European Institute of Knowledge & Innovation

Annals of Innovation in Medicine (AIM) ISSN: 2977-0335

Research Article

Impact of Clinical Pharmacist-Led Educational Program on Knowledge and Practice of Sudanese Pediatricians About the Management of Epilepsy in Children

Salma Eltahir[1,*], Haydar Babikir[2], and Imad Taj Eldin[3]

[1] Doctor of Clinical Pharmacy, Wad Medani Pediatric Teaching Hospital, Ministry of Health, Gezira State, Sudan; shani23101982@gmail.com
[2] Consultant Paediatric Neurologist, Department of Paediatrics and Child Health, University of Gezira, Sudan; haydarbabikir@yahoo.com
[3] Department of Pharmacology, Faculty of Pharmacy, University of Gezira, Sudan; omdataj64@gmail.com
*Correspondence: shani23101982@gmail.com ; Tel.: 00966596485979

https://doi.org/10.59652/sxv0xa19

Abstract: *Background*: Epilepsy is one of the most common neurological disorders in children. Seizure frequency is an important indicator of treatment effectiveness. This study assessed the impact of a clinical phar-macist-led educational program on the knowledge and practice of pediatricians regarding the man-agement of epilepsy in children. *Methods*: This was a pre-post interventional hospital-based study conducted at Wad Medani Pediatric Teaching Hospital from February 2022 to August 2023. Prescribers working at the hospital were included. *Results*: Wilcoxon signed-rank testing showed statistically sig-nificant differences in knowledge regarding the recommended route of administration of midazolam for acute seizures ($p = 0.022$) and discontinuation of chronic sodium valproate in seizure-free children ($p = 0.016$). A statistically significant difference was also observed in practice regarding planning the overall tapering period of antiseizure drugs (ASDs) in seizure-free patients ($p = 0.016$). Conclusion: The clinical pharmacist-led educational program improved selected aspects of knowledge and practice among pre-scribers managing childhood epilepsy.

Keywords: epilepsy, questionnaire, prescribers, guidelines, protocols, education, pharmacist

Received: 14 February 2026
Accepted: 22 March 2026
Published: 28 March 2026

1. Introduction

Epilepsy was defined conceptually in 2005 as a disorder of the brain characterized by an enduring predisposition to generate epileptic seizures [1]. It is one of the most common neurological disorders in children [2]. In Sudan, epilepsy accounts for 1.6 annual mortality rates and 238.7 disability-adjusted life years per 100,000 population [3]. Approximately 10% of the population will experience a seizure at some point in life, and up to 30% of all seizures are provoked by central nervous system disorders or insults such as meningitis, trauma, tumors, and exposure to toxins [2,5]. As part of the healthcare team, pharmacists should engage at every stage of care to monitor the patient's response and support effective treatment [4].

Successful management of epilepsy depends on many factors, including the cause, seizure type, epilepsy syndrome, and selection of an appropriate antiseizure drug (ASD) [5-7].

Valproic acid monotherapy remains one of the most frequently prescribed treatments for children with epilepsy [7-9]. It has long been used as a first-line option for several seizure types in children [10]. Carbamazepine is also commonly prescribed in pediatric practice [6,7].

Clinical practice guidelines and protocols are developed to improve quality of care, reduce variation in practice, and help ensure that evidence is used appropriately [11,12]. A guideline recommendation is a statement that promotes or advocates a particular course of action in clinical care [12]. To assist implementation, a protocol can be developed to operationalize the guideline and specify the steps to follow [13]. Guidelines provide direction, whereas protocols are intended to standardize action in defined situations. The International League Against Epilepsy (ILAE) has also developed tools to support high-quality guideline development in epilepsy and to improve clinical processes of care and health outcomes [14,15].

The objective of this study was to evaluate the impact of a clinical pharmacist-led educational program on the knowledge and practice of pediatricians regarding the management of epilepsy in children.

2. Materials and Methods

Study Area

This study was conducted at Wad Medani Pediatric Teaching Hospital, which was established in March 1987 in Wad Medani, the capital of Gezira State in central Sudan. It is the main urban referral hospital for children in Gezira State, with a capacity of 204 beds, and receives patients from day one of life to 16 years of age from Wad Medani and neighboring areas. The hospital includes outpatient services, emergency and referral clinics, and inpatient services.

Study Design

A pre-post, cross-sectional, interventional, hospital-based study design was used to assess the knowledge and current practice of prescribers regarding the management of epilepsy.

Study period

The study started in February 2022 and ended in August 2023.

