Academic performance of pediatric epileptic patients at King Abdulaziz University Hospital

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ABSTRACT

Background: Epilepsy is a prevalent neurological condition affecting children worldwide, with a particularly high incidence in Saudi Arabia. Children with epilepsy can experience poor school performance due to cognitive deficits and frequent absences. This study investigates the impact of seizures on school attendance among children with epilepsy. **Methods:** This cross-sectional study was conducted at King Abdulaziz University Hospital (KAUH) in Jeddah, Saudi Arabia, including pediatric epilepsy patients from 2016 to 2022. Data were collected via an online questionnaire and analyzed using IBM SPSS. Factors examined included seizure frequency, medication use, comorbidities, teacher awareness, and absenteeism. **Results:** The study included 207 pediatric epilepsy patients, predominantly Saudi nationals (87%). Most parents had higher education backgrounds (70%). Participants' mean age was 9.66 years, with 57% diagnosed before the age of 5. Most (45%) patients took daily medication with 57% experiencing no side effects. Over half (56%) of the population reported focus and memory problems, significantly related to age at diagnosis ($P < 0.001$). Comorbidities were reported by 35%, with a significant relationship to absenteeism ($P < 0.01$). Teacher awareness was reported in 58% of cases. Regarding absenteeism, over half (57%) were absent fewer than 10 days during the past academic year, with 41% attributing absenteeism to non-seizure reasons. Seizure attacks at home caused 22% of absences. A significant relationship existed between the etiology of absenteeism and seizures ($P < 0.001$). Bullying at school due to seizures was reported, with a significant relationship to absenteeism ($P = 0.02$). **Conclusion:** This study highlights the complex relationship between epilepsy, school attendance, and associated factors among pediatric patients in Saudi Arabia, shedding light on the importance of poor academic experience to improve the quality of life for children with epilepsy.

Keywords: Epilepsy, pediatrics, school, seizure, teachers

Introduction

Epilepsy stands as one of the earliest and most prevalent neurological conditions affecting humanity, with a worldwide occurrence of 1% among children. In Saudi Arabia, the prevalence is notably higher, estimated to reach 6.54 per 1000 population.[1,2] This condition holds the distinction of being the most common chronic neurological condition observed in pediatric neurology units in developing nations.[3,4] Defined as a persistent condition of the brain, epilepsy is marked by a lasting susceptibility to generate recurring, unprovoked seizures.[5-7] The impact on children with epilepsy extends beyond the seizures themselves, potentially leading to cognitive deficits and school absences, thereby contributing to poor academic performance.[3] Numerous global research studies have sought to investigate the impact of epilepsy on school absenteeism, academic achievement, and behavioral performance, given the heightened

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susceptibility of children with epilepsy to encounter challenges in these domains.[8-11] Epilepsy has a remarkable effect on the quality of life. Numerous research have demonstrated how health education affects teachers' attitudes and knowledge of epilepsy.[12] Practitioners, including pediatric neurologists and general pediatricians, can better understand how epilepsy affects school attendance and academic performance. This insight can help in developing more comprehensive treatment plans that not only focus on seizure control but also address the child's broader educational and developmental needs. Our study aims to determine the effect of seizures on school attendance among children diagnosed with epilepsy.

Materials and Methods

Study design

This cross-sectional study was conducted at the King Abdulaziz University Hospital (KAUH) in Jeddah, Saudi Arabia, and enrolled all pediatric patients diagnosed with epilepsy between 2016 and 2022. This study was approved by the KAUH Ethical Committee (reference number 662–22). Contacting data for the study were obtained from the Hospital Health Informatics department, and collected using Google Forms online questionnaire was sent via online massaging services between March to July 2023, and interpreted in a Microsoft Excel spreadsheet.

