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From Traditional Medicine to Physicians: Dynamics and Determinants of Healthcare- Seeking Behavior Following an Inaugural Epileptic Seizure in Mali

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Abstract

Background

In sub-Saharan Africa, over 80% of the population relies on traditional medicine (TM) as their primary healthcare resource. Following our team's previous work establishing broad healthcare-seeking patterns, this study investigates the specific clinical window immediately following an inaugural epileptic seizure in Mali, analyzing the behavioral and socioeconomic determinants driving choices between TM and conventional medicine (CM).

Methods

We employed a prospective, sequential exploratory mixed methods design across two interconnected urban and rural referral facilities in Mali. Qualitative thematic findings informed the cultural adaptation of a structured quantitative questionnaire administered to 87 patients with confirmed epilepsy according to International League Against Epilepsy (ILAE) criteria. Predictors of primary physician utilization were isolated using univariable and multivariable logistic regression.

Results

The study population were young with a mean age of 20 (SD = 14) years. Following the inaugural seizure, primary consultations were evenly split between traditional practitioners (49.4%) and conventional physicians (48.3%). Conversely, secondary consultations marked a definitive therapeutic shift, with 100% returning patients transitioning to physicians. In the final multivariable model, male sex (Adjusted Odds Ratio [AOR] = 3.89, p = 0.03), primary education (AOR = 4.84, p = 0.03), and higher education (AOR = 33.47, p = 0.02) were robust predictors of primary physician utilization. Conversely, rural residency in Koulikoro (AOR = 0.13, p = 0.002) or Sikasso (AOR = 0.07, p = 0.04) significantly hindered formal healthcare access. Clinical follow-up indicated that 85.1% of patients achieved complete seizure freedom under conventional anti-seizure medications.

Conclusion

Traditional medicine remains a powerful primary resort following an inaugural seizure in Mali, driven by geographic barriers and socioeconomic determinants. Bridging the epilepsy treatment gap requires scaling universal health insurance, decentralizing care through community health workers, and formalizing collaborative triage networks with trained traditional healers.

1. Introduction

Epileptic seizures affect approximately 10% of the global population, with 1% to 2% ultimately developing clinical epilepsy worldwide. In 2021, an estimated 51.7 million people were living with epilepsy (PWE), 80% of whom resided in low- and middle-income countries (LMICs) where profound treatment gaps have emerged. In these resource-limited regions, it is estimated that only one in four people with epilepsy have access to appropriate biomedical care. In Mali, epidemiological data indicate that the prevalence of epilepsy remains substantial, estimated at 15.6 per 1,000 in rural areas and 14.6 per 1,000 in urban settings. Recognizing this critical burden, the World Health Organization (WHO) has declared epilepsy a public health imperative, developing the Intersectoral Global Action Plan on Epilepsy and Other Neurological Disorders 2022–2031 (IGAP), which was formally adopted by the World Health Assembly in May 2022.

Numerous structural challenges render the management of epilepsy complex in sub-Saharan Africa (SSA), particularly within rural communities. These include critical shortages of qualified neurological personnel, uneven distribution of healthcare facilities, and highly restricted access to diagnostic resources. Furthermore, deeply entrenched sociocultural beliefs often lead to a lack of acceptance of the disease, hindering adherence to biomedical treatment by patients and their families. This suboptimal care for PWE is further compounded by the high cost of anti-seizure medications, their relative unavailability in rural markets, and the absence of universal health coverage mechanisms. Beliefs, perceptions, and fears regarding the etiology of seizures vary across communities and heavily dictate individual and collective healthcare-seeking behaviors [8–11]. Consequently, epilepsy remains associated with profound stigma, prejudice, and discriminatory practices that disrupt daily life and prevent evidence-based diagnosis and management. These converging factors largely explain the higher prevalence of active and lifetime epilepsy observed in developing countries overall, and in SSA, a reality that is especially tragic given that epilepsy is one of the few severe neurological conditions that can be effectively managed with low-cost interventions.

In this pluralistic landscape, the utilization of traditional medicine (TM) remains high, serving as the first line of care for many PWE in SSA. Building directly upon our team’s previous work published in this journal, which established a baseline map of traditional medicine utilization for neurological disorders in Mali, we demonstrated that over two-thirds of neurological patients consult a traditional healer prior to hospital arrival. In neighboring countries sharing similar sociocultural realities, such as Guinea, the average duration of care with a traditional healer before consulting conventional medicine (CM) was reported to be as long as 39 months—a critical period during which patients remain completely deprived of effective anti-seizure medications.

While the treatment gap for established epilepsy is well-documented in the literature, the specific, acute window immediately following a patient's very first seizure represents a critical intersection that often dictates the entire long-term therapeutic trajectory. Within Africa, this acute phase crystallizes the subtle competition between TM and CM in neurological care. A meticulous assessment of the underlying factors and determinants that motivate families to seek traditional medicine versus conventional physicians immediately following an inaugural seizure is crucial, as optimal management of this initial

phase can radically alter disease outcomes. Furthermore, analyzing the precise sociodemographic parameters and clinical drivers of this health-seeking behavior is vital to inform effective national epilepsy control programs tailored to local beliefs. To address this gap, this study aimed to investigate the determinants of healthcare utilization and therapeutic choices following a first epileptic seizure in Mali, using a rigorous mixed-methods approach.

2. Materials and Methods

2.1. Study Design

This study investigated human health-seeking behavior during a critical clinical event, the inaugural epileptic seizure, within a complex pluralistic care environment characterized by the co-existence of conventional medicine (CM) and traditional medicine (TM). To achieve a nuanced and comprehensive understanding of these dynamics, we employed a sequential exploratory mixed-methods design, integrating qualitative and quantitative approaches grounded in constructivist frameworks.