Population of the study

The study population comprised consultant pediatricians, specialist pediatricians, pediatric residents, and medical officers who were available at Wad Medani Pediatric Teaching Hospital during the study period.

Inclusion criteria

Consultant pediatricians, specialist pediatricians, pediatric residents, and medical officers from different units and positions who were available during the study period were included.

Exclusion criteria

Those who refused consent

Sample size

The baseline sample included 56 consultant pediatricians, specialist pediatricians, pediatric residents, and medical officers at Wad Medani Pediatric Teaching Hospital; 36 completed the post-education assessment.

Sampling techniques

Prescribers were sampled while they were in their resting room.

Data Collection methods

A self-constructed questionnaire, reviewed by the supervision committee and the Faculty of Pharmacy, was used to assess pediatric consultants', specialists', residents', and medical officers' knowledge and current practice regarding epilepsy management at the beginning of the study and again after provision of an educational program.

The questionnaire included items on sociodemographic characteristics, current position, years in practice, initially recommended ASDs for selected seizure types, recommended baseline investigations, and related topics (Appendix A). Responses were compared with the National Institute for Health and Care Excellence (NICE) guideline on epilepsies in children, young people and adults [16].

Educational program

The prescriber educational program involved lectures and posters containing current information on the management of epilepsy, adapted primarily from the NICE guideline [16] and related guidance on acute seizure management.

Data analysis plan

Collected data were entered into the Statistical Package for the Social Sciences (SPSS) version 20. Descriptive statistics (means, standard deviations, and percentages) were used for sociodemographic characteristics, and the Wilcoxon signed-rank test was used to assess pre- and post-education knowledge and practice among pediatricians. All comparisons were performed at a 95% confidence interval and a significance level of 0.05.

Ethical approval was obtained before study initiation.

3. Results

The questionnaire was distributed to 56 prescribers; the response rate was 100% in the pre-education phase. A total of 36 prescribers completed the post-education assessment, giving a response rate of 64.3%.

3.1. Clinical and sociodemographic characteristics

In the pre-education phase, 24 (42.9%) of the studied doctors were aged <30 years, 25 (44.6%) were aged 30-40 years, and 7 (12.5%) were aged >40 years. Exactly 12 (21.4%) were male and 44 (78.6%) were female. There was 1 (1.8%) medical officer, 40 (71.4%) residents, 9 (16.1%) specialists, and 6 (10.5%) consultants. Fourteen (25.0%) had been in practice for <2 years, 18 (32.1%) for 2 to <4 years, and 24 (42.9%) for >4 years. In the post-education phase, 19 (52.8%) of the studied doctors were aged <30 years, 11 (30.6%) were aged 30-40 years, and 6 (16.6%) were aged >40 years. Exactly 6 (16.7%) were male and 30 (83.3%) were female. There was 1 (2.8%) medical officer, 25 (69.4%) residents, 4 (11.1%) specialists, and 6 (16.7%) consultants. Twelve (33.3%) had been in practice for <2 years, 10 (27.8%) for 2 to <4 years, and 14 (38.9%) for >4 years (Table 1).

Table 1. Distribution of study participants according to clinical and sociodemographic characteristics

Category		Frequency (pre-education)	Percent (pre-education)	Frequency (post-education)	Percent (post-education)
Age	< 30 years	24	42.9	19	52.8
	30-40 years	25	44.6	11	30.6
	> 40 years	7	12.5	6	16.6

Gender	Male	12	21.4	6	16.7
	Female	44	78.6	30	83.3
Current position	Medical officers	1	1.8	1	2.8
	Resi-dents	40	71.4	25	69.4
	Special-ists	9	16.1	4	11.1
	Consult-ants	6	10.5	6	16.7
Number of years in prac-tice	< 2 years	14	25.0	12	33.3
	2- <4 years	18	32.1	10	27.8
	> 4 years	24	42.9	14	38.9
Total		56	100	36	100

3.2. Outcomes

3.2.1. Knowledge

The Wilcoxon signed-rank test showed no statistically significant pre- and post-education difference in knowledge regarding the recommended baseline investigations before initiating an ASD ($Z = -1.645$, $p = 0.100$), the second-line or add-on ASD for generalized epilepsy ($Z = -0.392$, $p = 0.695$), or the first-line ASD for acute seizures in the first 5 minutes of presentation ($Z = -0.577$, $p = 0.564$). A statistically significant difference was observed for the recommended initial ASD for newly diagnosed patients with generalized tonic-clonic seizures, absence seizures, and juvenile myoclonic seizures ($Z = -2.985$, $p = 0.003$), the recommended route of administration of midazolam for acute seizures ($Z = -2.294$, $p = 0.022$), and discontinuation of chronic sodium valproate in seizure-free patients ($Z = -2.415$, $p = 0.016$).