Patients and participants

The medical records of 300 patients were initially reviewed, and patients aged ≤ 16 years were identified as pediatrics. All patients who were diagnosed with epilepsy were included, While those who had an underlying condition that could mask or provoke the seizure, such as metabolic and electrolyte disorders (hypoglycemia, hyperglycemia, uremia, etc.), brain tumor, meningitis, encephalitis, were excluded from the study. Seizure frequency, number of drugs and their side effects, and other concurrent medical conditions were collected. Also, if the teachers are known of the patient's condition, absent days and the cause behind it, any problems regarding focus and memorization, and if the patient had suffered from bullying due to seizing at school.

Statistical analysis

Data were statistically analyzed using IBM SPSS software, version 26. The Chi–squared test ($\chi2$) was applied to investigate the association between qualitative variables, which were expressed as numbers and percentages The Mann–Whitney *U* test was used to examine the association between the quantitative nonparametric variables expressed as means and standard deviations (mean ± standard deviation). Statistical significance was defined as a $P < 0.05$ with a confidence interval of 95%.

Results

In Table 1, a summary of demographic characteristics is provided. The participants' mean age was 9.66 ± 3.43 years, ranging from 2 to 21 years. The majority (87%) were Saudis, while 13% were non-Saudis. Parental education data, presented in Table 2, indicated that most participants had parents who completed higher education (70%), followed by those with parents who completed secondary education (58%). None of the participants had both parents with no educational background. Table 3 summarizes the epilepsy profiles of the patients. Out of the participants, 57% were diagnosed at the age of 5 or younger (≤5), approximately 43% were diagnosed

Table 1: Descriptive demographic data

Characteristic	Descriptive statistics (*n*=207)
Age mean (SD)	9.66 (3.43)
Nationality *n* (%)	
Saudi	180 (86.96)
Non-Saudi	27 (13.04)

N=total sample size; SD=standard deviation; *n*=number of participants

Table 2: Parental Education Descriptive Matrix

Paternal Education Level *n* (%)	Maternal Education Level *n* (%)		
	Higher education	Secondary education	N/A
Higher Education	88 (70.40)	34 (41.98)	1 (100)
Secondary Education	37 (29.60)	47 (58.02)	0 (0)

N=number of participants; N/A=non-applicable (in this context, no educational background)

Table 3: Descriptive statistics of epilepsy profile

	Descriptive statistics (*n*=207)	
	n	%
Age of diagnosis		
≤5 years	118	57.00
>5 years	88	42.51
No diagnosis	1	0.48
Seizures prevalence in the past month		
Once	52	25.12
More than once	69	33.33
No seizures	86	41.55
Seizure medication intake		
One per day	93	44.93
Two per day	52	25.12
More than two	44	21.26
No medication	18	8.70
Prevalence of medication side-effects		
No	119	57.49
Yes	88	42.51
Focus and memory problems		
No	92	44.44
Yes	115	55.56
Comorbidities		
No comorbidity	211	65.00
Neurological	44	14.00
Musculoskeletal/Genetic	32	10.00
Hematological	9	3.00
Other	8	2.00
Respiratory	8	2.00
Ocular	8	2.00
Endocrine disorder	4	1.00

N=total sample size; *n*=number of participants

after the age of 5 (>5), and only 0.5% remained undiagnosed. Regarding seizure frequency in the past month, 42% reported no seizures, 33% experienced seizures more than once, and 25% had one seizure. The relationship between the number of seizures and the age of diagnosis was not significant ($P = 0.08$) as shown in Table 4. Figure 1 illustrates the distribution of seizure prevalence in the past month by nationality. The majority of Saudi participants (38%) reported no seizures, while most non-Saudis (5%) experienced seizures more than once in the past month. Regarding medication, 45% of participants reported taking one medication per day, and 57% reported no associated side effects. The analysis did not find a significant relationship between the number of medications and the age of diagnosis ($P = 0.07$) [Table 4]. Figure 2 visualizes the distribution of medication use by reported seizure frequency. Participants who reported one seizure per month mostly took one medication per day, while those experiencing more seizures per month took two or more medications. More than half of the participants (56%) reported experiencing focus and memory

problems. The analysis revealed a significant relationship between focus and memory problems and the age of diagnosis ($P < 0.001$) but no significant relationship with bullying ($P = 0.20$) [Table 4]. Figure 3 displays the distribution of focus and memory problems by seizure frequency. Figure 4 depicts the distribution of focus and memory problems by medication intake. Participants taking one medication per day mostly reported no focus and memory problems, whereas those taking two or more medications had more difficulties. The relationship between focus and memory problems and medication intake was significant ($P < 0.01$) [Table 4]. Neurological conditions (14%)

