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Factors associated with academic performance in children living with epilepsy followed in a pediatric referral hospital in Cameroon

Facteurs associés à la performance académique chez les enfants vivant avec une épilepsie suivis dans un hôpital pédiatrique de référence au Cameroun

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Original Article

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ABSTRACT

Background: Epilepsy is a chronic neurological condition affecting children's neurocognitive development and academic performance. This study aimed to describe academic performances of children with epilepsy and identify their determinants in Douala, Cameroon.

Materials and Methods: This cross-sectional analytical study (November 2024-April 2025) included 102 school-enrolled children aged 6 to 15 years with confirmed epilepsy diagnoses. Data collection involved structured questionnaires administered to parents/guardians, clinical examinations by a pediatric neurologist, and medical record reviews. Academic performance was assessed using last trimester grades, with good academic performance, defined as a grade ≥10/20. Statistical analysis employed chi-square tests, Fisher's exact tests, and logistic regression. The significance threshold was set for $p < 0.05$.

Results: Among 102 participants, average age at diagnosis was 55.5± 36.6 months, with slight female predominance (52.9%). Idiopathic epilepsy was most common (60.8%). Poor academic performance occurred in 32.4% of children, while 38.2% had repeated a grade. Factors associated with good academic performance included idiopathic epilepsy (aOR = 13.241, 95% CI [2.393-73.266]), age over 5 years at diagnosis (aOR = 1.862, 95% CI [0.581-5.974]), and after-school academic support (aOR = 4.395, 95% CI [1.554-12.426]). High seizure frequency was associated with poor academic performance (aOR = 0.293, 95% CI [0.105-0.822]).

Conclusion: This study revealed a strong association between epilepsy and reduced academic achievement in children. Findings highlight the need for comprehensive management strategies including early screening and intervention for learning challenges to minimize epilepsy's impact on educational progress.

RESUME

Contexte : L'épilepsie est une affection neurologique chronique qui affecte le développement neurocognitif et les résultats scolaires des enfants. Cette étude visait à décrire les résultats scolaires des enfants épileptiques et à identifier leurs déterminants à Douala, au Cameroun.

Matériel et méthodes : cette étude analytique transversale (novembre 2024-avril 2025) a porté sur 102 enfants scolarisés âgés de 6 à 15 ans présentant un diagnostic confirmé d'épilepsie. La collecte des données s'est faite à l'aide d'un questionnaire structuré administré aux parents/tuteurs à partir des dossiers médicaux, après un examen clinique effectué par un neuropédiatre. Les résultats scolaires ont été évalués à partir des notes obtenues au dernier trimestre, les mauvais résultats étant définis comme < 10/20. L'analyse statistique a consisté aux tests du chi carré, test exact de Fisher et de régression logistique.

Résultats : parmi les 102 participants, l'âge moyen au moment du diagnostic était de 55,5 mois, avec une légère prédominance des filles (52,9 %). L'épilepsie idiopathique était la plus fréquente (60,8 %). 32,4 % des enfants avaient de mauvais résultats scolaires, tandis que 38,2 % avaient redoublé au moins une classe. Les facteurs associés à de bons résultats scolaires comprenaient l'épilepsie idiopathique (aOR = 13,241, IC à 95 % [2,393-73,266]), un âge supérieur à 5 ans au moment du diagnostic (aOR = 1,862, IC à 95 % [0,581-5,974]) et le soutien scolaire après l'école (aOR = 4,395, IC à 95 % [1,554-12,426]). Une fréquence élevée des crises était associée à de mauvais résultats scolaires (aOR = 0,293, IC à 95 % [0,105-0,822]).

Conclusion : Cette étude a révélé une forte association entre l'épilepsie et la baisse des résultats scolaires chez les enfants. Les résultats soulignent la nécessité de mettre en place des stratégies de prise en charge globales, notamment un dépistage précoce et une intervention rapide en cas de difficultés d'apprentissage, afin de minimiser l'impact de l'épilepsie sur la scolarité.