3.2.2. Practice

The Wilcoxon signed-rank test showed no statistically significant pre- and post-education difference in the calculation of sodium valproate dose ($Z = 0.000$, $p = 1.000$), the second step in the management of acute convulsive seizures ($Z = -0.632$, $p = 0.527$), or changing from carbamazepine immediate-release (CBZ-IR) to carbamazepine controlled-release (CBZ-

CR) to decrease side effects (Z = -0.626, p = 0.532). A statistically significant difference was observed only in planning the overall tapering period of ASD in a seizure-free patient (Z = -2.415, p = 0.016).

Table 2. Comparison of pre- and post-education knowledge and practice of prescribers using the Wilcoxon signed-rank test

Knowledge	Test statistics	
	Z	Asymp. Sig. (2-tailed)
Post- pre- education - the recommended baseline investigation/s before initiating an ASD.	-1.645-[b]	.100
Post- Pre- education - the recommended initial ASD for newly diagnosed patient with: GTCs, AS and JMS	-2.985-[b]	.003
Post- Pre- education - the second line or add on ASD to a patient with generalized epilepsy	-.392-[b]	.695
Post- Pre- education - the first line ASD/s to manage acute seizures in the first 5 min. of presentation	-.577-[b]	.564
Post- pre- education recommended route of administration of midazolam for acute seizures	-2.294-[b]	.022
Post - Pre- education - discontinuation of chronic administration of sodium valproate from seizure free patient	-2.415-[b]	.016
PRACTICE		
Post - Pre- education calculations of sodium valproate	.000[b]	1.000
Post- Pre- education second step in management of acute convulsive seizures	-.632-[b]	.527
Post- Pre- education changing from CBZ-IR form to CBZ-CR to decrease side effects	-.626-[b]	.532
Post- Pre education planning for overall tapering period of ASD from seizure free patient	-2.415-[b]	.016

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

ACSs = acute convulsive seizures; AS = absence seizure; ASD = antiseizure drug; ASs = acute seizures; CBZ-IR = carbamazepine immediate release; CBZ-CR = carbamazepine controlled release; GE = generalized epilepsy; GTCs = generalized tonic-clonic seizures; JMS = juvenile myoclonic seizures.

4. Discussion

4.1. Knowledge

Source of drug information: Three quarters of the participating prescribers reported using textbooks as a source of drug information in the pre-education stage, and a slightly higher proportion reported the same in the post-education stage. There was no clear improvement in the use of online search tools or mobile applications.

Baseline investigations before initiating an ASD: Nearly half of the participating pediatricians had incorrect knowledge about baseline investigations before initiating an ASD, about one third had correct knowledge, and nearly one quarter remained at the same level. Overall, participants' knowledge regarding baseline investigations did not improve.

Initial ASD and second-line or add-on therapy: About half of the study participants remained at the same knowledge level regarding the initial ASD. Although a statistically significant pre-post difference was observed, the overall pattern did not indicate a clear improvement in knowledge regarding initial ASD selection. One study reported that pediatric residents' knowledge about seizures and epilepsy improved significantly after a pharmacist-led educational program [17]. Exactly one third of participating pediatricians had incorrect knowledge about second-line ASD therapy, nearly one third improved, and more than one third remained unchanged. Overall knowledge regarding second-line or add-on therapy did not improve.

Management of acute seizures in the first 5 minutes of presentation: The majority of prescribers remained with the same correct knowledge regarding the management of acute seizures in the first 5 minutes of presentation. Overall knowledge remained unchanged.

Recommended route of administration of midazolam for acute seizures: Only around one tenth of study prescribers showed improved knowledge regarding the recommended route of administration of midazolam for acute seizures. The proportion of participants with poorer knowledge and those who remained unchanged was similar and approached half in each group. Overall knowledge improved in this aspect.

Discontinuation of chronic ASDs in seizure-free children: Exactly half of the pediatricians had incorrect knowledge about when to discontinue ASDs. Less than one sixth of participants improved, and about one third remained unchanged. Overall knowledge improved regarding this aspect.

4.2. Practice questions

Calculation of ASD dose: All participants remained at the same correct practice level, and no change occurred after the intervention.

Second step in the management of acute convulsive seizures: Around three quarters of participants remained at the same practice level regarding the second step in the management of acute convulsive seizures, and this was the correct practice. Around one tenth showed improvement. Overall practice did not change after the intervention.