### Table 4: Bivariate analysis comparing multiple clinical and school-related variables

Comparison	P
Seizure frequency – absenteeism	<0.001
Number of medications – absenteeism	<0.01
Medication side effects – absenteeism	<0.01
Comorbidity – absenteeism	<0.01
Absenteeism – etiology of absenteeism	<0.001
Paternal education level - absenteeism	0.15
Maternal education level – absenteeism	0.14
Bullying – absenteeism	0.02
School medical care – absenteeism	0.28
Age of diagnosis – absenteeism	<0.001
Age of diagnosis – number of seizures	0.08
Age of diagnosis – number of medications	0.07
Age of diagnosis – comorbidity	<0.001
Age of diagnosis – focus and memory	<0.001
Number of medications – focus and memory	<0.01
Bullying – focus and memory	0.20

*Statistics indicates the use of a Chi–squared test (with simulated *P* values), and the rest of the analyses are done with Fisher's exact test. The variation of kinds of tests is a function of the subsample sizes

Table 5: Descriptive statistics on absenteeism

| Variable	n (%)
Absenteeism in the past academic year	
<10 times	117 (56.52)
10–30 times	39 (18.84)
>30 times	11 (5.31)
Withdrawn	40 (19.32)
Etiology of Absenteeism	
Check-up or lab test hospital appointment	26 (9.56)
Follow-up appointment with doctor	44 (16.18)
Seizure attack at school	29 (10.66)
Seizure attack in the morning before school	2 (0.74)
Seizure attack at home	60 (22.06)
Other	111 (40.81)

n=number of participants
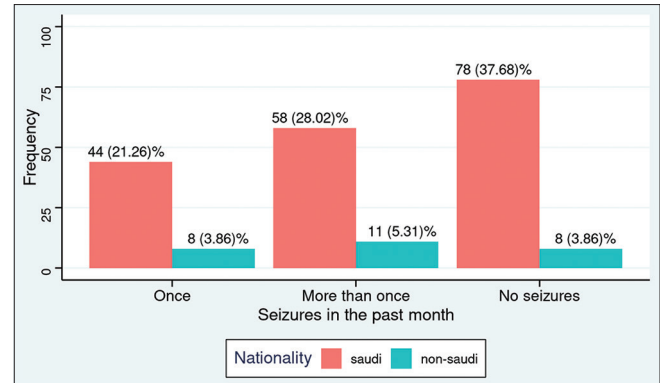
Figure 1: Seizure prevalence in Saudis and non-Saudis during the past month
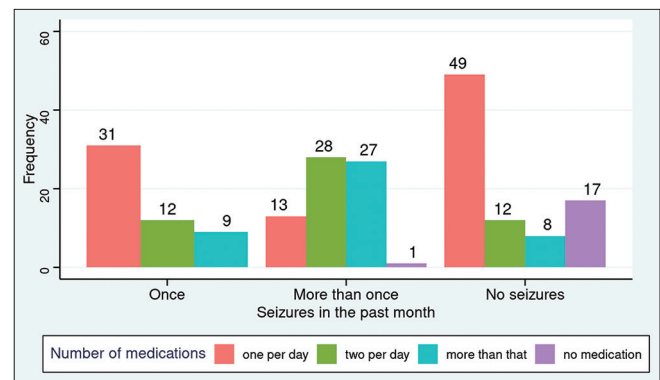

