Prevalence and Factors Associated with Epilepsy in the Gbeke Health Region of Cote d'Ivoire: A Community-Based Cross-Sectional Study

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Abstract

Background

Epilepsy is a major neurological disorder affecting more than 50 million people worldwide, with nearly 80% of the disease burden occurring in low- and middle-income countries. Despite this substantial burden, population-based data on epilepsy prevalence in Cote d'Ivoire remain scarce, limiting evidence-based planning and implementation of effective control strategies. In response, Medecins Sans Frontieres West and Central Africa (MSF-WaCA) initiated an epilepsy and mental health programme in the Gbeke region in 2021. This study was conducted to estimate the prevalence of epilepsy in the general population and to identify sociodemographic factors associated with epilepsy in this setting.

Methods

We conducted a cross-sectional, community-based household survey between 29 April and 31 May 2025 in three districts of the Gbeke region (Beoumi, Botro, and Sakassou), located in central Cote d'Ivoire. A two-stage cluster sampling design was used to recruit 2,586 participants aged 12 years and older, with villages selected by probability proportional to size as first-stage clusters and households selected within villages. This age restriction was applied because the screening questionnaire was validated for adolescents and adults; younger children would have required specialized pediatric neurological evaluation beyond the operational scope of the survey. Community health workers administered a validated epilepsy screening questionnaire to all eligible individuals. Screen-positive participants were subsequently evaluated by neurologists for diagnostic confirmation using clinical assessment and supportive diagnostic investigations when indicated. Epilepsy prevalence and 95% confidence intervals (CI) were estimated using survey methods that account for the two-stage cluster design, and survey-adjusted analyses were used to identify factors associated with epilepsy.

Results

Among 2,586 participants (61.7% female; 70.3% rural), 59 individuals were confirmed to have epilepsy, corresponding to a survey-adjusted prevalence of 22.8 per 1,000 population (95% CI: 15.3–30.3; design effect 1.71). Prevalence varied across districts, with the highest rate observed in Botro (33.2 per 1,000), followed by Sakassou (23.8 per 1,000) and Beoumi (11.9 per 1,000). In survey-adjusted multivariable analysis, epilepsy was associated with residence in Botro district (adjusted odds ratio [aOR] 2.84; 95% CI: 1.12–7.22), single marital status (aOR 5.01; 95% CI: 2.54–9.85), economic inactivity (aOR 3.36; 95% CI: 1.23–9.17), and home-based work (aOR 2.35; 95% CI: 1.13–4.87). Overall, 59.3% of people living with epilepsy were not receiving antiepileptic treatment, indicating a substantial treatment gap.

Conclusion

Epilepsy prevalence in the Gbeke region is substantially higher than global estimates and shows marked geographic variation across districts. The large treatment gap highlights persistent barriers to diagnosis, access to antiepileptic therapy, and continuity of care. These findings underscore the need to strengthen epilepsy services through integration into primary healthcare, targeted interventions in high-prevalence districts, and community-based strategies to improve early detection and sustained treatment in Cote d'Ivoire.

INTRODUCTION

Epilepsy is one of the most common chronic neurological disorders of the central nervous system and affects individuals across all age groups and socioeconomic settings. It is characterized by recurrent, unprovoked seizures resulting from abnormal, excessive, or synchronous neuronal activity in the brain, leading to transient disturbances in motor, sensory, autonomic, or cognitive functions depending on the region affected [1], [2]. Globally, more than 50 million people are estimated to be living with epilepsy, making it one of the most prevalent neurological conditions worldwide, with approximately 5 million new cases diagnosed annually [3]. The global prevalence is commonly estimated at around 10 per 1,000 population; however, multiple community-based surveys conducted in low- and middle-income countries (LMICs) have consistently demonstrated much higher rates, often two to three times greater than estimates from high-income settings [4], [5], [6]. In sub-Saharan Africa, where exposure to perinatal insults, central nervous system infections, trauma, and inadequate access to neurological care is widespread, median prevalence estimates reach 14.2 per 1,000 population, with some rural studies reporting figures exceeding 20 per 1,000 [7].

Despite this substantial burden, diagnosis and treatment of epilepsy remain suboptimal, particularly in resource-limited settings. The World Health Organization (WHO) estimates that up to 70% of people with epilepsy could live seizure-free with timely and appropriate treatment, yet the treatment gap, defined as the proportion of individuals who require but do not receive adequate antiepileptic therapy, exceeds 70% in many African countries [3], [8]. Contributing factors include pervasive stigma, cultural beliefs attributing seizures to spiritual or supernatural causes, scarcity of trained neurologists, high cost or inconsistent availability of antiepileptic medications, and limited integration of epilepsy management into primary healthcare systems [9], [10], [11]. These barriers not only delay diagnosis but often lead to chronic morbidity, psychosocial exclusion, and increased mortality.

In Cote d'Ivoire, epidemiological data on epilepsy remain extremely limited. No population-based prevalence study has been published to date, and most available information comes from small clinical or hospital-based investigations, including a single study that estimated a prevalence of 8 per 1,000 among hospital attendees [12]. Such facility-based estimates likely underestimate the true burden, as they overlook individuals who never seek formal healthcare due to distance, cost, or sociocultural perceptions of epilepsy. This absence of robust, population-level data hampers the development of national policies, resource allocation, and the design of effective community-based interventions.

Recognizing this gap, Medecins Sans Frontieres, West and Central Africa (MSF-WaCA) launched an integrated mental health and epilepsy programme in 2021 within the Gbeke health region, located in central Cote d'Ivoire. The programme aims to strengthen early detection, diagnosis, and management of epilepsy within primary care settings while addressing structural, social, and cultural barriers to care. To inform these efforts and ensure that interventions are evidence-based and contextually appropriate, it was essential to generate reliable epidemiological data on the burden of epilepsy in the area. The present study was therefore undertaken to estimate the prevalence of epilepsy and identify its associated factors among individuals aged 12 years and older living in MSF-WaCA intervention zones of the Gbeke region.