2.2. Conventional Healthcare System in Mali

The healthcare system in Mali is organized in a pyramidal structure, reflecting a hierarchical model of service delivery. At the base of the pyramid are community and primary healthcare facilities, including health posts and community health centers (CSCOM), which provide basic preventive and curative services, maternal and child healthcare, and health education. The intermediate level comprises district and regional referral hospitals (CSREF), offering specialized care, laboratory services, and management of complex cases referred from primary facilities. At the top of the pyramid are national referral hospitals and specialized centers, responsible for advanced diagnostics, specialized tertiary treatments, research, and medical training. Although this pyramidal structure aims to guarantee progressive healthcare access, geographical disparities, workforce maldistribution, and resource constraints frequently challenge its optimal operation in Mali.

2.3. Study Sites

This prospective cohort study was conducted among outpatients managed at two interconnected referral centers collaborating within an urban-rural healthcare network in Mali. All patients were assigned a unique identification number to prevent duplicate registration across sites.

Study Site 1 (Urban): Polyclinique Pasteur: An urban, intermediate-level health facility located in Bamako, the capital city of Mali. It benefits from the infrastructure available in a major African metropolitan area, employing several neurologists with formal training in epileptology. Its technical facilities include an electroencephalography (EEG) system, a 16-slice computed tomography (CT) scanner, and a 1.5 Tesla magnetic resonance imaging (MRI) unit.

Study Site 2 (Rural): Dinandougou Medical Clinic: A rural, intermediate-level health facility located in Markacoungo, approximately 85 km from Bamako. This rural clinic was selected due to its extensive

involvement and recognized expertise in the community management of PWE in Mali, having served as the site for several national epilepsy research initiatives [19–22]. Furthermore, it is recognized by the Faculty of Medicine and Odonto-Stomatology of Bamako as a rural medical clerkship training site and is one of the few rural facilities equipped with a digital EEG machine capable of performing standard wakefulness and sleep recordings.

2.4. Study Timeline and Phased Implementation

The sequential exploratory mixed-methods design was implemented in two distinct phases separated by an operational constructive step :

Qualitative Phase (August 1 – November 23, 2023)

We conducted semi-structured interviews to explore healthcare pathways and the underlying sociocultural logic dictating choices between TM and CM within the population.

Constructive Step

Themes that emerged from the qualitative analysis were operationalized to develop and culturally adapt the quantitative survey instrument, ensuring all variables were deeply grounded in the patients lived experiences.

- **Quantitative Phase (December 1, 2023 – February 28, 2024)**: The resulting structured questionnaire was administered to the cohort to statistically assess the socio-geographic, economic, and clinical determinants of healthcare utilization immediately following the first seizure.

2.5. Study Population and Eligibility Criteria

2.5.1. Inclusion Criteria

Participants were eligible for inclusion if they met all of the following criteria: (i) aged ≥ 1 year and presenting to either Polyclinique Pasteur (Bamako) or Dinandougou Medical Clinic (Markacoungo); (ii) a confirmed diagnosis of epilepsy according to ILAE criteria, with detailed medical records allowing for a comprehensive retrospective reconstruction of the therapeutic pathway starting specifically from the inaugural seizure; (iii) capable (themselves or via a primary caregiver) of providing reliable information regarding healthcare-seeking behavior and therapeutic choices; and (iv) provided written or verbal informed consent (or, for minors, via a parent or legal guardian).

2.5.2. Exclusion Criteria

Participants were excluded if they met any of the following criteria: (i) seizures clearly attributable to acute provisional symptomatic causes (e.g., severe hypoglycemia, acute intoxication, acute febrile convulsions without neurological involvement) with complete resolution and no long-term recurrence risk; (ii) an uncertain or unverified diagnosis of epilepsy; (iii) severe cognitive impairment or altered

consciousness preventing reliable data collection in the absence of a primary caregiver; (iv) refusal to provide informed consent; or (v) incomplete clinical records or insufficient information regarding care pathways immediately after the first seizure.

2.5.3. Sampling and Sample Size Calculation

Consecutive sampling was used to enroll patients meeting the eligibility criteria. The minimum required sample size was calculated using the Daniel Schwartz formula, assuming a statistical power of 95% and a precision set at 10% (i = 0.10). Based on previous literature in Mali [8] reporting that 63% of parents of children with epilepsy sought care from a traditional healer as their first line of treatment (p = 0.63), the minimum required sample size was estimated at 89 patients.

2.6. Data Collection and Clinical Investigations

Data were collected through direct, semi-structured interviews using context-specific individual collection forms. Comprehensive patient medical records were reviewed to extract sociodemographic characteristics, comprehensive disease history, and personal or family medical history (including familial epilepsy, consanguinity, perinatal context, previous central nervous system infections, and head trauma).

Diagnostic data included standard awake/sleep EEG findings and neuroimaging data (head CT and/or brain MRI). Biological investigations were guided by clinical presentations and included complete blood counts, blood glucose, renal and liver function tests, serum electrolytes, inflammatory markers, HIV serology, hemoglobin electrophoresis, malaria testing, and cerebrospinal fluid analysis where indicated.

To evaluate whether clinical features and underlying causes influenced the therapeutic itinerary following the inaugural seizure, syndromic and etiological classifications were established in accordance with ILAE criteria and adapted to local diagnostic capabilities. The final etiological fram$ework comprised:

Structural causes

Pediatric sequelae related to pregnancy or difficult childbirth, sequelae of head trauma, stroke, malformations, central nervous system inflammatory lesions, and other epileptogenic structural abnormalities discovered on CT or MRI.

Infectious causes

Cerebral malaria sequelae, post-meningitis or neuro-meningeal tuberculosis sequelae, HIV-associated neurological complications, neurocysticercosis, and other central nervous system infections.

Neurodevelopmental disorders and developmental encephalopathies

Epilepsies occurring within the context of cerebral palsy, autism spectrum disorders, or severe attention-deficit/hyperactivity disorder (ADHD).

