 18years but with a median age of 9 (5-13) years. The two groups were not significantly different in age (p = 0.67) (Table I).

Table I: Sociodemographic characteristics of the study subjects

Characteristics	CWE n = 100 Freq (%)	Controls n = 100 Freq (%)	X^2	Df	p-value
Age group (years)					
1-5	31 (31.0)	29 (29.0)	0.12	2	0.93
>5-10	31 (31.0)	33 (33.0)			
>10	38 (38.0)	38 (38.0)			
Median Age (IQR)	8 (4-13)	9 (5-13)	48.27*		0.67
Gender					
Male	55 (55.0)	55 (55.0)	0.00	1	1.00
Female	45 (45.0)	45 (45.0)			
Socioeconomic class					
I	12 (12.0)	9 (9.0)	3.26**	4	0.51
II	21 (21.0)	32 (32.0)			
III	33 (33.0)	30 (30.0)			
IV	33 (33.0)	28 (28.0)			
V	1 (1.0)	1 (1.0)			
Schooling history (for children >5 years)					
Appropriate	42 (57.5)	73 (96.1)	42.53**	4	<0.001
Repeated the class	15 (20.5)	3 (3.9)			
Dropped out of school	3 (4.1)	0 (0.0)			
Special Education	1 (1.4)	0 (0.0)			
Not enrolled in school	12 (16.5)	0 (0.0)			

CWE: Children with Epilepsy; *Mann-Whitney U test; ** Fishers Exact test.

Of the 73 CWE who had attained school age (at least five years of age), 15 (20.5 %) had repeated a class, 12 (16.5%) had never been enrolled in a school, 3 (4.1 %) had dropped out of school, and 1 (1.4 %) was in a special school. The remaining 42 (57.5 %) CWE who were aged 5 years and above were enrolled in regular schools, and their classes were appropriate for their age. In comparison, 3 (3.9%) of the 76 controls over five years old had repeated a class, while 73 (96.1%) had an appropriate schooling history for their age. The difference in the school history between the cases and control was statistically significant (p <0.001).

Among CWE, 21 (21.0%) had their first seizure before the age of one year, while 45 (45.0%) had it between one and five years. The difference between the median age at onset and median age at presentation was statistically significant (X^2 = 93.282, p<0.001). Seventy (70%) CWE had generalised epilepsy, while 30 (30%) had partial epilepsy. Sixty-four (64%) cases had severe epilepsy, defined as a seizure frequency of at least one seizure attack per month. Overall, 80 (80%), 44 (44%), 13 (13%0, 5 (5%) and 1 (1%) of the CWE were on carbamazepine, sodium valproate, phenobarbitone, ethosuximide and levetiracetam, respectively. Sixty-eight (68%) were on AED monotherapy. The suspected risk factors for epilepsy among the CWE included family history (29%), poor cry at birth (26%), admission into the newborn unit (17%), prolonged labour (14%), history of neonatal jaundice (14%), prior history of head trauma (10%), history suggestive of intracranial infection (22%) and prematurity (1%).

Intellectual disability was recorded in 36 (36%) of the 100 CWE and 2 (2%) of the controls (X^2 = 45.17, p <0.001). Intellectual disability was mild, moderate and severe in 28 (77.8%), 5 (13.9%) and 3 (8.3%) CWE, respectively. Two children in the control group had mild intellectual disability (Figure 1).

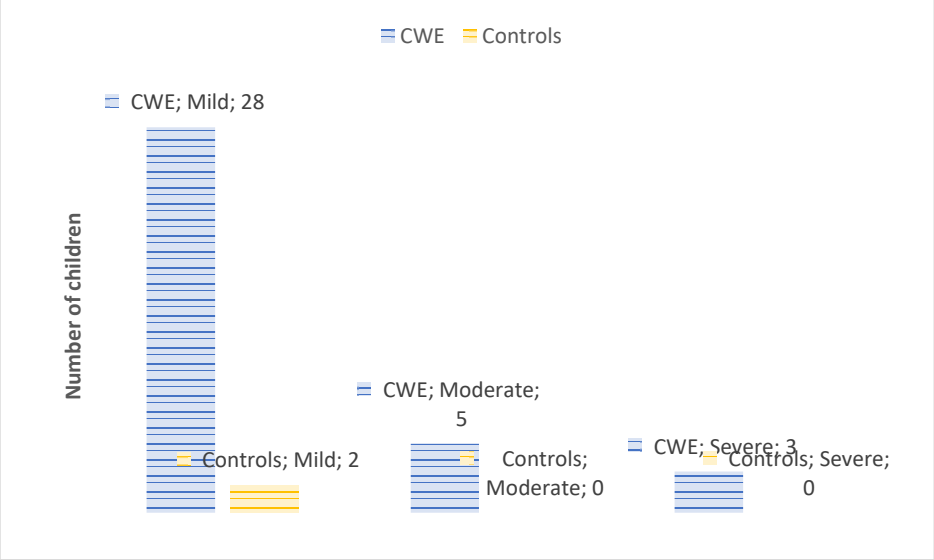

Figure 1: Pattern of intellectual disability among children with epilepsy compared to controls