METHODS

Study design and setting

We conducted a cross-sectional, community-based household survey in three districts of the Gbeke region (Botro, Beoumi, and Sakassou), located in central Cote d'Ivoire. The Gbeke region has a total estimated population of approximately 1,328,000 inhabitants according to the 2021 national census [23] and is characterized by limited availability of specialized neurological services, particularly in rural areas.

Study population

All individuals aged 12 years and older who had resided in the selected households for at least one month prior to the survey were eligible to participate. The lower age limit of 12 years was selected because the screening questionnaire (IENT) had been validated primarily for adolescents and adults, and reliable seizure history reporting in younger children would have required pediatric neurological assessment beyond the operational scope of this survey. Younger children were therefore not included; this restriction is acknowledged as a limitation. Individuals who were unable to respond to the questionnaire and for whom no proxy respondent was available were excluded from the study.

Sampling strategy

A two-stage cluster sampling design was employed to obtain a representative sample of the population across the three study districts.

In the first stage, 30 villages (clusters) were selected using probability proportional to size (PPS), based on population figures from the most recent national census. In the second stage, within each selected village, 30 random geographic points were generated using Google Earth, a geospatial tool that uniformly distributes points within predefined village boundaries. Field teams uploaded the GPS coordinates into OsmAnd, a mobile navigation application, to locate each point in the field.

The nearest inhabited household to each geographic point was identified and approached for inclusion. When a concession contained more than one household, a single household was randomly selected using a simple lottery method to minimize selection bias. All eligible individuals aged 12 years and older within the selected household were invited to participate in the study (Fig. 1).

Sample size

The minimum required sample size was estimated at 2,766 individuals (approximately 960 households), assuming an epilepsy prevalence of 0.8%, a precision of 0.6%, a design effect of 3, and a nonresponse rate of 10%. A total of 2,586 participants were successfully enrolled and included in the final analysis.

Data collection

Data collection was conducted between 29 April and 31 May 2025 and was implemented in three sequential phases across the study districts. A structured digital questionnaire was administered using KoboCollect. The questionnaire collected information on household characteristics, sociodemographic variables, and epilepsy screening using a validated screening instrument, the IENT questionnaire [13]. The study is reported in accordance with the STROBE guidance for cross-sectional studies.

Clinical assessment

Participants who screened positive for epilepsy during the household survey underwent a clinical evaluation conducted by two trained neurologists to confirm the diagnosis. A specific informed consent form was obtained from all participants prior to clinical assessment. Epilepsy diagnosis was established according to the International League Against Epilepsy (ILAE) criteria, defined as a history of at least two unprovoked seizures occurring more than 24 hours apart, or one unprovoked seizure with a high probability of recurrence [1]. The clinical assessment included a detailed medical history, seizure characterization and classification according to ILAE guidelines. Diagnosis was primarily clinical, based on detailed seizure history and neurological examination; supportive diagnostic investigations (including blood tests, malaria testing, and, when clinically indicated, further paraclinical workup such as electroencephalography) were performed to support differential diagnosis or etiological assessment, not as a prerequisite for all diagnoses.

Ethical considerations

The study protocol was reviewed and approved by the Comite National d'Ethique des Sciences de la Vie et de la Sante de Cote d'Ivoire, as well as by the MSF Ethics Review Board, prior to any data collection activity. Written informed consent was obtained from all adult participants. For participants aged 12–17 years, written assents were obtained in addition to parental or legal guardian consent. Participation was

voluntary and withdrawal at any time was permitted without consequence. All collected data were treated as strictly confidential.

Data analysis

Data were analyzed using R software (version 4.5.0; R Foundation for Statistical Computing) with the survey package for design-based estimation. Descriptive statistics were used to summarize participant sociodemographic and household characteristics. Continuous variables were presented as medians with interquartile ranges (IQR), while categorical variables were summarized using frequencies and percentages.

To account for the two-stage cluster sampling design, all prevalence estimates, confidence intervals, standard errors, and regression results were computed using survey-analysis methods (Taylor-series linearization), with villages specified as the primary sampling units (30 clusters). The prevalence of epilepsy was calculated as the number of neurologist-confirmed epilepsy cases divided by the total number of participants screened and expressed per 1,000 population, with design-based 95% confidence intervals (95% CI). Because the first-stage selection used probability proportional to size followed by an approximately fixed second-stage allocation, the design was treated as approximately self-weighting. The design effect was estimated to quantify the impact of clustering on variance. Because case ascertainment applied the ILAE definition without restricting to recent seizure activity, these estimates reflect epilepsy diagnosed at the time of the survey rather than active epilepsy defined by a recent seizure. Prevalence was further stratified by sex, age group, district, educational level, and occupation to explore variations across subgroups.

Bivariate associations between epilepsy status and sociodemographic characteristics were assessed using the survey-adjusted Rao-Scott chi-square test. Survey-weighted logistic regression was performed to estimate crude odds ratios (from separate univariable models) and adjusted odds ratios (from a single multivariable model including sex, age group, district, residence, marital status, education level, and occupation), with variance estimation accounting for the cluster design. A p-value < 0.05 was considered statistically significant.

RESULTS

Participant characteristics

A total of 2,586 individuals aged 12 years and older were included in the survey. Of these, 457 (17.7%) were adolescents aged 12–17 years and 2,129 (82.3%) were adults aged 18 years and older (Table 1). Females accounted for 61.7% of the study population. Participants were predominantly from Sakassou district (51.9%), followed by Beoumi (26.0%) and Botro (22.1%). Overall, 70.3% of participants resided in rural areas. Among adults, 53.0% were married or cohabiting, and 51.0% had no formal education or

were only literate. As expected for this age group, adolescents were predominantly students (81.4%) and almost all were single (99.6%).