Idiopathic generalized epilepsy syndromes

Well-defined syndromic entities including childhood absence epilepsy, juvenile absence epilepsy, and juvenile myoclonic epilepsy.

Unknown causes

Patients in whom no specific structural, infectious, or syndromic cause could be identified despite complete workup.

For the qualitative phase, interviews were conducted utilizing a flexible semi-structured interview guide. For the quantitative phase, adult patients or primary caregivers of minors/cognitively impaired individuals were administered a structured questionnaire containing both closed- and open-ended items covering the specific attributes of their healthcare consultations.

2.8. Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki. Authorization to collect data was obtained from the administrative authorities of Polyclinique Pasteur and the Dinandougou Medical Clinic in Markacoungo. All participants provided informed consents. Patients and their parents or guardians were informed that declining participation would in no way affect the quality of care they received. Interviews were conducted in quiet, private settings. Participant anonymity and confidentiality were fully ensured, and no identifying information was collected. The data were used exclusively for scientific purposes. Our protocol received approval from the ethics committee of the Faculty of Medicine, Pharmacy, and OdontoStomatology (FMOS) of Bamako under the number 2024/45/CE/USTTB.

3. Results

3.1. Sociodemographic Characteristics

A total of 87 patients met the eligibility criteria and completed the study protocol. The study population was characterized by a young demographic, with a mean age of 20 ± 14 years, and a slight male predominance (n = 50, 57.5%). The vast majority of participants identified as Muslim (n = 83, 95.4%). Regarding educational background, 40.2% (n = 35) had received no formal schooling, while 17.2% (n = 15) had attended Koranic school exclusively. Geographically, patients were primarily from the capital city of Bamako (41.4%) and the Koulikoro region (34.5%). Detailed sociodemographic data are summarized in Table 1.

Table 1
Sociodemographic characteristics of the study population (N = 87)

Characteristic	
Age (years), mean (SD)	20 (14)
Sex, n (%)	
Male	50 (57.5)
Female	37 (42.5)
Religion, n (%)	
Muslim	83 (95.4%)
Christian	4 (4.6%)
Geographic Origin (Region), n (%)	
Bamako	36 (41.4)
Koulikoro (including Markacoungo)	30 (34.5)
Ségou	6 (6.9)
Sikasso	6 (6.9)
Kayes (including Kita)	5 (5.7)
Mopti	4 (4.6)
Education Level, n (%)	
No formal schooling	35 (40.2)
Koranic school only	15 (17.2)
Primary school	21 (24.1)
Secondary school	9 (10.3)
Higher education	7 (8.0)
Marital Status, n (%)	
Child / Minor	33 (37.9)
Single	27 (31.0)
Married	22 (25.3)
Widowed	3 (3.4)
Divorced	2 (2.3)

SD: Standard Deviation.

3.2. Clinical Features, Diagnostic Workup, and Etiological Classification

All patients underwent at least one standard awake EEG, with the majority (n = 78, 89.7%) receiving more than two serial recordings at different follow-up stages. Regarding neuroimaging, 81.6% (n = 71/87) of patients underwent a head CT scan, and 12 of these subsequently underwent a brain MRI.

Etiological classification revealed that structural causes were the most prevalent (n = 25, 28.7%), predominantly comprising pediatric sequelae of complicated childbirth and head trauma, alongside five cases of vascular epilepsy secondary to sickle cell disease. Infectious etiologies were identified in 26.4% of cases (n = 23), with cerebral malaria sequelae being the primary driver (n = 11, 47.8%), followed by two cases of neurocysticercosis (n = 2, 2.3%). Neurodevelopmental disorders and developmental encephalopathies accounted for 12.6% (n = 11) of the cohort, while idiopathic generalized epilepsies were identified in 8.0% (n = 7). Lastly, the etiology remained unknown in 24.1% of patients (n = 21). Clinical and syndromic distributions are summarized in Table 2.

Table 2
Etiological and syndromic classification of the study population (N = 87)

Etiologies and Syndromes	**n (%)**
Structural causes	**25 (28.7[1])**
Sequelae of childbirth	9 (36.0[2])
Head trauma	7 (28.0[2])
Vascular epilepsy	5 (20.0[2])
Other structural causes	4 (16.0[2])
Infectious causes	**23 (26.4[1])**
Sequelae of cerebral malaria	11 (47.8[2])
Sequelae of meningitis	6 (26.1[2])
Neurocysticercosis	2 (8.7[2])
Other infections	4 (17.4[2])
Neurodevelopmental disorders	**11 (12.6[1])**
Cerebral palsy	5 (45.5[2])
Autism spectrum disorder	4 (36.4[2])
ADHD with or without hyperactivity	2 (18.2[2])
Idiopathic generalized epilepsy	**7 (8.0[1])**
Absence epilepsy	4 (57.1[2])
Myoclonic epilepsy	3 (42.9[2])
Epilepsy of unknown etiology	**21 (24.1[1])**

[1]*Percentage calculated out of the total study population (N = 87);* [2]*Percentage calculated out of the respective major category total.* **ADHD**: *Attention-Deficit/Hyperactivity Disorder;* **EEG**: *Electroencephalography;* **CT**: *Computed Tomography;* **MRI**: *Magnetic Resonance Imaging*

3.3. Perceptions, Beliefs, and Phenotypic Onset

Regarding baseline perceptions and beliefs, the majority of respondents identified epilepsy as an organic disorder of the brain (n = 75, 86.2%) and considered it a curable condition (n = 84, 96.6%), primarily through conventional medical therapy (n = 75, 86.2%). However, 75.9% (n = 66) did not view epilepsy as an ordinary illness, with 81.8% of these sub-respondents classifying it as significantly more severe than other diseases (Table 3).