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Introduction

Epilepsy is one of the most common brain disorders, affecting 50 million people worldwide, with serious physical, psychological, social, and economic consequences for affected individuals and their families [1]. Epilepsy in children can be linked to significant learning and behavioral problems, leading to poor academic outcomes; several factors contribute to these educational challenges, primarily brain pathology, ongoing seizures, antiepileptic drugs, and psychosocial issues [2]. Nine out of ten people with epilepsy in low-income countries (LICs) are under 20 years old [3]. With a prevalence of approximately 7 to 8 per 1,000 children under 11 years, it is the most common neurological condition in the pediatric population [4]. Children with epilepsy in Sub-Saharan Africa (SSA) experience higher rates of school dropout, more days absent from school, and reduced participation in extracurricular sports activities [5,6]. Most existing studies have focused on teachers' beliefs and perceptions. Teachers' misconceptions about epilepsy are common. Few studies have examined barriers to education from the perspective of children with epilepsy and their families. This study aims to address this gap by identifying factors associated with academic performance in children living with epilepsy, followed in a pediatric referral hospital in Douala, Cameroon. The findings will enhance understanding of the challenges these children face and help develop targeted interventions to improve their educational outcomes.

Materials and Methods

We conducted a cross-sectional descriptive and analytical study from November 1, 2024, to April 30, 2025 (6 months) at the pediatrics department of a pediatric referral hospital in Douala. This department includes two units: a hospitalization unit and an outpatient clinic. The hospitalization unit has two sections: general pediatrics for infants and children and neonatology for newborns (0 to 28 days). The outpatient clinic is dedicated to ambulatory care of children aged 0-15 years, including those diagnosed with epilepsy. The hospital is equipped with a clinical biology laboratory, neuroimaging facilities (brain CT scans, ultrasound, and standard radiography), and a video-electroencephalography unit (video-EEG). There is also a physiotherapy unit for patient rehabilitation as well as a clinical psychologist. The health care team includes nurses, one child neurologist, one neonatologist, three general pediatricians, and two general practitioners. Epilepsy management is multidisciplinary and coordinated by the child neurologist.

The study included children aged 6 to 15 years old diagnosed with epilepsy according to the International League Against Epilepsy (ILAE) criteria, who were attending school at the time of the study. All children in this age group with a confirmed diagnosis of epilepsy, attending school, and whose parents or legal guardians provided informed consent were recruited. Those with incomplete data were excluded. A consecutive, exhaustive sampling method was used.

We contacted the parents or guardians of eligible patients to invite them to take part in the study. Parents or guardians who provided informed consent were asked to accompany their child to the child neurology clinic. The children received a clinical examination from the child neurologist. Additionally, a pre-tested questionnaire, specifically designed for the study was used to collect relevant data. It included sections on sociodemographic details, clinical features of epilepsy, and school information (current grade level, overall grades in the last trimester, history of repeating grades, and extracurricular activities).

Academic performance: refers to the results students achieve in their studies, usually measured through evaluations, exams, and grades. It reflects the student's ability to understand, absorb, and apply the knowledge and skills gained in a school setting. Therefore, we assessed academic performance based on the overall grades received in class [15]. Academic performance was ranked according to the average score out of 20: 18-20 (excellent), 15-17 (very good), 12-14 (good), 10-11 (fair), 08-09 (insufficient), and 00-07 weak. **Poor academic performance** refers to insufficient or unsatisfactory academic results in a student, characterized by low grades, difficulty understanding concepts, or a lack of motivation for studies. Thus, poor academic performance indicates a grade < 10/20 [15]. **Good academic performance** refers to satisfactory or excellent results, marked by a strong understanding of concepts, high grades, and quick skill development. It indicates a grade of ≥ 10/20 [15].

This study was approved by the ethical board of the study hospital (ethical clearance n°2024/1621/HGOPED/DG/CEI from the 26th November 2024). An authorization was also granted by the Faculty of Medicine and Pharmaceutical Sciences at the University of Dschang (no. B6/3098/24/UDs/FMSP/D/CDAASR). Informed consent forms were signed by parents or guardians who agreed to participate in the study. Children aged 12 or older provided their own consent whenever possible. Participation was voluntary, and data confidentiality was maintained.

Data were entered and coded, then exported to SPSS version 25.0 for Windows (SPSS, IBM, Chicago, IL, USA) for statistical analysis. Quantitative variables were presented as mean ± standard deviation (SD) or median and interquartile range (IQR). Qualitative variables were presented as frequencies and percentages. Logistic regression models were used to identify factors associated with good academic

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performance, defined as a grade ≥10/20, with results expressed as adjusted odds ratios (aOR) and their 95% confidence intervals (CI). A p-value < 0.05 was considered statistically significant.

Results

A total of 102 children living with epilepsy were included in the study (Figure 1).