Table 1
Participant characteristics by age group, Gbeke health region, Cote d'Ivoire, 2025

Characteristic	12–17 years	18 + years	Total
Total N	**457**	**2,129**	**2,586**
Sex			
Female	259 (56.7%)	1,337 (62.8%)	1,596 (61.7%)
Male	198 (43.3%)	792 (37.2%)	990 (38.3%)
District			
Beoumi	122 (26.7%)	550 (25.8%)	672 (26.0%)
Botro	83 (18.2%)	489 (23.0%)	572 (22.1%)
Sakassou	252 (55.1%)	1,090 (51.2%)	1,342 (51.9%)
Residence			
Rural	277 (60.6%)	1,540 (72.3%)	1,817 (70.3%)
Urban	180 (39.4%)	589 (27.7%)	769 (29.7%)
Marital status			
Single	455 (99.6%)	688 (32.3%)	1,143 (44.2%)
Married/Cohabiting	2 (0.4%)	1,129 (53.0%)	1,131 (43.7%)
Divorced/Separated	0 (0.0%)	48 (2.3%)	48 (1.9%)
Widowed	0 (0.0%)	264 (12.4%)	264 (10.2%)
Education level			
None/Literate	30 (6.6%)	1,085 (51.0%)	1,115 (43.1%)
Primary	209 (45.7%)	545 (25.6%)	754 (29.2%)
Secondary	217 (47.5%)	446 (20.9%)	663 (25.6%)
Higher	1 (0.2%)	53 (2.5%)	54 (2.1%)
Occupation			
Farmer/Livestock	18 (3.9%)	1,108 (52.0%)	1,126 (43.5%)
Artisan/Trader	4 (0.9%)	350 (16.4%)	354 (13.7%)
Student	372 (81.4%)	139 (6.5%)	511 (19.8%)
Inactive	50 (10.9%)	278 (13.1%)	328 (12.7%)

Characteristic	12–17 years	18 + years	Total
Total N	**457**	**2,129**	**2,586**
Sex			
Salaried/Professional	5 (1.1%)	161 (7.6%)	166 (6.4%)
Home-based worker	8 (1.8%)	93 (4.4%)	101 (3.9%)

Values are n (%).

Prevalence of epilepsy

Among the 2,586 participants screened, 59 individuals were confirmed to have epilepsy, corresponding to a survey-adjusted overall prevalence of 22.8 per 1,000 population (95% CI: 15.3–30.3). Accounting for the two-stage cluster design yielded a design effect of 1.71, and the design-based confidence interval was accordingly wider than an interval assuming simple random sampling. Epilepsy prevalence showed marked geographic variation across districts (Fig. 2). The highest prevalence was observed in Botro district (33.2 per 1,000; 95% CI: 16.2–50.2), followed by Sakassou (23.8 per 1,000; 95% CI: 13.3–34.4), while Beoumi recorded the lowest prevalence (11.9 per 1,000; 95% CI: 3.8–20.0). Age-stratified analysis showed a slightly higher prevalence among adolescents (28.4 per 1,000; 95% CI

Medical and family history among people with epilepsy

Medical and family history characteristics among the 59 people living with epilepsy (PWE) are presented in Table 2.

Table 2
Medical and family history among people with epilepsy, Gbeke health region, Cote d'Ivoire, 2025

Variable	12–17 years	18 + years	Total
Antenatal care and delivery			
Antenatal follow-up by health professional	6 (46.2%)	13 (28.3%)	19 (32.2%)
Medication taken during pregnancy	2 (15.4%)	3 (6.5%)	5 (8.5%)
Caesarean delivery	1 (7.7%)	1 (2.2%)	2 (3.4%)
Dystocic delivery (forceps/ventouse)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Preterm birth	0 (0.0%)	3 (6.5%)	3 (5.1%)
Place of birth			
Home	2 (15.4%)	20 (43.5%)	22 (37.3%)
Health facility	8 (61.5%)	18 (39.1%)	26 (44.1%)
Unknown / Not known	3 (23.1%)	8 (17.4%)	11 (18.6%)
Neurological antecedents			
Neuro-malaria	2 (15.4%)	3 (6.5%)	5 (8.5%)
Encephalitis / encephalopathy	1 (7.7%)	0 (0.0%)	1 (1.7%)
Meningitis	0 (0.0%)	1 (2.2%)	1 (1.7%)
Head trauma with loss of consciousness	0 (0.0%)	1 (2.2%)	1 (1.7%)
Family history			
Parental consanguinity	1 (7.7%)	9 (19.6%)	10 (16.9%)
Family history of epilepsy	3 (23.1%)	12 (26.1%)	15 (25.4%)
Other family neurological history	0 (0.0%)	3 (6.5%)	3 (5.1%)

Values are n (%); denominator = 59 people with epilepsy (13 adolescents, 46 adults). Medication during pregnancy likely includes routine antenatal supplements; specific types were not systematically recorded.

Antenatal follow-up by a health professional was reported for 32.2% of PWE, while 8.5% reported that their mothers had taken medication during pregnancy. Given routine antenatal care practices in the region, this likely included iron-folate supplementation and other standard antenatal medications, although the specific drug types were not documented.

Reported early-life conditions included neuro-malaria (8.5%), preterm birth (5.1%), and caesarean delivery (3.4%). Central nervous system infections were uncommon, with encephalitis/encephalopathy (1.7%)

and meningitis (1.7%) each reported by a small proportion of participants. A history of head trauma with loss of consciousness was also reported in 1.7% of cases.

Regarding place of birth, 44.1% of PWE were born in a health facility, 37.3% at home, and 18.6% reported an unknown birthplace, reflecting limited documentation or recall among older participants.

A family history of epilepsy was reported by 25.4% of PWE, while parental consanguinity was reported by 16.9%.