Table II shows the factors associated with the presence of ID among CWE. The onset of epileptic seizures before the age of one year (X^2 = 16.07, p = 0.001), presenting to the hospital on account of epileptic seizure before the age of one year (X^2 = 15.771, p = 0.001), polytherapy (X^2 = 8.375, p = 0.004), severe seizures (X^2 = 4.63, p = 0.031) and not been enrolled in school or attending special school (X^2 = 31.62, p <0.001) had statistically significant association with the presence of ID.

Table II: Factors associated with intellectual disability in children with epilepsy

Factor	Intellectual Disability		X^2	p-value
	Yes Freq (%)	No Freq (%)		
Age group (years)				
1-5	13 (41.9)	18 (58.1)	12.07*	**0.004**
>5-10	16 (51.6)	15 (48.4)		
>10	7 (16.2)	31 (83.4)		
Age at the onset of epileptic seizures (years)				
<1	13 (61.9)	8 (38.1)	16.07	**0.0001**
1-5	19 (42.2)	26 (57.8)		
>5-10	4 (14.8)	23 (85.2)		
>10	0 (0.0)	7 (100.0)		
Age at first presentation (years)				
<1	7 (70.0)	3 (30.0)	15.771	**0.0001**
1-5	22 (46.8)	25 (53.2)		
>5-10	6 (22.2)	21 (77.8)		
>10	1 (6.3)	15 (93.7)		
AED Therapy				
Polytherapy	18 (56.3)	14 (43.7)	8.375	**0.004**
Monotherapy	18 (26.5)	50 (73.5)		
Schooling history (Age >5 years)				
Appropriate	7 (16.7)	35 (83.3)	31.62*	**<0.001**
Class repeat	5 (33.3)	10 (66.7)		
Drop-out	1 (33.3)	2 (66.7)		
Not enrolled	12 (100.0)	0 (0.0)		
Special Education	1 (100.0)	0 (0.0)		
Seizure severity				
Severe	28 (43.8)	36 (56.3)	4.63	**0.031**
Not severe	8 (22.2)	28 (77.8)		
Intracranial infection				
Present	11 (52.4)	11 (47.6)	2.95	**0.086**
Absent	25 (32.1)	17 (67.9)		
Carbamazepine therapy				
Yes	33 (41.2)	47 (58.8)	4.78	**0.029**
No	3 (15.0)	17 (85.0)		
Sodium valproate therapy				
Yes	19 (43.2)	25 (56.8)	1.75	**0.185**
No	17 (30.4)	39 (69.6)		
Ethosuximide Therapy				
Yes	0 (0.0)	5 (100.0)	2.96	0.085
No	36 (37.9)	59 (62.1)		

***Fisher's Exact Test**

Logistic regression analysis was performed using eight variables with significant associations with ID at the bivariate level of analysis. Children presenting to the hospital for the first time between the ages of 5-10 years on account of epilepsy were less likely to have ID compared to those presenting at < 1 year (OR 0.0333, 95% CI=0.001-0.98, p= 0.04) as shown in Table III.

Table IIIa: Predictors of intellectual disability among children with epilepsy

Variable	Odds Ratio	95% Confidence Interval	p-value
Age group (years)			
1-5	1		
>5-10	0.941	0.458-1.932	0.867
>10	0.799	0.378-1.602	0.528
Duration before diagnosis			
<1	1		
1-5	2.985	0.784-11.356	0.109
>5-10	1.155	0.118-11.255	0.901
>10	0.000	0.000	0.999
AED Therapy			
Monotherapy	1		
Polytherapy	2.553	0.677-9.621	0.166
Age at onset of seizure			
<1	1		
1-5	1.169	0.117-11.699	0.894
>5-10	2.239	0.155-34.886	0.541
>10	0.000	0.000	0.999
Age at first presentation			
<1	1		
1-5	0.082	0.006-1.197	0.067
>5-10	0.033	0.001-0.983	0.049
>10	0.104	0.001-8.930	0.319

Discussion

The prevalence of intellectual disability observed among CWE in this present study was significantly higher than in the control group. This is similar to other studies that have demonstrated a higher prevalence of ID among CWE than the general population.[12,42-43] However, in Nigeria, Iloeje *et al.*[26] in Enugu observed a lower prevalence of ID among CWE than observed in the present study. The Enugu study was a retrospective study where patients' charts were reviewed to obtain information about seizure types and ID diagnosis, making it difficult to determine the accuracy and consistency of the IQ assessment. In contrast but also in Nigeria, Lagunju *et al.*[30] reported a prevalence of 47.5% higher than observed in this study. This higher prevalence obtained by Lagunju *et al.*[30] may be

attributed to the higher prevalence of focal seizures among the study population. Intellectual disability occurs more frequently with focal seizures than the generalised form.[44]