Table 3
Participants' perceptions and beliefs regarding epilepsy (N = 87)

Primary Information Respondent	**n (%)**
Parent / Caregiver	50 (57.5)
Patient	37 (42.5)
What do you think is the cause of epilepsy?	
Disorder of the brain	75 (86.2)
Natural disorder	7 (8.0)
Witchcraft / Supernatural causes	5 (5.7)
Do you consider epilepsy an illness like any other?	
No	**66 (75.9)**
It is a more serious disease	54 (81.8[1])
It is a less serious disease	12 (18.2[1])
Yes	**21 (24.1)**
Do you believe epilepsy is a curable disease?	
Yes	84 (96.6)
No (Treatment only calms the disease)	2 (2.3)
No opinion	1 (1.1)
What do you consider the most appropriate treatment?	
Medical (Conventional) treatment	75 (86.2)
Mixed approach (Medical & Traditional)	10 (11.5)
Traditional medicine only	2 (2.3)

[1]*Percentage calculated out of the sub-total of participants who answered "No" (n = 66).*

Analysis of clinical onset revealed that the first seizure occurred predominantly during the second decade of life (10–19 years: 35.6%), with 77.0% of the cohort experiencing their inaugural event before the age of 30. In terms of clinical presentation, generalized tonic-clonic seizures represented the most prevalent phenotype, accounting for 65.5% (n = 57) of cases (Table 4).

Table 4
Clinical characteristics of and age distribution at first seizure (N = 87)

Age at first seizure (years)	**n (%)**
1–9	19 (21.8)
10–19	31 (35.6)
20–29	17 (19.5)
30–39	11 (12.6)
40–49	4 (4.6)
50–60	3 (3.4)
> 60	2 (2.3)
Semiology of the first seizure	
Tonic-clonic	57 (65.5)
Clonic	8 (9.2)
Tonic	7 (8.0)
Absence	3 (3.4)
Other (Focal / Unclassified)	**12 (13.8)**

3.4. Healthcare-Seeking Dynamics and Care Pathways

Healthcare utilization dynamics shifted significantly between the primary and secondary consultation phases (Table 5). Most patients (93.1%) sought healthcare immediately following their inaugural seizure. Beyond this initial contact, 71.3% (n = 62/87) pursued a secondary consultation.

For the primary healthcare-seeking event, a near-even split was observed between those who initially consulted a conventional physician (48.3%) and those who sought a traditional practitioner (49.4%). Conversely, a definitive therapeutic shift occurred during the secondary phase, with 100% (n = 62/62) of seeking patients transitioning to conventional medical practitioners. Word-of-mouth and provider reputation emerged as the primary drivers for healthcare provider selection during both the first (62.1%) and second (80.6%) consultations.

Prognostic counseling and therapeutic interventions also diverged sharply between provider types. Primary consultants overwhelmingly assured patients that the condition was readily curable (70.1%), proposing herbal remedies in 48.3% of cases. Conversely, secondary consultants (physicians)

overwhelmingly characterized management as a prolonged, slow process (98.4%), relying exclusively on conventional pharmacology (100.0%).

Furthermore, the transition to specialized medical care was associated with a substantial increase in perceived financial burden. The proportion of participants classifying their treatment as inexpensive dropped from 47.1% at the first consultation to just 3.2% at the second. Concurrently, the perception of medical care as reasonable or very expensive rose markedly, reaching 59.7% and 37.1%, respectively.

Table 5
Comparative dynamics of the first (N = 87) and second (N = 62) therapeutic consultations

Characteristics of consultations	First consultation (N = 87) n (%)	Second consultation (N = 62) n (%)
Sought care after the inaugural seizure		
Yes	81 (93.1)	—
Sought care immediately	81 (100.0)[1]	—
No	6 (6.9)	—
Reason: Considered not serious	6 (100.0)[2]	—
Sought a subsequent (second) consultation		
Yes	62 (71.3)	—
No	25 (28.7)	—
Type of Healthcare Provider Consulted		
Traditional practitioner / Healer	43 (49.4)	0 (0.0)
Medical Doctor / Physician	42 (48.3)	62 (100.0)
Pastor / Religious leader	2 (2.3)	0 (0.0)
Primary Reason for Choosing this Provider		
Recommended by word of mouth ("told about them")	54 (62.1)	50 (80.6)
Personal trust / Confidence	22 (25.3)	8 (12.9)
Known by reputation	6 (6.9)	4 (6.5)
Did not know who else to consult	5 (5.7)	0 (0.0)
Geographical Location of Consultation		
Village / Rural area	56 (64.4)	38 (61.3)
City / Urban area	31 (35.6)	23 (37.1)
Other region	0 (0.0)	1 (1.6)
Provider's Explanation: Perceived Severity		
Severe	53 (60.9)	3 (4.8)

Characteristics of consultations	First consultation (N = 87) n (%)	Second consultation (N = 62) n (%)
Sought care after the inaugural seizure		
Very severe	12 (13.8)	0 (0.0)
No explanation given ("Nothing")	22 (25.3)	59 (95.2)
Provider's Explanation: Contagion Risk		
Not contagious	38 (43.7)	62 (100.0)
Contagious (via saliva)	1 (1.1)	0 (0.0)
No explanation given ("Nothing")	48 (55.2)	0 (0.0)
Provider's Explanation: Curability Timeline		
Curable	61 (70.1)	0 (0.0)
Slow/Prolonged process to cure	26 (29.9)	61 (98.4)
Rapidly curable	0 (0.0)	1 (1.6)
Proposed Therapeutic Interventions		
Herbal remedies / Plants	42 (48.3)	0 (0.0)
Conventional anti-seizure medications	42 (48.3)	62 (100.0)
Prayers / Spiritual rituals	3 (3.4)	0 (0.0)
Timing of Treatment Administration		
Interictally (Outside of seizures)	85 (97.7)	62 (100.0)
Ictally (Only during seizures)	2 (2.3)	0 (0.0)
Pre-consultation Expectations regarding the Provider		
Expected a complete cure	25 (28.7)	14 (22.6)
Expected some help/relief	1 (1.1)	2 (3.2)
Expected little to no efficacy	4 (4.6)	0 (0.0)
No initial opinion	57 (65.5)	46 (74.2)
Pre-consultation Beliefs regarding the Cure Medium		