**Figure 2:** Distribution of medication use by seizure frequency
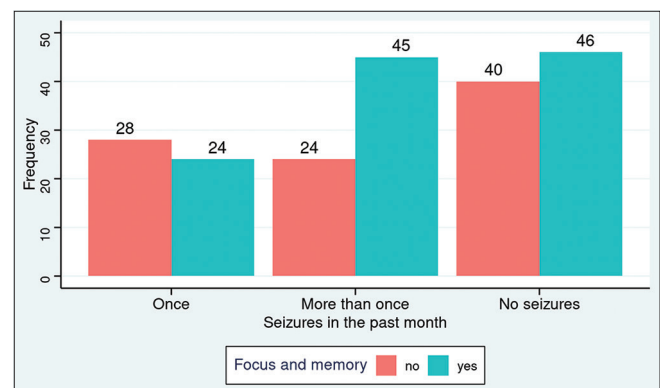
Figure 3: Distribution of focus and memory problems by seizure frequency

and musculoskeletal/genetic conditions (10%) were the most commonly reported comorbidities. However, the majority of participants (65%) reported no comorbidity. Figure 5 illustrates the distribution of comorbidities. Bivariate analyses using Fisher's exact test demonstrated significant relationships between comorbidity and absenteeism ($P < 0.01$) and between comorbidity and age of diagnosis ($P < 0.001$) [Table 4]. Figure 6 shows that more than half of the participants (58%) had teachers who were aware of their condition. Table 5 provides a descriptive summary of participants' absenteeism during the past academic year. The majority (57%) were absent less than 10 times, while 19% withdrew from school. Seizure attacks at home accounted for the most reported cause of absenteeism (22%), while other reasons were reported by 41% of the participants. The relationship between absenteeism and the etiology of absenteeism was significant ($P < 0.001$), but no significant relationships were found with paternal ($P = 0.15$) and maternal ($P = 0.14$) education levels [Table 4]. Figure 7 displays the distribution of age of diagnosis across absenteeism groups. Fisher's exact test confirmed the significance of the relationship between age of diagnosis and absenteeism ($P < 0.001$) [Table 4]. The distribution of seizure frequency during the past month across absenteeism groups is illustrated in Figure 8. Within the < 10 absenteeism group, most participants ($n = 57$) reported no seizures during the past month. Most participants within the 10–30 ($n = 22$) and >30 ($n = 7$) absenteeism groups

reported experiencing seizures more than once. Within the withdrawn group, most participants reported experiencing seizures more than once ($n = 18$) or no seizures ($n = 17$). Chi–squared test further confirmed the significance of this relationship ($P < 0.001$). The prevalence of medication side effects across absenteeism groups is illustrated in Figure 9. Within the <10 absenteeism group, most participants did not experience medication side effects (42%). Within the 10–30 absenteeism group, nearly 14% reported medication side effects. Within the >30 absenteeism group, nearly 2% reported no side effects and 3% reported side effects. Within the withdrawn group, 11% reported side effects. Further analysis using Fisher's exact test confirmed the significance of the relationship between medication side effects and absenteeism ($P < 0.01$) [Table 4]. Additionally, a Chi–squared test on the relationship between the number of medication intake and absenteeism revealed a significant relationship ($P < 0.01$) [Table 4]. However, the relationship between the provision of school medical care and absenteeism was not significant ($P = 0.28$) [Table 4]. Figure 10 illustrates the distribution of bullying at school because of seizures across absenteeism groups. Most participants (103) who were not bullied at school fell into the <10 absenteeism group. Of the participants who were bullied, 14 were in the <10 absenteeism group; 12 were in the 10–30 group; 4 were in the >30 group, and 6 were in the withdrawn group. Further investigation of the relationship between bullying across absenteeism groups using
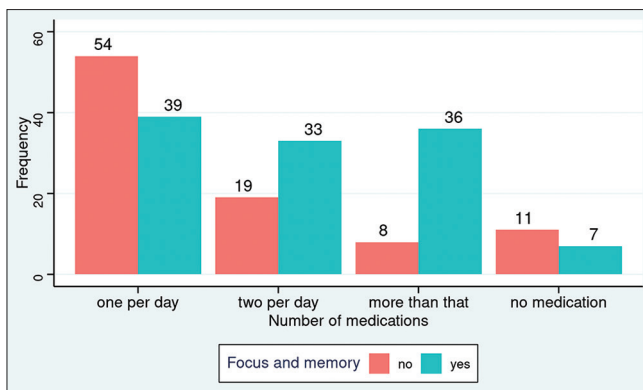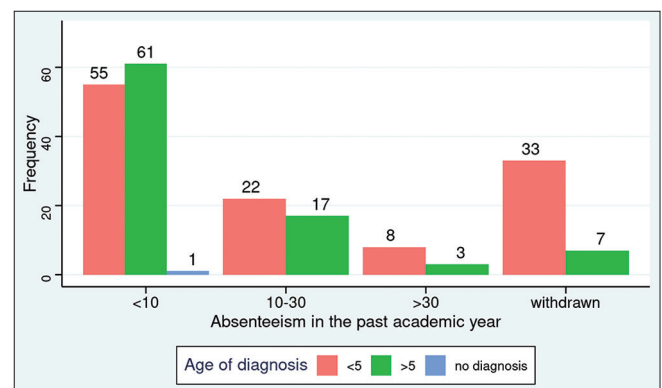