Changing from CBZ-IR to CBZ-CR to decrease side effects of CBZ: More than one quarter of the study population showed incorrect practice regarding changing from CBZ-IR

to CBZ-CR. More than one third of prescribers improved, and another one third remained unchanged. There was no overall impact of the intervention in this aspect.

Planning the overall tapering period of ASD in a seizure-free patient: Half of prescribers showed incorrect practice regarding planning the overall tapering period of ASD. Less than one fifth showed improved practice, whereas one third remained unchanged. Overall practice improved in this aspect after the intervention.

5. Conclusions

Positive impact was found on knowledge regarding the recommended route of administration of midazolam for acute seizures and discontinuation of chronic ASDs in seizure-free children. No clear impact was found on knowledge regarding the management of acute seizures in the first 5 minutes of presentation, second-line or add-on therapy, initial ASD selection, or baseline investigations before initiating an ASD. No impact was found on practice regarding the second step in the management of acute convulsive seizures or changing from CBZ-IR to CBZ-CR to decrease side effects. A positive impact was found on practice regarding planning the overall tapering period of ASD in a seizure-free patient. Overall, the clinical pharmacist-led intervention showed benefit in selected aspects of prescriber knowledge and practice.

6. Administrative Information

Author Contributions: Conceptualization, investigation, and methodology: Prof. Imad-Eldeen Mohammed Taj El Deen and Prof. Haydar El Hady Babikir. Data curation, software, formal analysis, writing-original draft, and visualization: Dr. Salma Hassan Mohammed Eltahir. Resources (patients): Prof. Haydar El Hady Babikir and Dr. Salma Hassan Mohammed Eltahir. Validation: Prof. Imad-Eldeen Mohammed Taj El Deen and Prof. Haydar El Hady Babikir. Writing-review and editing: Prof. Imad-Eldeen Mohammed Taj El Deen and Prof. Haydar El Hady Babikir.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Institutional Review Board Statement: This study was approved by the Ministry of Health, Gezira State, and by the Ethical Committee of the University of Gezira before recruitment and enrolment of participants. This article formed part of a broader study conducted by the same authors. Ethical approval for the overall study was granted under approval number 5-22 on 22/2/2022. This article involved no experimental interventions in humans or animals.

Informed Consent: Informed consent was obtained from all subjects involved in the study.

Acknowledgements: The authors acknowledge the support of Professor Imad Eldeen Mohammed Taj El Deen and Professor Haydar El Hady Babikir for their mentorship, encouragement, and guidance throughout this work. The assistance provided in data transcription, editing, and proofreading is also gratefully acknowledged.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix

Self-Pre-constructed questionnaire related to assessment of pediatricians' knowledge and current practice in management of acute seizures and epilepsy.

1-Serial No ( )

E.mail ……
2- Age (year):
< 30 ( ) 30 – 40 ( ) >40 ( )
3- Gender:
Male ( ) Female ( )
4-Current position
Medical officer ( ) Resident ( ) Specialist ( ) Consultant ( )
5-Number of years in practice (years)
<2 ( ) 2 - <4 ( ) 4 – 6 ( ) > 6 ( )
6-What is/are source/s of information you follow in your practice? i- Text books ( ) ii- Mobile applications ( ) iii- Online search ( ) iv-Directly from seniors ( )

7-What is the recommended initial ASD for newly diagnosed patient with:

i- Generalized tonic- clonic seizures? ……..…….

ii- Absence seizures? ……..

iii- Juvenile myoclonic seizures (JMS)? …….

8- How do you calculate sodium valproate dose for patient with generalized Epilepsy? I will use patient's…….

i-weight ( ) ii- height ( ) iii- body surface area( )

9- What is your intervention if a patient with generalized epilepsy does not respond well to maximum dose of sodium valproate?

i- Add carbamazepine (Tegretol) ( )

ii- Add levetiracetam (Epitam) ( )

iii- Change sodium valproate with carbamazepine ( )

iv- I don't know ( )

10- What is/are the recommended baseline investigation/s before initiating an ASD?

……

……..

11- A 5 year olds patient with established acute convulsive seizures

received a dose of IV diazepam but seizure recurs after 5min.

What is the next step?

i- Administer phenytoin infusion immediately ( )

ii- Administer a second dose of IV diazepam and reassess ( )

iii- -administer IV diazepam + phenytoin ( )

iv- I don't know ( )

12-what is/are the first line anti-seizure drug/s to manage acute seizures

in the first 5 min. of presentation?

i- a Benzodiazepine (Diazepam, Lorazepam or Midazolam) ( )

ii- phosphenytoin (phenytoin equivalent) or phenytoin ( )

iii-phenobarbital ( )

iv- I don't know ( )

13- When using midazolam for acute seizures (NOT refractory Status Epilepticus), What is the recommended route of administration?

i- Slow intramuscular injection (not less than 5 min.) ( )

ii- Rapid intravenous infusion ( )

iii- IV bolus inj ( )

iv- I don't know ( )

14-What is the suitable time to discontinue chronic anti-seizure drug/s

in seizure free children?