Characteristics of consultations	First consultation (N = 87) n (%)	Second consultation (N = 62) n (%)
Sought care after the inaugural seizure		
Believed medications would cure	16 (18.4)	9 (14.5)
Believed plants would cure	7 (8.0)	2 (3.2)
No initial opinion	61 (70.1)	51 (82.3)
Post-consultation Perception of Financial Means Needed		
Reasonable / Affordable	26 (29.9)	37 (59.7)
Very expensive / Prohibitive	16 (18.4)	23 (37.1)
Inexpensive / Cheap	41 (47.1)	2 (3.2)
No opinion	4 (4.6)	0 (0.0)

[1]Percentage calculated out of the sub-total of patients who sought care (n = 81); [2]Percentage calculated out of the sub-total of patients who did not seek care (n = 6).

3.5. Determinants of Initial Healthcare Utilization

To isolate the independent predictors of initial healthcare-seeking choices, univariable and multivariable logistic regression analyses were performed (Table 6). In the final multivariable model, male sex remained a robust predictor of choosing a physician as the first line of care (Adjusted Odds Ratio [AOR] = 3.89; 95% CI 1.15–13.17, p = 0.03). Educational attainment emerged as a powerful determinant; compared to individuals with no formal schooling, those with primary education (AOR = 4.84; 95% CI 1.19–19.62, p = 0.03) and higher education (AOR = 33.47; 95% CI 2.00–561.00, p = 0.02) demonstrated significantly higher odds of initial physician utilization.

Conversely, geographical location significantly hindered formal healthcare access. Living in the Koulikoro (AOR = 0.13; 95% CI 0.04–0.47, p = 0.002) or Sikasso (AOR = 0.07; 95% CI 0.01–0.86, p = 0.04) regions was independently associated with a drastically lower likelihood of primary physician consultation compared to residing in the capital, Bamako.

Table 6
Logistic regression analysis of factors associated with physician utilization for initial consultation after the first seizure

Age (per continuous year)	**Univariable Analysis**	**p-value**	**Multivariable Analysis**	**p-value**
	OR (95% CI)		**OR (95% CI)**	
	1.01 (0.98 – 1.04)*	**0.69**	**—**	**—**
Sex				
Female	Ref.	—	Ref.	—
Male	2.55 (1.06–6.13)	**0.04**	3.89 (1.15–13.17)	**0.03**
Religion				
Christian	Ref.	—	—	—
Muslim	0.30 (0.03–2.96)	0.30	—	—
Geographic Region				
Bamako	Ref.	—	Ref.	—
Koulikoro	0.15 (0.05–0.45)	**0.001**	0.13 (0.04–0.47)	**0.002**
Sikasso	0.09 (0.01–0.84)	**0.04**	0.07 (0.01–0.86)	**0.04**
Kayes	0.22 (0.02–2.69)	0.24	0.08 (0.00–1.68)	0.11
Ségou	2.20 (0.23–21.10)	0.49	2.95 (0.25–34.52)	0.39
Markacoungo	0.44 (0.03–7.70)	0.57	2.18 (0.11–44.85)	0.61
Mopti	0.44 (0.05–3.54)	0.44	0.21 (0.02–2.35)	0.21
Kita	N/A	—	—	—
Education Level				
No formal schooling	Ref.	—	Ref.	—
Primary school	4.06 (1.29–12.78)	**0.02**	4.84 (1.19–19.62)	**0.03**
Higher education	15.00 (1.60–140.96)	**0.02**	33.47 (2.00–561.00)	**0.02**
Koranic school only	2.86 (0.82–10.00)	0.10	3.02 (0.61–14.99)	0.18
Secondary school	3.13 (0.59–14.08)	0.14	1.70 (0.27–10.60)	0.57
Marital Status				
Single	Ref.	—	—	—

Age (per continuous year)	**Univariable Analysis**	**p-value**	**Multivariable Analysis**	**p-value**
	OR (95% CI)		**OR (95% CI)**	
	1.01 (0.98 – 1.04)*	**0.69**	**—**	**—**
Divorced / Child / Married / Widow	0.87 to 2.50	> 0.40	—	—
Perceived Cause of Epilepsy				
Disorder of the brain	Ref.	—	—	—
Natural disorder	6.86 (0.79–59.76)	0.08	—	—
Witchcraft	0.29 (0.03–2.68)	0.27	—	—
Is epilepsy an illness like any other?				
No	Ref.	—	—	—
Yes	0.58 (0.21–1.58)	0.29	—	—
Is epilepsy curable?				
No	Ref.	—	—	—
Yes	0.95 (0.06–15.80)	0.97	—	—
Appropriate Treatment Type Belief				
Medical (Conventional)	Ref.	—	—	—
Mixed approach	4.82 (0.96–24.20)	0.06	—	—
Traditional	N/A	—	—	—

*OR: Odds Ratio; CI: Confidence Interval; Ref.: Reference category; N/A: Not Applicable due to zero cell count. Bold values indicate statistically significant results (p < 0.05). Variables with (—) in the multivariable column were excluded during step-wise model selection due to lack of significance in univariable screening (p > 0.05). *Age coefficient converted to OR for presentation homogeneity.*

Over the preceding six months, patients reported an average of 1.9 ± 0.6 total consultations. Notably, among the sub-cohort that pursued a secondary consultation, 96.8% (n = 60/62) perceived the medical consultation as substantially more effective and helpful than their primary encounter. From a pharmacological standpoint, Carbamazepine was the most frequently prescribed anti-seizure medication (50.6%, n = 44/87). Reassuringly, clinical follow-up indicated that 85.1% (n = 74/87) of the patients achieved complete seizure freedom under conventional therapy

4. Discussion

4.1. Methodological and Anthropological Frameworks

Epilepsy research in sub-Saharan Africa (SSA) has historically focused on broad epidemiological surveys and cross-sectional stigma assessments, often to the detriment of acute behavioral and therapeutic considerations [14, 25]. To our knowledge, this study is among the few in West Africa to rigorously analyze the precise socio-geographic and clinical determinants of healthcare-seeking behavior immediately following an inaugural epileptic seizure.