Figure 4: Distribution of focus and memory problems by medication intake
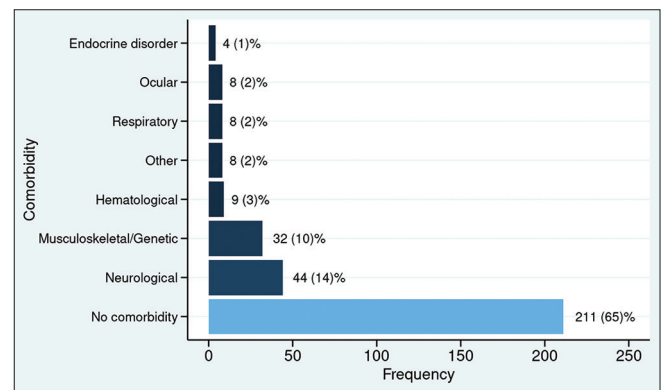
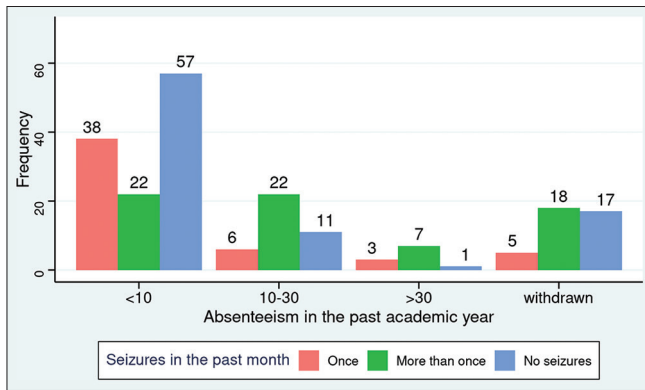**Figure 5:** Distribution of comorbidities
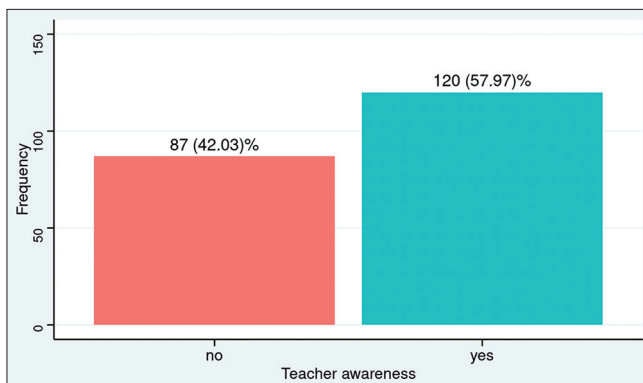
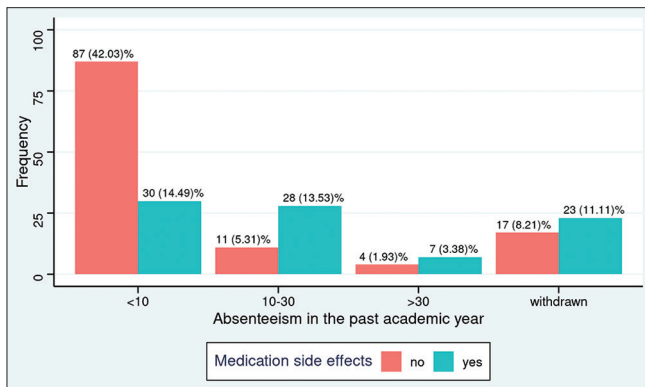**Figure 6:** Prevalence of teacher awareness of child's condition