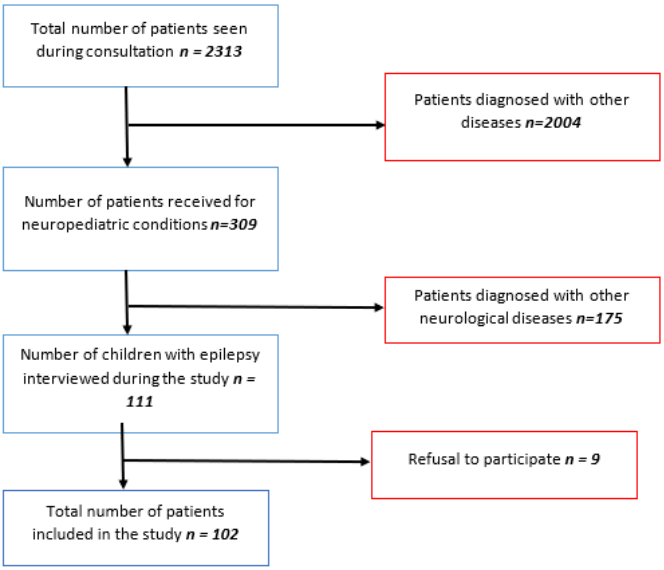

Figure 1. Participants inclusion diagram

The average age of participants was 9 years, with a female predominance (59.9%). Most children were in primary school (88.2%), and among them, the vast majority were in class 1 (42.2%). The average age at diagnosis was 55.5±36.6 months (Table 1).

Regarding the type of epilepsy: 61% had the idiopathic type, 28% the symptomatic type, and 11% the cryptogenic type (Figure 2).

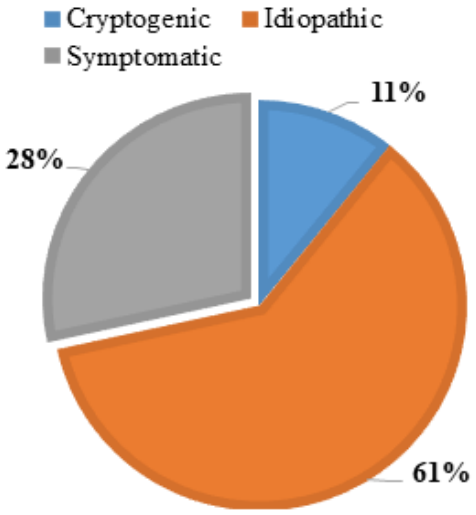

Figure 2. Distribution of participants according to epilepsy types

66.6% of children were on monotherapy, and 30.4% on polytherapy. 49% of children had well-controlled seizures at the time of the study.

Table 1. Sociodemographic characteristics of children and their parents and clinical characteristics of epilepsy

Variables	Modalities	Number (N=102)	Percentages(%)
Children's age group (year)	6-10	70	68.6
	>10	32	31.4
Age group at diagnosis (months)	0-59	51	50.0
	60-119	41	40.2
	120-180	10	9.8
Sex	Male	48	47.1
	Female	54	52.9
School level			
Primary	Class 1	38	37.3
	Class 2	14	13.7
	Class 3	7	6.9
	Class 4	11	10.8
	Class 5	14	13.7
	Class 6	6	5.9
Secondary	Form 1	2	2
	Form 2	2	2
	Form 3	3	2.9
	Form 4	1	1
	Form 5	2	2
	Lower sixth	1	1
	Upper sixth	1	1
Type of schooling	Normal	97	95.1
	Adapted	5	4.9
School system	Public	15	14.7
	Private	87	85.3
Parent/ guardian education level	None	0	0
	Primary	7	6.9
	Secondary	51	50
	Higher	44	43.1
Marital status	In a relationship	85	83.3
	Single parent	17	16.7

Poor academic performance (grades <10/20) was observed in 33 of 102 children (32.4%, 95% CI: 23.8-42.0%). Grade repetition occurred in 39 of 102 participants (38.2%, 95% CI: 29.0-48.2%). Among children with grade repetition, 18 repeated once (18/39, 46.2%) (Table 2). The most common difficulties involved mathematics and languages.

Multivariate analysis identified several factors significantly linked to academic performance. Children with idiopathic epilepsy (aOR = 13.241, 95% CI [2.393-73.266]), those diagnosed after the age of 5 (aOR = 1.862, 95% CI [0.581-5.974]), and children receiving after-school academic support (aOR = 4.395, 95% CI [1.554-12.426]) experienced significantly fewer academic difficulties than others. Conversely, children with frequent seizures faced more academic challenges (aOR = 0.293, 95% CI

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[0.105-0.822]) (Table 3).