In SSA, the epilepsy treatment gap remains critically high, with approximately 80% of people with epilepsy (PWE) lacking access to appropriate biomedical care [2, 3, 26]. This profound gap is sustained by a pluralistic medical landscape where conventional medicine (CM) and traditional medicine (TM) operate in parallel [17]. While TM is widely recognized as a primary resource, granular data explaining why families select one pathway over another during the critical window of a first seizure have been scarce. By leveraging a well-documented cohort with verified clinical and electrophysiological diagnoses, our study minimizes recall and misclassification biases—a common limitation in resource-limited settings where systematic medical records and vetted neurological diagnoses are frequently unavailable [28].

Human health-seeking behavior in complex cultural arenas is inherently difficult to capture through single-modality designs. Consistent with contemporary behavioral research guidelines, we employed a sequential exploratory mixed-methods framework [19, 20]. This approach allowed qualitative narratives of lived experiences to actively shape and ground our quantitative tools, ensuring cultural relevance and capturing nuances that standardized Western instruments often miss [29–31].

From both anthropological and medical perspectives, illness explanatory models in SSA diverge fundamentally from Western ontological frameworks. In many Malian communities, an inaugural seizure is not viewed merely as an isolated organic event, but rather as a disruption involving supernatural or spiritual forces [7, 17]. Consequently, therapeutic interventions are traditionally bidirectional: plant-based remedies are deployed to address physical symptoms, while rituals or prayers seek to restore cosmological balance, often leading families to deprioritize or disqualify conventional medical consultation [17]. This cultural reality stands in sharp contrast to high-income settings, where recent technological advances—such as digital tools, smartphone videos, early electroencephalography, and artificial intelligence—accelerate diagnostic accuracy and treatment initiation [33, 34]. In rural Africa, technological barriers compound cultural distances, leaving a vast majority of PWE vulnerable to prolonged untreated seizures before entering the formal healthcare pyramid [32, 35]. [1]

4.2. Clinical and Etiological Profiles: Preventable Burden and Local Particularities

The young demographic profile of our cohort (77.0% experiencing onset before age 30) and the slight male preponderance align with broad sub-Saharan African epidemiological trends [53]. This gender distribution may reflect healthcare-seeking disparities or localized underreporting of seizures in females due to heightened marital and social stigmatization [36].

Consistent with literature from low- and middle-income countries, structural etiologies represented the leading cause of epilepsy in our study (28.7%), driven predominantly by preventable perinatal insults and complicated childbirth sequelae [37]. In rural Mali, structural barriers, massive distances to emergency obstetric care, and deeply rooted cultural preferences frequently result in unassisted home deliveries [38]. The resulting neonatal distress, hypoxia, and hypoglycemia manifest as irreversible structural brain damage, highlighting that a substantial portion of pediatric epilepsy in West Africa could be eradicated through improved prenatal and perinatal care [39–41].

A distinct and highly relevant finding in our cohort was the identification of vascular epilepsy secondary to sickle cell disease (SCD) [42]. As the most prevalent monogenic disorder in SSA, SCD-related cerebrovascular accidents are known to multiply epilepsy risk by two- to three-fold [43, 44]. In regions like Mali, where endogamous and consanguineous marriages remain culturally prevalent, integrating neurological screening and anti-seizure awareness into comprehensive SCD control programs is a public health imperative.

Infectious etiologies remained highly prevalent (26.4%), with cerebral malaria sequelae constituting the primary infectious driver, validating recent case-control data from Mali [45, 46, 52]. Febrile seizures associated with cerebral malaria are severe and recurrent among African children and have been implicated as a cause of epilepsy in up to 71% of cases in regional studies [47–49]. Crucially, our study revealed an unusually low prevalence of neurocysticercosis (2.3%), a parasite traditionally cited as a leading cause of adult-onset epilepsy across much of SSA [50]. This epidemiological divergence is directly explained by local socio-religious and dietary patterns; over 95% of our study population practiced Islam, a cultural context where pork consumption is strictly prohibited, thus naturally breaking the *Taenia solium* transmission cycle [51].

4.3. The First-Seizure Care Dilemma: Pluralistic Equilibrium and Predictors

Regarding acute healthcare utilization, our data unveiled a critical near-even split immediately following the inaugural seizure: 48.3% of families sought conventional physicians, while 49.4% resorted to traditional healers. This striking 1:1 equilibrium demonstrates that even in modernizing urban-rural networks, the very first seizure constitutes a major crossroads where western biomedicine and ancestral healing traditions compete with equal weight.

Our multivariable regression analysis unveiled three structural forces that rigidly dictate this initial therapeutic itinerary: educational attainment, geographical location, and gender. Educational level emerged as the most powerful individual predictor of biomedical care utilization. Patients with higher

education demonstrated a striking 33-fold increase in the odds of initial physician consultation compared to those with no formal schooling. Formal education acts as a critical cognitive shield, enabling individuals and caregivers to dismantle deeply embedded supernatural etiologies and recognize a seizure as an organic neurological emergency requiring prompt specialized intervention [56–58].