Supportive diagnostic investigation findings

Supportive diagnostic investigations performed to assist with differential diagnosis and etiological assessment are summarized in Table 3. Of the 59 PWE, 53 (89.8%) underwent biological investigations; the proportions reported below are expressed among those tested. A positive malaria blood smear was detected in 18.9% of those tested (10 of 53). Complete blood count abnormalities were identified in 30.2% of PWE, and were more frequent among adults (34.9%) than adolescents (10.0%). Electrolyte disturbances were observed in several participants. Hyperchloraemia was present in 66.0% of PWE, while hyperkalaemia was detected in 45.3%. Abnormalities in other electrolytes were less frequent. Hypernatraemia was observed in 9.4%, while hypocalcaemia occurred in 17.0% of participants. Regarding magnesium levels, hypomagnesaemia was detected in 9.4%, whereas 9.4% had elevated magnesium levels. The high proportions of hyperchloraemia and hyperkalaemia should be interpreted with caution, as they may reflect pre-analytical factors (for example haemolysis or delays in sample processing under field conditions) rather than true electrolyte disturbances.

Table 3
Supportive diagnostic investigation findings among people with epilepsy, Gbeke health region, Cote d'Ivoire, 2025

Variable	12–17 years	18 + years	Total
Blood smear (malaria)			
Negative	9 (90.0%)	34 (79.1%)	43 (81.1%)
Positive	1 (10.0%)	9 (20.9%)	10 (18.9%)
Full blood count (FBC)			
Normal	9 (90.0%)	28 (65.1%)	37 (69.8%)
Abnormal	1 (10.0%)	15 (34.9%)	16 (30.2%)
Chloride (mmol/L)			
Low (< 96)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Normal (96–106)	3 (30.0%)	15 (34.9%)	18 (34.0%)
High (> 106)	7 (70.0%)	28 (65.1%)	35 (66.0%)
Potassium (meq/L)			
Low (< 3.5)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Normal (3.5-5)	6 (60.0%)	23 (53.5%)	29 (54.7%)
High (> 5)	4 (40.0%)	20 (46.5%)	24 (45.3%)
Sodium (meq/L)			
Low (< 136)	1 (10.0%)	0 (0.0%)	1 (1.9%)
Normal (136–145)	9 (90.0%)	38 (88.4%)	47 (88.7%)
High (> 145)	0 (0.0%)	5 (11.6%)	5 (9.4%)
Calcium (mg/L)			
Low (< 85)	0 (0.0%)	9 (20.9%)	9 (17.0%)
Normal (85–105)	10 (100.0%)	33 (76.7%)	43 (81.1%)
High (> 105)	0 (0.0%)	1 (2.3%)	1 (1.9%)
Magnesium (mg/dL)			
Low (< 1.7)	0 (0.0%)	5 (11.6%)	5 (9.4%)
Normal (1.7–2.1)	10 (100.0%)	33 (76.7%)	43 (81.1%)
High (> 2.1)	0 (0.0%)	5 (11.6%)	5 (9.4%)

Values are n (%). Not all people with epilepsy underwent investigations; denominator = 53 (10 adolescents, 43 adults). Reference ranges: chloride 96–106 mmol/L; potassium 3.5-5.0 meq/L; sodium 136–145 meq/L; calcium 85–105 mg/L; magnesium 1.7–2.1 mg/dL.

Treatment gap among people with epilepsy

Overall, 35 of the 59 people living with epilepsy (59.3%) were not receiving antiepileptic treatment at the time of the survey, indicating a substantial treatment gap (Fig. 3). The treatment gap was more pronounced among adolescents (76.9%) than adults and was present across all sociodemographic subgroups, with overlapping confidence intervals for differences by sex, district, residence, education level, and occupation.

Factors associated with epilepsy: bivariate analysis

Table 4 presents the results of the survey-adjusted bivariate analyses. No significant association was observed between epilepsy and sex ($p = 0.904$), age group ($p = 0.470$), residence ($p = 0.057$), or education level ($p = 0.451$). Marital status ($p < 0.001$) and occupation ($p < 0.001$) were significantly associated with epilepsy, while district of residence showed a borderline association that did not reach statistical significance after accounting for the cluster design ($p = 0.078$). The higher epilepsy rate among single individuals (3.6%) should be interpreted cautiously because of potential age confounding, as most adolescents, who had a higher epilepsy prevalence, were unmarried. Inactive individuals showed the highest epilepsy rate (6.1%), compared with 1.1-4.0% among other occupational groups.

Table 4
Factors associated with epilepsy: survey-adjusted bivariate analysis, Gbeke health region, Cote d'Ivoire, 2025

Characteristic	Epilepsy n (%)	No epilepsy n (%)	p-value
Sex			**0.904**
Female	36 (2.3%)	1,560 (97.7%)	
Male	23 (2.3%)	967 (97.7%)	
Age group			**0.470**
12–17 years	13 (2.8%)	444 (97.2%)	
18 + years	46 (2.2%)	2,083 (97.8%)	
District			**0.078**
Beoumi	8 (1.2%)	664 (98.8%)	
Botro	19 (3.3%)	553 (96.7%)	
Sakassou	32 (2.4%)	1,310 (97.6%)	
Residence			**0.057**
Rural	48 (2.6%)	1,769 (97.4%)	
Urban	11 (1.4%)	758 (98.6%)	
Marital status			< 0.001
Single	**41 (3.6%)**	**1,102 (96.4%)**	
Married/Cohabiting	11 (1.0%)	1,120 (99.0%)	
Divorced/Separated	2 (4.2%)	46 (95.8%)	
Widowed	5 (1.9%)	259 (98.1%)	
Education level			0.451
None/Literate	**30 (2.7%)**	**1,085 (97.3%)**	
Primary	18 (2.4%)	736 (97.6%)	
Secondary	11 (1.7%)	652 (98.3%)	
Higher	0 (0.0%)	54 (100.0%)	
Occupation			**< 0.001**
Farmer/Livestock	21 (1.9%)	1,105 (98.1%)	
Artisan/Trader	4 (1.1%)	350 (98.9%)	

Characteristic	Epilepsy n (%)	No epilepsy n (%)	p-value
Sex			**0.904**
Student	7 (1.4%)	504 (98.6%)	
Inactive	20 (6.1%)	308 (93.9%)	
Salaried/Professional	3 (1.8%)	163 (98.2%)	
Home-based worker	4 (4.0%)	97 (96.0%)	

P-values are from the survey-adjusted Rao-Scott chi-square test, accounting for the two-stage cluster design (villages as primary sampling units).