Table IIIb: Predictors of intellectual disability among children with epilepsy

Variable	Odds Ratio	95% Confidence Interval	p-value
Schooling history (children >5 years)			
Appropriate	1		
Class repeat	3.481	0.519-23.361	0.199
Dropout	6.064	0.110-333.471	0.378
Not enrolled	0.000	0.000	0.998
Special Education	0.000	0.000	1.000
Severity of seizure			
Not severe	1		
Severe	0.650	0.142-2.979	0.579
Intracranial infection			
Yes	1		
No	1.605	0.381-6.755	0.519
Carbamazepine therapy			
No			
Yes	0.533	0.063-4.547	0.565
Sodium valproate therapy			
No	1		
Yes	0.666	0.148-3.004	0.597
Ethosuximide			
No	1		
Yes	0.000	0.000	0.999

Burton *et al.*,[12] reported a higher prevalence of 64% among CWE in a community-based study in Tanzania, East Africa using the Harris Good Enough Draw a Man test. In Africa, more CWE can be found in the community who would not be brought to the hospital due to financial constraints and poor access to health care.[29] Therefore, more children may be found with ID in the community than at the health care facility due to poorly controlled seizures and their effect on cognition. In contrast, another community survey in Uganda and East Africa revealed that 24 % of CWE had impaired cognition based on caregivers' observation, but objective assessment was not performed in the study and may have reduced the actual prevalence.[45] In Central Africa, Matonda-Ma-Nzuzi *et al.* [29] obtained a much higher prevalence of 73.3% in Congo. The study was carried out at a mental care hospital, which is expected to care for a high burden of neurological disorders, being a referral centre, unlike the present study that was carried out in a hospital with a different speciality. In the developed world, ID has also been observed to be more common among CWE than the general population.[13, 46-47] In a CDC analysed NHIS data, Cui *et al.* [46] in the USA obtained a lower prevalence of 22.9% vs 1.0% among CWE

compared to the general population. The treatment gap of epilepsy in these regions is lower than in the developing countries of Africa and may be responsible for the lower prevalence.

The age at onset of seizures was significantly associated with intellectual disability in this study, proposing that the earlier the onset, the more the chances of developing ID.[47] Other studies have also reported a significant association between age at onset of seizure and intellectual disability in CWE.[26,42] Similar to the findings of this study, Iloeje *et al*.[26] in Enugu demonstrated that only 11% of children who developed their seizures after one year of age had ID. In addition, Sunmonu *et al*.[27], in Ile-Ife, in a study of 41 persons living with epilepsy, 20% of whom had an intellectual disability, found that age at the onset of epilepsy significantly affected intellectual functioning among their subjects. Similarly, Park *et al*.[39] in South Korea, in their evaluation of 322 CWE, 54.7% of whom had ID, found that children who started having seizures before the age of five years were five times more likely to have ID compared to those who started at an older age.

Most studies have supported this relationship between ID and age at the onset of epilepsy, but the findings of Lagunju *et al*.[30] contradict this trend. Their study found no significant association between age at onset of epilepsy and ID. The small sample size (40), studying only new cases of epilepsy and the exclusion of those with a history suggestive of brain insult may account for this difference. Brain insults may suggest symptomatic epilepsy, which may be associated with early onset of seizure, hence increasing the chances of developing ID. Some authors also suggest that age at onset is not a pejorative factor, especially in benign epilepsies[21], but it is in more severe forms of epilepsy.[23-25]

In addition, Elger *et al*.36, in a review of the literature on epilepsy and cognition, noted that the influence of early age at the onset of seizures may not be separable from the influence of long disease duration as both are associated with neuronal loss, metabolic dysfunction and morphological abnormalities on MRI. Understandably, early alteration in brain development may affect cognitive development more than when a seizure develops later because some cognitive development should have occurred before a seizure's onset.[4]

It is thought that early onset of seizure also indicates prolonged exposure to abnormal neural activity in the developing brain, resulting in impaired intellectual capacity in CWE.[25,39] Park *et al*.[39] used the term “seizure burden” to summarise the cumulative effect of seizure duration (based on age at onset) and seizure severity on the brain. Seizure burden is thought to damage the brain through anoxia, lactic acidosis and excessive excitatory neurotransmitters.[47] However, it is not certain whether ID had been present even before the onset of seizures because ID could result from the underlying aetiology of seizures, the effect of prolonged seizures or medications.[1] Also, some authors have shown that cognitive impairment remains at a trajectory over time and does not worsen, substantiating the importance of early assessment and treatment. [25,48-51]