Figure 7: Distribution of age of epilepsy diagnosis across absenteeism groups
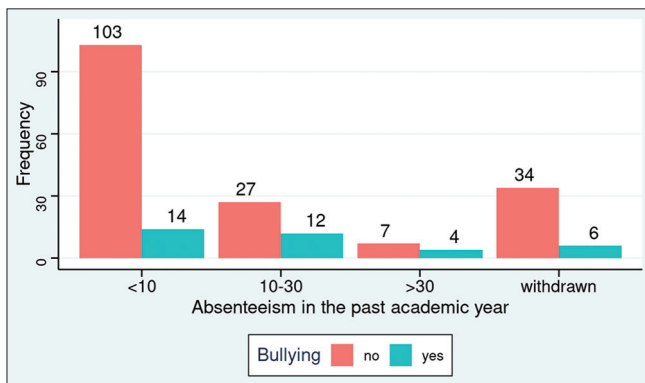
Figure 8: Distribution of seizure frequency in absenteeism groups

Figure 9: Prevalence of medication side effects by absenteeism

Figure 10: Distribution of bullying in absenteeism groups

Fisher's exact test shows that this relationship was statistically significant ($P = 0.02$) [Table 4].

Discussion

The primary objective of our research is to assess the impact of epilepsy on the academic performance of children. The results reveal that 55% of the participants exhibited indications of memory and attention issues, significantly influencing their academic achievements. These outcomes are consistent with the literature findings demonstrating a heightened likelihood for individuals diagnosed with epilepsy to attain scores at or below the national minimum standards in academic performance.[13]

Moreover, 24% missed school for more than ten days, differing from their result indicating that 25.9% missed over 50% of their school days.[3] In a separate study in Brazil, 88% of their patients were reported to have missed at least one day of school. Discrepancies in the estimates of poor school attendance may be attributed to variations in sample sizes, demographic factors, seizure durations, and differing definitions of inadequate attendance.[14] The primary cause of absenteeism, accounting for 22% of cases, was seizures occurring at home. In contrast, the predominant reasons for absenteeism in Ethiopia were medical appointments (80.3%) and experiencing a seizure before arriving at school.[3] In a separate study comprising 200 participants, 24 individuals (12%) did not disclose any adverse drug effects, while 176 individuals (88%) reported experiencing at least one adverse effect, and 164 individuals (82%) reported encountering at least two adverse effects.[15] Another study reported that 15% of respondents acknowledged experiencing adverse effects attributed to AEDs.[16] Additionally, in a study involving 290 epileptic patients, 33.4% reported experiencing adverse effects related to their AED therapy. These findings collectively underscore the considerable prevalence of adverse effects associated with AEDs among individuals with epilepsy across diverse study populations.[17] Regarding the correlation between AED side effects and absenteeism, among the patients experiencing adverse effects, 14.49% had an absenteeism rate of <10 days, 13.53% had an absenteeism rate of 10–30 days, 3.38% had an absenteeism rate of >30 days, and 11.11% withdrew from school. These findings highlight a significant relationship between increased AED-related adverse effects and absenteeism. Previous research supports these observations, indicating that poor school results were a common adverse drug effect.[18] Studies discussing the educational outcomes of children receiving AEDs also underscored increased school absenteeism, the need for special educational support, and poorer academic performance in pediatric epileptic patients.[19] Among the 52 patients who reported experiencing seizures once in the past month, 46.15% (24 patients) noted issues with focus and memory. This proportion increased among the 45 patients who had multiple seizures in the past month, with 65.22% reporting difficulties in focus and memory. Interestingly, among the 86 patients who reported no seizures in the past month, 53.49% (46 patients) still reported challenges related to focus and memory. The observed association between frequent seizures and difficulties in maintaining attention, along with struggles in inhibiting impulsive responses, underscores the cognitive challenges faced by individuals with epilepsy. Frequent seizures, a fundamental characteristic of epilepsy, contribute to impaired cognition not only during the seizure itself but also in the post-ictal phase. This post-seizure period is characterized by a notable reduction in cognitive functioning, further emphasizing the short-term impact of recurrent seizures on cognitive abilities.[20-22] Educating teachers about students diagnosed with epilepsy attending classrooms is an initial step in actively engaging schools to enhance the management of the child's condition. This involves creating a conducive environment, providing necessary support, and ensuring