Multivariable logistic regression

Table 5 presents crude and adjusted odds ratios from the survey-weighted logistic regression analysis. After simultaneous adjustment for all variables included in the model, district of residence, marital status, and occupation remained independently associated with epilepsy. Compared with residents of Beoumi, individuals living in Botro district had significantly higher odds of epilepsy (aOR 2.84; 95% CI 1.12–7.22; p = 0.031). Single marital status was also independently associated with epilepsy (aOR 5.01; 95% CI 2.54–9.85; p < 0.001) compared with married or cohabiting individuals, although residual age confounding cannot be excluded. Regarding occupation, economically inactive individuals (aOR 3.36; 95% CI 1.23–9.17; p = 0.022) and home-based workers (aOR 2.35; 95% CI 1.13–4.87; p = 0.025) had higher odds of epilepsy compared with farmers or livestock keepers. No statistically significant associations were observed for sex, age group, residence type, education level, or other occupational categories in the multivariable model.

Table 5
Crude and adjusted odds ratios for factors associated with epilepsy: survey-weighted logistic regression, Gbeke health region, Cote d'Ivoire, 2025

Variable	Crude OR	95% CI	Adjusted OR	95% CI	p-value
Sex: Female	Ref	-	Ref	-	-
Sex: Male	1.03	0.62–1.72	1.19	0.61–2.32	0.588
Age group: 18 + years	Ref	-	Ref	-	-
Age group: 12–17 years	1.33	0.59–2.96	1.06	0.39–2.92	0.901
District: Beoumi	Ref	-	Ref	-	-
District: Botro	2.85	1.15–7.08	2.84	1.12–7.22	0.031
District: Sakassou	2.03	0.86–4.80	1.82	0.72–4.62	0.188
Residence: Rural	Ref	-	Ref	-	-
Residence: Urban	0.53	0.27–1.06	0.62	0.33–1.15	0.118
Marital: Married/Cohabiting	Ref	-	Ref	-	-
Marital: Single	3.79	2.19–6.56	5.01	2.54–9.85	< 0.001
Marital: Divorced/Separated	4.43	0.77–25.50	4.44	0.68–28.80	0.109
Marital: Widowed	1.97	0.80–4.81	0.95	0.26–3.43	0.936
Education: None/Literate	Ref	-	Ref	-	-
Education: Primary	0.88	0.55–1.43	0.67	0.33–1.37	0.248
Education: Secondary	0.61	0.28–1.33	0.55	0.23–1.33	0.167
Education: Higher †	-	-	-	-	-
Occupation: Farmer/Livestock	Ref	-	Ref	-	-
Occupation: Artisan/Trader	0.60	0.24–1.54	0.70	0.28–1.78	0.429
Occupation: Student	0.73	0.27–2.01	0.49	0.17–1.43	0.172
Occupation: Inactive	3.42	1.56–7.49	3.36	1.23–9.17	0.022
Occupation: Salaried/Professional	0.97	0.27–3.49	1.13	0.29–4.44	0.851
Occupation: Home-based worker	2.17	0.93–5.09	2.35	1.13–4.87	0.025

Odds ratios are from a survey-weighted logistic regression model with variance estimation accounting for the cluster design. The dagger indicates complete separation for higher education (no epilepsy cases

among 54 participants); the estimate is not interpretable and is omitted.

DISCUSSION

This population-based cross-sectional survey provides the first community-level estimate of epilepsy prevalence in the Gbeke region of Cote d'Ivoire. The overall epilepsy prevalence of 22.8 per 1,000 population among individuals aged 12 years and older falls within the range commonly reported in sub-Saharan Africa, where prevalence estimates typically range between 10 and 30 per 1,000 population [4–6], and exceeds the regional median of 14.2 per 1,000 [7]. These comparisons should be made cautiously, as the present estimate is restricted to individuals aged 12 years and older and is not age-standardised, whereas many global and regional figures are all-age. This prevalence is substantially higher than estimates from high-income countries, which generally range between 4 and 10 per 1,000 population [14]. These findings confirm that epilepsy remains a significant public health concern in many rural and semi-urban African settings.

Geographic heterogeneity of epilepsy prevalence

One of the most notable findings of this study is the marked geographic heterogeneity in epilepsy prevalence across districts. Prevalence was highest in Botro, intermediate in Sakassou, and lowest in Beoumi, with further clustering observed at the subdistrict level. Although the bivariate association between district and epilepsy did not reach statistical significance once the cluster design was taken into account ($p = 0.078$), the multivariable analysis confirmed that residence in Botro remained independently associated with epilepsy, with individuals living in Botro having nearly threefold higher odds of epilepsy compared with Beoumi.

Spatial heterogeneity in epilepsy distribution has been widely reported across sub-Saharan Africa and is often attributed to localized variations in exposure to preventable risk factors, including perinatal complications, traumatic brain injury, central nervous system infections, and parasitic diseases such as neurocysticercosis and cerebral malaria [15, 16]. Environmental, socioeconomic, and healthcare access differences between districts may also contribute to the observed spatial variation.

The higher prevalence observed in Botro may therefore reflect a greater burden of environmental or infectious risk factors, disparities in maternal and child health services, or differences in healthcare access and health-seeking behaviour. Although causal inference cannot be established in a cross-sectional design, the spatial clustering identified in this study suggests that targeted surveillance and intervention strategies may be particularly important in high-prevalence districts.

Age-specific patterns

Epilepsy prevalence was slightly higher among adolescents aged 12–17 years compared with adults aged 18 years and older, although the difference was not statistically significant. Similar patterns have been reported in several African studies, where epilepsy frequently begins during childhood or

adolescence, often following early-life neurological insults such as perinatal asphyxia, neonatal infections, febrile seizures, or cerebral malaria [17, 21, 22].