…….
15-If you decided to discontinue chronic administration of sodium valproate tabs from seizure free epileptic patient, what is your plan for overall tapering period? …….
16- A.M is 8 year male patient. He received diagnoses of focal epilepsy two months ago, and received immediate released carbamazepine tabs (Tegretol 200mg). Today the patient comes to referred clinic for follow up. The care giver said that the child has no seizure for the past 5 weeks but the patient C/O severe headache and nausea which interferes with his daily activities and school performance. What is your action in this case? i. Change carbamazepine with another suitable ASD ( ) ii. Decrease the dose of carbamazepine ( ) iii. Give the patient analgesic and antiemetic ( ) iv. Replace immediate release form of carbamazepine with the equivalent dose of controlled release(CR) form of the same generic ( )

References

1. Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE, et al. ILAE official report: a practical clinical definition of epilepsy. Epilepsia. 2014;55(4):475-82.
2. Beghi E. The epidemiology of epilepsy. Neuroepidemiology. 2020;54(2):185-91.
3. Bashir MBA, Cumber SN. The quality of life and inequalities in health services for epilepsy treatment among patience in the urban cities of Sudan. Pan Afr Med J. 2019;33:10.
4. Ernawati I, Yasin NM, Setyopranoto I, Ikawati Z. The role of pharmacists' interventions in increasing medication adherence of patients with epilepsy: a scoping review. J Prev Med Public Health. 2024;57(3):212-22.
5. Deonna T. Management of epilepsy. Arch Dis Child. 2005;90(1):5-10.
6. van de Vrie-Hoekstra NW, de Vries TW, van den Berg PB, Brouwer OF, de Jong-van den Berg LTW. Antiepileptic drug utilization in children from 1997-2005: a study from the Netherlands. Eur J Clin Pharmacol. 2008;64(10):1013-20.
7. Kwong KL, Tsui KW, Wu SP, Yung A, Yau E, Eva F, et al. Utilization of antiepileptic drugs in Hong Kong children. Pediatr Neurol. 2012;46(5):281-6.

8. Cho YS, Ah YM, Jung AH, Kim KJ, Lee JY. Trends in antiepileptic drug prescriptions for childhood epilepsy at a tertiary children's hospital in Korea, 2001-2012. Pediatr Drugs. 2015;17(6):487-96.
9. Putignano D, Clavenna A, Campi R, Bortolotti A, Fortino I, Merlino L, et al. Antiepileptic drug use in Italian children over a decade. Eur J Clin Pharmacol. 2017;73(2):241-8.
10. Balagura G, Iapadre G, Verrotti A, Striano P. Moving beyond sodium valproate: choosing the right anti-epileptic drug in children. Expert Opin Pharmacother. 2019;20(12):1449-56.
11. Thomas LH, Cullum NA, McColl E, Rousseau N, Soutter J, Steen N. Guidelines in professions allied to medicine. Cochrane Database Syst Rev. 1999;(1):CD000349.
12. Lugtenberg M, Burgers JS, Westert GP. Effects of evidence-based clinical practice guidelines on quality of care: a systematic review. Qual Saf Health Care. 2009;18(5):385-92.
13. Grol R, Wensing M, Eccles M, Davis D. Improving patient care: the implementation of change in health care. 2nd ed. Chichester: Wiley-Blackwell; 2013.
14. Sauro KM, Wiebe S, Perucca E, French J, Dunkley C, de Marinis A, et al. Developing clinical practice guidelines for epilepsy: a report from the ILAE Epilepsy Guidelines Working Group. Epilepsia. 2015;56(12):1859-69.
15. Jetté N, Kirkpatrick M, Lin K, Fernando SMS, French JA, Jehi L, et al. What is a clinical practice guideline? A roadmap to their development. Special report from the Guidelines Task Force of the International League Against Epilepsy. Epilepsia. 2022;63(8):1920-9.
16. National Institute for Health and Care Excellence. Epilepsies in children, young people and adults. London: NICE; 2022. (NICE guideline NG217).
17. Leviton A, Patel AD, Loddenkemper T. Self-management education for children with epilepsy and their caregivers. A scoping review. Epilepsy Behav. 2023;144:109232.