The present study also found that the severity of seizures (defined in terms of frequency) was significantly associated with intellectual disability in this population of CWE. Park *et al*. 39, in a retrospective analysis of 220 CWE, also observed that more frequent seizures were associated with ID, but it was not a significant factor for those with idiopathic epilepsy on logistic regression analysis. This may point to the role the type of epilepsy may play on intellectual functioning in epilepsy.[39] Van[21] noted that though some "minor" seizures, such as absence seizures,

may impact cognition, the effect of severe and refractory epilepsies on cognition is not necessarily related to the seizure type. However, the current study did not study the impact of seizure type on cognition to enhance this. Nevertheless, Lagunju *et al*.[30] in Nigeria observed that the seizure type was not related to ID among CWE. Other studies have also reported that children with severe seizures tend to present with low IQ scores.[26,44,52] It is expected that more severe or frequent seizures worsen anoxia and neuronal damage, which may worsen or precipitate cognitive impairment.[22]

Similar to the findings of Park *et al*.[39,] the present study found a significant association between AED use and ID; however, this significance was not sustained in logistic regression. Several authors have described the effect of AEDs on the mental capacity of CWE in terms of the types, numbers and doses of AEDs used in treating childhood epilepsy.[53-54] Foster *et al.*[55] recently concluded that individual AEDs were not independently associated with cognitive dysfunction rather, they suspected that the relationship between AED and ID was more likely to be multifactorial.

Sunmonu *et al*.[27] suggested that it is the duration of treatment with AED and not the AED type, that had a negative impact on intellectual performance. However, their study only evaluated patients on phenytoin and carbamazepine, and the duration of AED was the same as the duration of illness, which on its own has been documented to affect intellectual functioning.[4] On the other hand, Tonekabonie *et al*.[56] demonstrated that withdrawal of some AEDs, such as phenobarbitone, leads to the reversal of poor cognition, suggesting that the AED type used may actually be responsible for poor cognition. However, there are some concerns that the effect of AED on cognition may be over-rated because there are more readily identifiable psychosocial factors like the fear of having seizures in public, low self-esteem, stigma, social isolation and depression, which may contribute to impaired cognition and are often unrecognised.[47]

Antiepileptic drugs like phenobarbitone, phenytoin, valproic acid and carbamazepine can affect cognition, and the greatest effects have been recorded in children treated with phenobarbitone.[32] AEDs have been shown to impair IQ by decreasing neuronal excitability, enhancing inhibitory neurotransmission, and interfering with neuronal networks.[24,39]

This study also demonstrated that polytherapy AED was significantly associated with ID. The use of AED polytherapy heightens the probability of developing intellectual disabilities.[22,52] This suggests that the individual impact of AEDs on intellectual capacities is amplified when combined. Gillham *et al*. 57 observed that carbamazepine alone had little effect on cognition, but when added to existing monotherapy, the cognitive impairment became significant. Some have noted that reducing a polytherapy regimen or switching to monotherapy improves cognitive outcomes.[58] Also, altering the type of combination therapy for pharmacodynamic purposes may also affect cognition.[59]

Schooling history (school enrolment and if they had repeated a class) among school-age participants was associated with ID in the population studied. Other authors have also described underachievement in school due to ID.[22,60] It is remarkable that two-thirds of those who dropped out or repeated a class did not have ID. This may suggest that academic underachievement in CWE may not necessarily be due to a lack of intellectual capacity. Instead, as some studies have suggested, there are other related factors, such as stigma, seizure frequency and other sociocultural events that contribute to a child's school attendance and achievement.[14, 61-62]

In addition, CWE with normal intelligence also have low academic achievement.[62]

Limitations: The present study is limited by the dependence on caregivers for information on the associated factors that may have influenced the ability of these factors to predict neurologic comorbidities in the study population due to possible recall bias. Other confounders, such as underlying neurologic disease, were not accounted for in the study.

Conclusion

Intellectual disability occurs more frequently in CWE than in their aged and sex-matched controls, and CWE had more severe forms of ID than their aged and sex-matched controls. Early age at onset of epilepsy, severity of seizures and polytherapy were significantly associated with but not predictive of ID. Screening for ID should be routine in the management of CWE. Government, policymakers, and caregivers must pay more attention to CWE's educational needs. It is recommended that prospective studies are required for a better understanding of the predictors of intellectual disability in CWE. This will raise the index of suspicion and choose whom to screen more easily because neurology clinics are usually busy while the doctor-to-patient ratio is still wide. Comparative studies to further characterise the factors associated with or predict intellectual disability between CWE who have neurologic comorbidities and those without intellectual disability may further identify the contribution of these comorbidities to the disease burden of CWE. Further studies to determine ID among CWE before the commencement of AED, while on AED and after remission may further explain the true trajectory of ID among CWE.

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