The persistence of epilepsy into adulthood in this study population may reflect limited access to early diagnosis and effective treatment, resulting in prolonged disease duration. In addition, the absence of a clear decline in prevalence among adults may suggest low remission rates, substantial treatment gaps, or excess epilepsy-related mortality, phenomena that have been documented in other low-resource settings [18, 19].

Sociodemographic factors

The analyses identified marital status and occupation as factors significantly associated with epilepsy, with district of residence showing an independent association in the multivariable model.

The higher prevalence observed among single individuals should be interpreted cautiously because of potential age confounding. Adolescents, who had a slightly higher epilepsy prevalence, were almost universally unmarried, which may partly explain this association. However, the persistence of this association in the multivariable model suggests that social factors linked to epilepsy, such as stigma or reduced marriage opportunities for individuals living with epilepsy, may also contribute.

Occupation was another important factor. Economically inactive individuals and home-based workers had significantly higher odds of epilepsy compared with farmers or livestock keepers. This association likely reflects bidirectional relationships between epilepsy and socioeconomic status. On one hand, uncontrolled seizures and neurological disability may limit employment opportunities; on the other, socioeconomic disadvantage may increase exposure to epilepsy risk factors or reduce access to healthcare.

Consistent with most population-based studies conducted in Africa, no significant differences in epilepsy prevalence were observed between males and females [3, 11]. Similarly, the lack of strong associations with education level or urban-rural residence may reflect the broad distribution of epilepsy risk factors across rural and peri-urban populations in the region.

Treatment gap

The treatment gap identified in this study is substantial. Overall, 59.3% of people living with epilepsy were not receiving antiepileptic treatment, and the gap was particularly pronounced among adolescents (76.9%). Although lower than the approximately 70–80% treatment gap frequently reported across sub-Saharan Africa [8, 20], this level of unmet treatment need remains concerning.

Multiple barriers likely contribute to this treatment gap, including limited access to trained healthcare providers, inconsistent availability of antiepileptic drugs, financial constraints, stigma, and reliance on traditional healing practices. The particularly high treatment gap among adolescents may reflect

healthcare transition challenges, under-recognition of seizures, or reduced healthcare engagement among younger individuals.

Addressing this treatment gap will require strengthening primary healthcare capacity for epilepsy diagnosis and management, improving drug supply chains, and implementing community-based strategies to identify untreated cases.

Public health implications

The findings of this study have important public health implications for epilepsy control in Cote d'Ivoire. The observed prevalence and spatial clustering highlight the need for decentralized epilepsy services and targeted interventions in high-prevalence areas such as Botro.

Integration of epilepsy care into primary healthcare systems, combined with task-shifting approaches involving trained community health workers, could substantially improve case detection and treatment coverage. Strengthening maternal and child health services, improving early detection of neurological complications, and ensuring consistent availability of affordable antiepileptic medications are also essential components of an effective response. Community awareness campaigns aimed at reducing stigma and misconceptions about epilepsy may further facilitate early diagnosis and treatment adherence.

Strengths and limitations

This study has several strengths. It represents the first community-based epilepsy prevalence study conducted in Cote d'Ivoire and used a probability-based sampling strategy, enhancing the representativeness of the findings. Prevalence and variance estimates were derived using survey-analysis methods that explicitly incorporate the two-stage cluster design, providing design-based confidence intervals. Epilepsy diagnoses were confirmed by neurologists, which improves diagnostic validity compared with studies relying solely on screening questionnaires. In addition, geographic mapping at the subdistrict level allowed identification of spatial clustering within the region.

Several limitations should also be considered. First, individuals younger than 12 years were not included, which may have led to underestimation of the true epilepsy burden, particularly given the early onset of many epilepsy cases. Second, the cross-sectional design prevents causal inference regarding the associations observed between epilepsy and sociodemographic factors. Third, stigma and recall bias may have led to underreporting of seizures or past medical events, potentially resulting in underestimation of prevalence. Fourth, although epilepsy diagnosis was confirmed by neurologists using standardized clinical criteria, supportive diagnostic investigations were not systematically performed for all participants, limiting etiological classification. Fifth, only screen-positive participants underwent neurological assessment, and prevalence was not adjusted for the sensitivity of the screening instrument, which may have further contributed to underestimation. Finally, with 59 confirmed cases relative to the number of covariates, the multivariable model had a low number of events per variable;

adjusted estimates with wide confidence intervals (notably single marital status and higher education) should therefore be regarded as exploratory, and residual confounding by age in the marital-status association cannot be excluded given the coarse age categorization. Some subgroup analyses involved small sample sizes, which may have reduced statistical power and should be interpreted cautiously.

CONCLUSION

Epilepsy represents a substantial public health burden in the Gbeke region of Cote d'Ivoire, with a survey-adjusted prevalence of 22.8 per 1,000 population, exceeding both global estimates and the median reported for sub-Saharan Africa. The pronounced geographic variability observed across districts indicates uneven distribution of epilepsy within the region, highlighting priority areas for targeted intervention. The large treatment gap, particularly among adolescents, underscores significant challenges in diagnosis, treatment access, and continuity of care. Strengthening epilepsy services through integration into primary healthcare systems, community-based screening, and reliable antiepileptic drug supply will be essential to reduce the burden of epilepsy in Cote d'Ivoire and similar settings.

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and approved by the Comite National d'Ethique des Sciences de la Vie et de la Sante de Cote d'Ivoire and by the MSF Ethics Review Board prior to study initiation. Written informed consent was obtained from all adult participants. For participants aged 12–17 years, written assent and parental/guardian consent were obtained.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Author Contribution

C.O.D. and F.A. conceived and designed the study and obtained the ethical approvals. C.O.D. performed the statistical analysis, and lead the manuscript writing. D.H. provided senior epidemiological and methodological supervision and contributed to the study design and the interpretation of the results. M.B.K.F. and Y.C. supervised the field data collection. O.R.B.B. and N.S.O.D. contributed to the study design, methodology, and interpretation of the data. Y.K., D.S., R.S., A.M.K., I.I.A., and M.B.K.F. carried out field data collection, field supervision, and data management. D.H., M.B.K.F., H.V.A., and H.A.K. performed the neurological clinical assessments and confirmed the epilepsy diagnoses according to International League Against Epilepsy criteria. S.H.I., L.S. and A.A. contributed to the data interpretation and manuscript review. All authors critically reviewed the manuscript and read and approved the final version.