Conversely, geographical placement severely constcripts this choice. Residing in the peripheral regions of Koulikoro or Sikasso drastically reduced the likelihood of accessing a physician first, validating East African data where distance from urban health centers directly reinforces reliance on traditional medicine [59]. In rural SSA, TM's dominance is less of a cultural preference and more of a logistical necessity born from a stark maldistribution of medical infrastructure.

The independent association between male sex and primary physician utilization (AOR = 3.89) highlights a critical intersection of socioeconomic vulnerability and gender dynamics. Faced with prohibitive medical costs in a pluralistic health system lacking universal insurance coverage [64], resource-constrained households frequently prioritize financial investments toward the healthcare of boys and men. Furthermore, this finding is deeply entangled with the deliberate underreporting of epilepsy in young women. In many West African communities, concealing an inaugural seizure in adolescent girls is a protective familial strategy to avoid severe social stigmatization and safeguard future marital prospects, which unfortunately delays crucial biomedical care [55].

The photograph shows a traditional amulet ("gris-gris") and medicinal substances on the scalp of a 27-year-old patient. This illustrates the therapeutic duality and sequential healthcare-seeking pathways (traditional medicine as first-line) frequently observed in the Malian epilepsy cohort.

4.4. Reversing the Treatment Gap: From Competition to Collaboration

Despite the deep-seated position of TM, a historical comparison suggests a promising, gradual shift toward conventional medicine (CM) in Mali. While a decade ago 63% of families sought traditional healers first [8], our cohort demonstrates a nearly equal split. In neighboring countries like Guinea, up to 79% of patients still consult a traditional healer first [16, 17], indicating that while community awareness is rising in Mali, the window immediately following an inaugural seizure remains highly vulnerable to therapeutic delays [60, 61].

To definitively bridge the West African epilepsy treatment gap, two parallel, evidence-based strategies must be deployed:

1. *Decentralization and Task-Shifting*: The extreme shortage of neurologists in SSA, where many countries have few or no trained specialists [63, 64], necessitates shifting primary neurological care to the frontline. Building on our team's validated model in Mali, training community health workers (CHWs) and non-physician frontline providers through concise, structured clinical guidelines

represents a highly scalable and cost-effective approach to ensure accurate early diagnosis and uninterrupted access to basic anti-seizure medications in rural areas [66].

2. *Formalizing Ethno-Biomedical Collaboration*: Rather than attempting to eradicate traditional healing, modern healthcare programs should leverage the high community trust enjoyed by traditional practitioners [67, 68]. Mirroring successful regional models in sub-Saharan Africa for tuberculosis and HIV management, selected traditional healers should be trained as strategic allies to act as detection and triage agents, ensuring immediate referral to conventional medical facilities following a patient's very first seizure [69, 70].

4.5. Strengths and Limitations

This study possesses several limitations that warrant consideration. First, its retrospective nature relies on patient and caregiver recall, introducing potential recall bias or narrative modification. In behavioral research, the Hawthorne effect—where participants alter responses due to the awareness of being studied—cannot be entirely ruled out. To mitigate this, our mixed-methods approach prioritized understanding the underlying logic and determinants of choices rather than evaluating the clinical 'correctness' of patient decisions.

Second, the relatively small sample size (N = 87) and selection bias—inherent to a cohort recruited from two specialized facilities—may limit statistical power and the generalizability of the findings to patients who remain entirely outside the conventional healthcare pyramid. Furthermore, the broader influence of extended family dynamics, specific ethnic customs, and socioeconomic status was not exhaustively modeled, requiring future large-scale multicenter studies. Lastly, the lack of standardized, validated questionnaires for such culturally specific environments was a challenge. However, this was effectively offset by developing a context-grounded instrument derived directly from our preliminary qualitative phase, significantly enhancing the socio-cultural validity and overall robustness of the data.

4.6. Conclusion

The timely diagnosis and management of epilepsy remain formidable public health challenges in Mali and across sub-Saharan Africa. This study demonstrates that traditional medicine remains a powerful primary resort immediately following an inaugural seizure, heavily driven by geographical barriers, specialized workforce shortages, and the prohibitive cost of conventional therapy. Reversing these delays requires decisive policy interventions. Implementing and scaling the Universal Health Insurance Plan (*Régime d'Assurance Maladie Universelle* — RAMU) is vital to alleviate the catastrophic financial burden of long-term anti-seizure medications for vulnerable families. Furthermore, policymakers must prioritize decentralizing care through validated task-shifting models with community health workers, formalizing collaborative triage networks with traditional healers, and deploying targeted educational campaigns. Aligning clinical pathways with local socio-economic and cultural realities is a mandatory prerequisite to reducing the epilepsy treatment gap and alleviating the burden of this disabling neurological condition in sub-Saharan Africa.

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and formally approved by the Institutional Review Board / Ethics Committee of the Faculty of Medicine, Odonto-Stomatology, and Pharmacy (FMPOS) of Bamako, Mali. All methods were executed in strict accordance with the ethical standards of the institutional research committee and with the 1964 Declaration of Helsinki and its subsequent amendments. Written or verbally informed consent was obtained from all adult participants prior to enrollment. For minors (participants aged under 18 years) or individuals with limited cognitive capacity, informed consent was systematically obtained from their parents, legal guardians, or primary caregivers.

Consent for publication

Not applicable. This manuscript does not contain any individual person's datasets, identifiable images, or clinical photographs.

Competing interests

The authors declare that they have no competing or conflicting interests (financial or non-financial) related to the research, authorship, or publication of this manuscript.