Children with epilepsy who receive after-school academic support are 4 times more likely to succeed in school, while those with idiopathic epilepsy had significantly higher odds of good academic performance (aOR = 13.241). Also, being diagnosed between ages 5-10 years was found to protect against school failure compared to diagnosis before age 5.

Table 2: Distribution of children with epilepsy according to their academic performance

Variables	Modalities	Frequencies	Percentages (%)
Overall average grade of the child in the last trimester	00-07	23	22.54
	08-09	10	9.8
	10-11	15	14.7
	12-14	30	29.4
	15-17	21	20.6
	18-20	3	2.94
Has the child ever repeated a class	Yes	39	38.2
	No	63	61.8
If yes, number of repetitions	1	18	46.2
	2-3	8	20.5
	>=4	13	33.3

Table 3. Multivariate analysis of factors associated with good academic performance (grade ≥ 10)

Variables	Modalities	Adjusted p-value (<0.05)	Adjusted OR (95% CI)
Age at diagnosis (in months)	0-59	-	-
	60-119	0.047	0.175 (0.031-0.975)
	120-180	0.296	1.862 (0.581-5.974)
Type of epilepsy	Cryptogenic	-	-
	Idiopathic	0.003	13.241 (2.393-73.266)
	Symptomatic	0.795	0.797 (0.144-4.419)
After-school academic support	No	-	-
	Yes	0.005	4.395 (1.554-12.426)
Presence of seizures at school	No	-	-
	Yes	0.911	0.897 (0.133-6.032)
Difficulty resuming school activities after a seizure	No	-	-
	Yes	0.752	1.390 (0.181-10.697)
Has ever missed school due to seizures	No	-	-
	Yes	0.261	0.409 (0.086-1.942)
Main difficulties encountered in their academic journey related to epilepsy	Seizure frequency	0.020	0.293 (0.105-0.822)
	Lack of academic support	0.000	0.086 (0.022-0.334)
	Emotional difficulties	0.053	0.244 (0.058-1.018)

Abbreviations: aOR = adjusted Odds Ratio; CI = Confidence Interval.
Note: The model identifies factors associated with good academic performance (grade ≥10/20). An aOR >1 indicates a positive association with good performance

Discussion

This study revealed that one-third of children with epilepsy experienced academic difficulties, with 32.4% showing poor academic performance and 38.2% having repeated at least one grade. Multivariate analysis identified seizure frequency as the primary modifiable risk factor, while idiopathic epilepsy type and after-school academic support emerged as protective factors.

Description of sociodemographic and clinical characteristics

The sociodemographic and clinical profile of our patients aligns with the typical picture of pediatric epilepsy in many parts of sub-Saharan Africa. We have a slight majority of girls (52.9% vs. 47.1% boys). This sex ratio of 0.89 is similar to other studies conducted in sub-Saharan Africa on pediatric epilepsy, although some may report a slight male predominance [16]. The most common age group (5-10 years, 68.6%) highlights the vulnerability of young schoolchildren, a critical period for learning the basics. The fact that 50% of parents have a secondary education level is an important indicator; higher parental education is often linked to better understanding of health issues, improved treatment adherence, and more effective academic support for the child, though further research is needed to confirm this specific correlation in our setting. The most frequent age group at diagnosis (0 to 59 months) was very early (50% of cases). This early onset, while potentially increasing the risk of long-term developmental issues due to interference with crucial periods of brain development [15,17], also allows for early management and treatment, which are vital for seizure control and may help reduce the impact on cognitive development [3,12]. Idiopathic epilepsy was the most common type in our study (60.8%). Although this predominance of idiopathic forms is often associated with better outcomes and a generally more favorable cognitive prognosis than symptomatic epilepsies, it could nonetheless explain some of the academic difficulties observed overall in our series [15,18].

Description of the academic performance

Our findings on the academic performance of children with epilepsy are significant. The data shows that 32.4% of children faced difficulties, such as poor academic performance, and 38.2% repeated a grade, despite 95.1% attending regular school. This suggests that even epilepsy that appears to be well-managed can still impact cognitive and educational development. These results match international studies that report higher rates of cognitive issues, learning challenges, and academic delays among children with epilepsy compared to the general population [16]. School-related problems can include issues with concentration, memory, and executive functions, all of which influence learning

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and academic success. While these challenges may not always cause outright failure, they can increase the child's effort, lead to academic fatigue, and result in underperformance. The fact that 85.3% of children in our series attend private schools may help explain some of these issues, as private schools often offer better supervision and smaller classes, potentially hiding the true level of cognitive difficulty and the need for specialized education. The low percentage of adapted schooling (4.9%) indicates possible underdiagnosis of specific needs or limited access to specialized support. The high rates of grade repetition and learning difficulties observed align with international reports, which frequently highlight cognitive deficits in children with epilepsy [15,18,19]. These difficulties can result from various factors, including the direct effects of seizures on the developing brain, subclinical interictal epileptiform activity, side effects of antiepileptic medications, and associated comorbidities.