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Data Availability

The datasets generated and analysed during the current study are not publicly available because they contain potentially identifying participant information collected in a household survey, but are available from the corresponding author on reasonable request and subject to the approval of Medecins Sans Frontieres and the relevant ethics committees.

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Figures

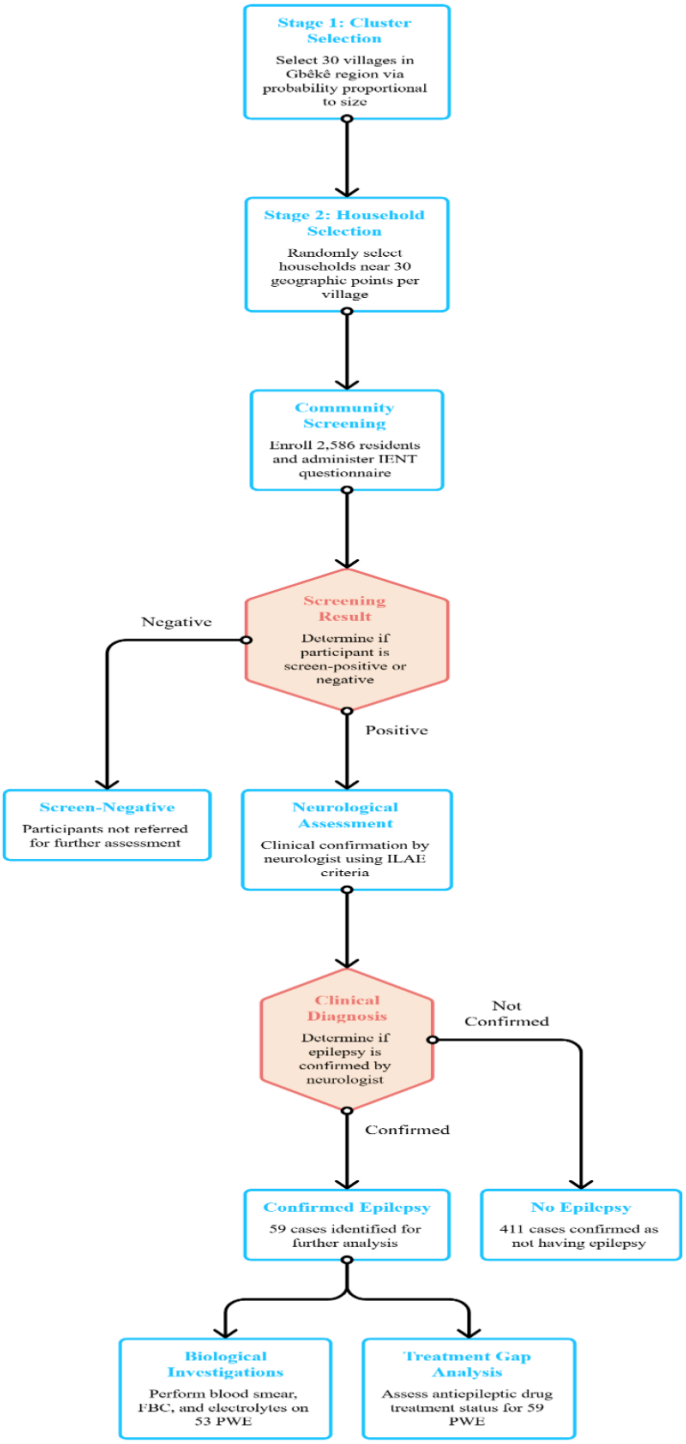

Figure 1

Sampling, Screening and Confirmation flow

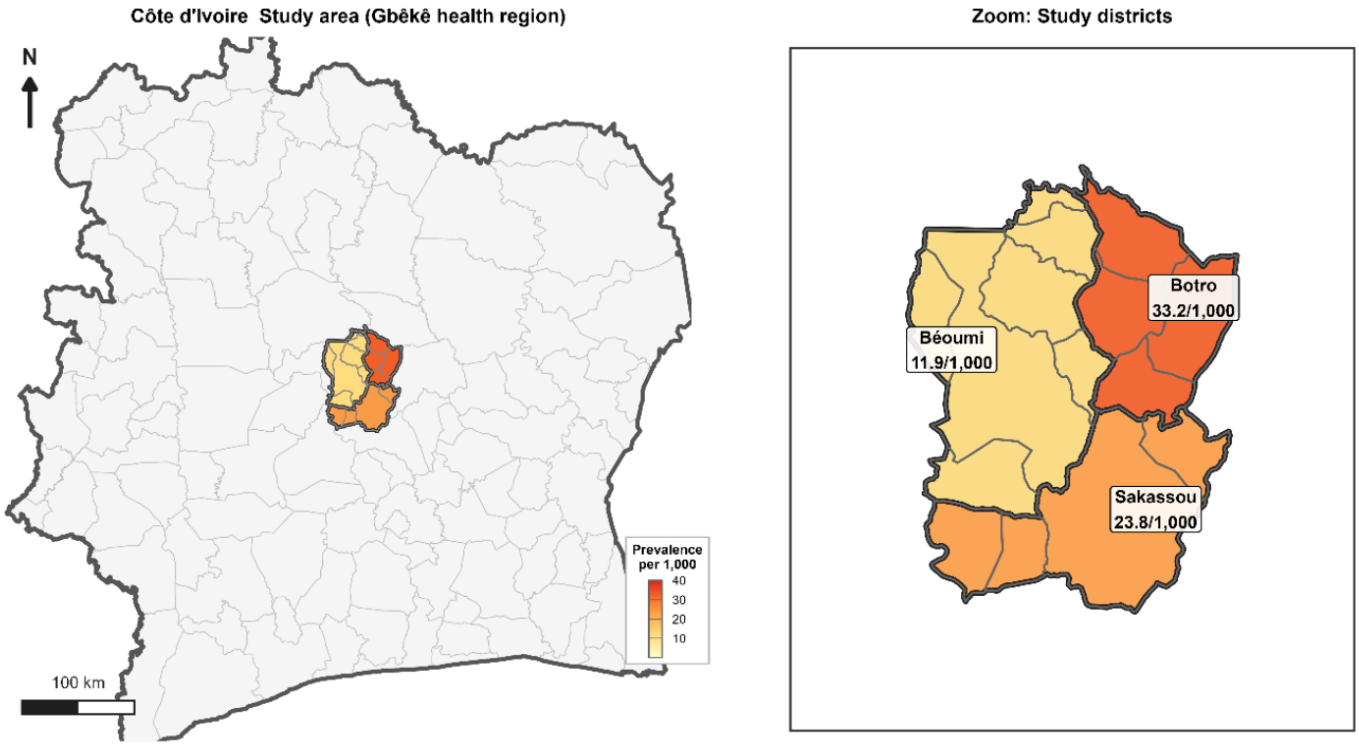

Figure 2

Epilepsy prevalence by district, Gbeke health region, Cote d'Ivoire, 2025