appropriate education. Given that school-age children spend a significant portion of their day at school, the impact of teacher awareness is crucial. In this study, data indicates that more than half of the patients (58%) had teachers who were aware of their epilepsy condition, highlighting the prevalence of teacher awareness regarding children's epilepsy. Teachers in Saudi Arabia exhibit a commendable level of knowledge and understanding concerning seizure etiology and treatment, as demonstrated by previous research.[12] Another study conducted in Saudi Arabia revealed that a significant majority of teachers (84%) acquired information about epilepsy through reading or hearing about it, while a substantial portion (67%) personally witnessed a seizure. Notably, a small percentage (1.7%) considered epilepsy to be contagious, while the majority (56%) viewed it as a psychological condition.[23] Reviewing the literature emphasizes the imperative need for teachers to be informed about pediatric epileptic patients in their classrooms and knowledgeable about appropriate actions if a seizure occurs. Teachers possessing a strong understanding of epilepsy exhibit reduced negative attitudes, including concerns about having a child with epilepsy in their class or the belief that such children should be assigned to a special classroom.[24] This underscores the significance of ongoing teacher education to maintain a supportive and informed environment for students with epilepsy.

Despite these valuable insights, the study has limitations, including its regional focus and the absence of pre-treatment data on school performance. Future investigations on a larger scale and with longitudinal data would provide a more comprehensive understanding of the complex interplay between epilepsy and academic outcomes.

Conclusion

This research highlights the impact of epilepsy on various aspects of children's lives, such as academics, absenteeism, comorbidities, medication side effects, and teacher awareness. The findings confirm the significant influence of epilepsy on memory and attention, consistent with prior studies. Regional disparities in school attendance patterns were observed, emphasizing the need for tailored interventions. The prevalence of comorbidities, particularly neurological conditions, aligns with existing literature, highlighting the complexity of the disorder. The study also emphasizes the importance of monitoring and managing medication side effects to minimize their impact on education, as increased side effects were correlated with higher rates of absenteeism. Teacher awareness was found to play a crucial role in supporting students with epilepsy in the school environment. While some teachers were aware of the condition, ongoing education for teachers is essential. The study acknowledges limitations, including its regional focus and the lack of pre-treatment school performance data. Future research with larger-scale and longitudinal data would enhance our understanding of the relationship between epilepsy and academic outcomes.

Data availability

Data will be made available when requested.

Ethics approval statement

The study received prior ethics approval from the Unit of Biomedical Ethics Research Committee at the Faculty of Medicine at King Abdulaziz University under reference number 662–22 before it was started.

Patient consent statement

The patient's consent was waived as it was a retrospective record review.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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