Clinical trial number

Not applicable.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and the accompanying image (Fig. 1). Although the patient's face is not visible, she was informed that complete anonymity cannot be guaranteed. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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Author Contribution

Conceptualization (Youssoufa MAIGA, Leon Samuel Moskatel; Seybou Hassane Diallo, Abou Sogodogo ; Data curation (Youssoufa MAIGA ; Cheick Oumar Tounkara, Salimata Diallo, Awa Coulibaly , Mariam Daou, Bakary Danthioko, Moussa Doumbia, Ibrahim Nimaga, Adama Sissoko, Souleymane dit Papa Coulibaly , Mohamed Albakaye, Zoumana Traoré, Aba Cissé) ; Formal analysis (Youssoufa MAIGA Leon Samuel Moskatel ; Seybou Hassane Diallo, Abou Sogodogo, Abdoulaye Yalcoué, Robert Cowan); Methodology (Youssoufa MAIGA, Leon Samuel Moskatel; Abou Sogodogo) ; Supervision (Youssoufa MAIGA, Leon Samuel Moskatel; Seybou Hassane Diallo; Julien Nizard; Robert Cowan) ; Validation (Youssoufa MAIGA, Leon Samuel Moskatel ; Robert Cowan ; Writing – original draft (Youssoufa MAIGA, Leon Samuel Moskatel ; Seybou Hassane Diallo, Abou Sogodogo, Abdoulaye Yalcoué, Cheick Oumar Tounkara) ; Writing – review and editing (Andreas Kattem Husøy, Leon Samuel Moskatel, Robert Cowan)

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Availability of data and materials

The quantitative and qualitative datasets generated and analyzed during the current study are not publicly available due to institutional regulations regarding patient confidentiality and privacy protections in Mali. However, the fully anonymized data is available from the corresponding author (Pr. Youssoufa MAIGA) upon reasonable academic request.

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Figures

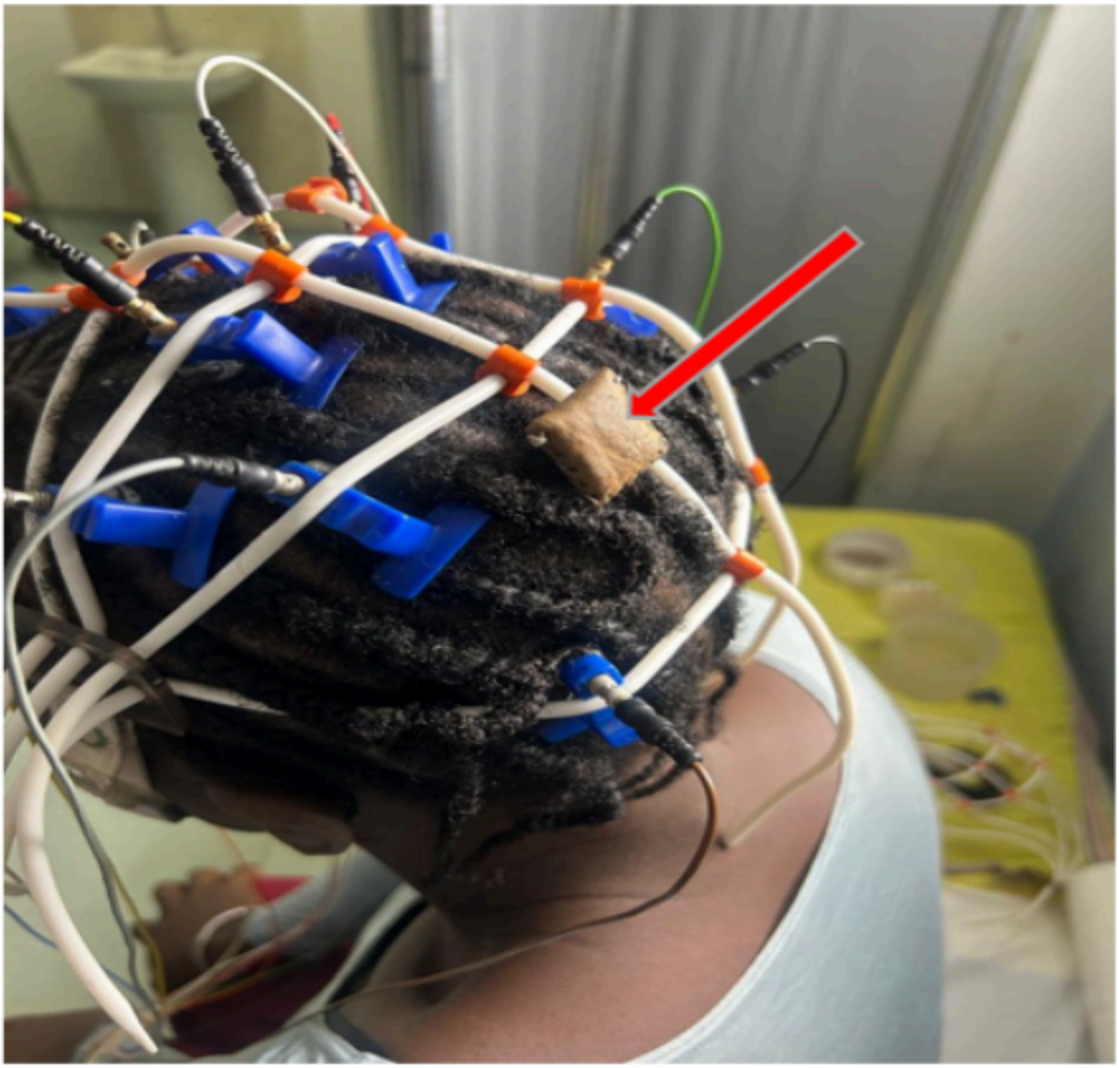


Figure 1

Clinical evidence of medical pluralism during an EEG recording.
The photograph shows a traditional amulet ("gris-gris") and medicinal substances on the scalp of a 27-year-

old patient. This illustrates the therapeutic duality and sequential healthcare-seeking pathways (traditional medicine as first-line) frequently observed in the Malian epilepsy cohort.

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