: 12.2-44.7) than among adults (21.6 per 1,000; 95% CI: 12.7-30.5).

Epilepsy prevalence by district, Gbeke health region, Cote d'Ivoire, 2025. Prevalence per 1,000 population (survey-adjusted); the national overview highlights the study districts without area-name labels, and the zoom inset shows district-level values with 95% confidence intervals.

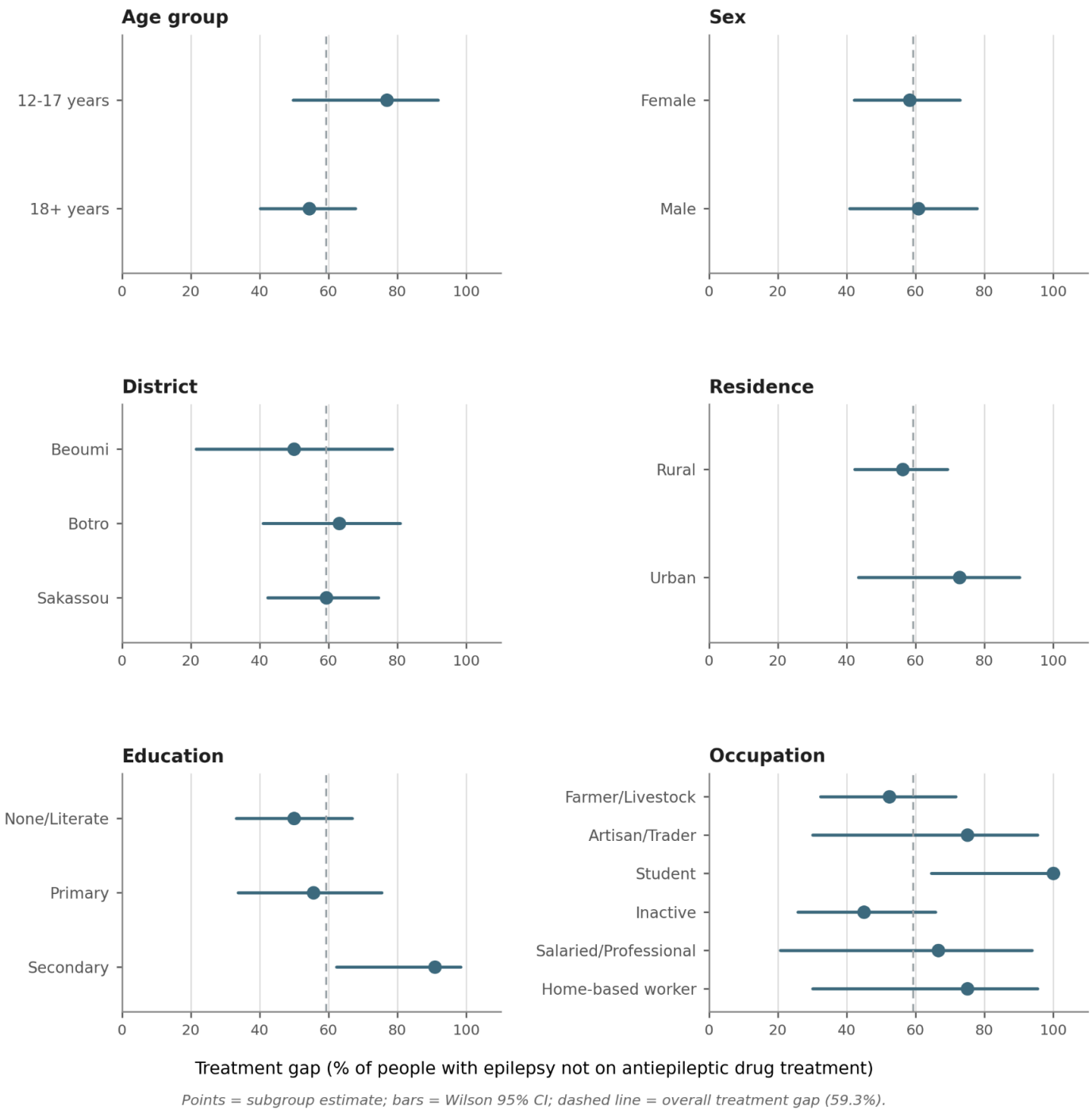

Figure 3

Treatment gap by sociodemographic subgroup among people with epilepsy, Gbeke health region, Cote d'Ivoire, 2025. Points indicate the proportion of people with epilepsy not receiving antiepileptic drug treatment; bars are Wilson 95% confidence intervals; the dashed line marks the overall treatment gap (59.3%).