Factors associated with good academic performance

Our results showed that seizure frequency is a key factor influencing academic performance. Uncontrolled seizures are often linked to poor academic results, likely due to more widespread epileptic activity and greater disruption of neural networks involved in learning and memory [18,20]. Our multivariate analysis confirmed this relationship, demonstrating that children who identified seizure frequency as their main academic difficulty had significantly lower odds of good academic performance (aOR = 0.293, p = 0.020), emphasizing the critical importance of optimal seizure control for educational success. Early onset of epilepsy, especially before acquiring fundamental skills like reading, writing, and arithmetic, can also hinder normal cognitive development, resulting in cumulative deficits [17,21,22]. This is particularly relevant given our finding that being diagnosed between ages 5-10 years protects against school failure compared to diagnosis before the age of 5 (aOR = 0.175, p = 0.047), suggesting that epilepsy onset during the preschool years may have more detrimental effects on subsequent academic achievement, possibly due to interference with critical early neurodevelopmental processes.

In our study, idiopathic epilepsy is associated with better academic performance (aOR = 13.241, p = 0.003) compared to those with cryptogenic epilepsy, probably because idiopathic epilepsy typically has a more favorable prognosis [18,19]. This striking association underscores the prognostic significance of epilepsy etiology, with idiopathic forms generally reflecting less severe underlying brain pathology and better response to treatment, thereby preserving cognitive and academic functioning.

The availability of tailored academic support is a critical factor; when missing or inadequate, it can worsen academic challenges. Our findings provide strong empirical evidence for this assertion, as children with epilepsy who receive after-school academic support are 4 times more likely to succeed in school (aOR = 4.395, p = 0.005). Furthermore, children who identified lack of academic support as their main difficulty had dramatically lower odds of good academic performance (aOR = 0.086, p < 0.001), representing an approximately 91% reduction in the likelihood of academic success. Targeted pedagogical and psychological interventions, customized to meet the specific needs of children with epilepsy (such as classroom accommodations and homework assistance), are vital to help them succeed and remain integrated into school [18]. Without such support, minor difficulties can accumulate and lead to dropout. These findings highlight academic support as one of the most modifiable and impactful factors in determining educational outcomes for children with epilepsy, suggesting that investment in structured after-school support programs should be a priority intervention in our setting.

Lastly, our study emphasizes the role of socioeconomic factors and stigmatization. In settings like Cameroon, where specialized educational resources are few, family support and a positive social environment become even more important. Stigmatization can cause social exclusion, low self-esteem, and reduced school participation, thereby worsening learning difficulties. The strong protective effect of after-school academic support observed in our study may be mediated not only through direct educational assistance but also through enhanced family engagement, improved self-esteem, and reduced stigma associated with receiving appropriate, individualized attention to the child's learning needs.

Study limitations

Several limitations warrant consideration. The cross-sectional design precludes establishing temporal relationships between epilepsy characteristics and academic outcomes. Academic performance assessment relied partially on parental reports, introducing potential recall bias. The absence of standardized neuropsychological testing limits our understanding of specific cognitive domains affected. Additionally, recruitment from a single tertiary center may limit generalizability to community-based populations.

Conclusion

These findings support implementing comprehensive epilepsy management strategies that integrate educational support services with medical treatment. Healthcare providers should routinely screen for academic difficulties and advocate for after-school support programs. Future research should

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evaluate the effectiveness of structured educational interventions through randomized controlled trials and investigate optimal timing for academic support initiation.

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Authorship Contributions: ED conceived the study, designed the methodology, supervised data collection, performed statistical analysis, and drafted the manuscript. MKIO contributed to study design, conducted clinical examinations, collected data, and revised the manuscript. NND participated in data collection and manuscript revision. KTDA provided statistical consultation and contributed to data interpretation. GMD supervised the research process and provided critical manuscript review. MCPC contributed to study design and manuscript revision. NS provided senior supervision, contributed to study conception, and approved the final manuscript version.

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