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RESEARCH ARTICLE

The prevalence and determinants of epilepsy in Ghana: A population-based study in two districts using a three-stage approach

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Abstract

Objective: Epilepsy imposes a disproportionate burden in Africa, yet there are no reliable epidemiological data from Ghana. This community-based cross-sectional survey addressed this gap in southeastern Ghana, incorporating an analytical comparison of confirmed cases and age- and sex-matched controls.

Methods: We conducted a population-based cross-sectional study using a validated tool and a three-stage screening approach to estimate the prevalence of active epilepsy in the two Ghanaian districts of Shai-Osudoku and Ningo-Prampram.

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The three-stage approach consisted of population screening, detailed individual assessment, and clinical confirmation by specialists. To identify factors associated with epilepsy, we conducted a cross-sectional analysis comparing confirmed cases with age- and sex-matched controls randomly selected from the same population. Trained fieldworkers administered standardized questionnaires to capture sociodemographic data and historical risk exposures.

Results: The attrition-adjusted prevalence of active epilepsy was 8.84 per 1000 people (95% confidence interval [CI]: 8.00–9.68), higher in Shai-Osudoku (12.30 per 1000) than in Ningo-Prampram, and greatest in remote rural areas. Prevalence was higher among males (10.53 per 1000) and peaked at ages 20–29 years (11.44 per 1000). The poorest quintile had a prevalence three times that of the wealthiest. In children (≤16 years), fever-related convulsions (adjusted odds ratio [aOR] = 94.75; 95% CI: 17.40–515.96; $p < .001$) and history of cerebral/severe malaria (1.03; 95% CI: 1.01–1.06; $p = .003$) were strongly associated with epilepsy; younger males had higher odds (2.78; 95% CI: 1.12–6.88). In adults, household members with epilepsy (6.21; 95% CI: 2.56–15.11), family history (3.55; 95% CI: 1.13–11.19), head injury (24.45; 95% CI: 3.07–194.60), and household ownership of cats (1.76; 95% CI: 1.10–2.81) or pigs (2.26; 95% CI: 1.10–4.66) were significant risk factors.

Significance: Our findings highlight a high burden of epilepsy in southeastern Ghana, with variations observed across geographic, demographic, and socioeconomic groups. Modifiable risks such as head injury and cerebral or severe malaria highlight urgent needs for targeted prevention, improved health care access, and poverty alleviation strategies.

KEYWORDS

febrile convulsions, head injury, risk factors, rural vs peri-urban, socioeconomic status, zoonotic factors

1 | BACKGROUND

Epilepsy is a significant public health challenge globally, with over 50 million individuals affected.[1–3] It accounts for ~.5% of the global disease burden, leading to an estimated 20.6 disability-adjusted life years (DALYs).[4] The prevalence and incidence of epilepsy, however, exhibit considerable geographical disparities, particularly between low- and middle-income countries (LMICs) and high-income countries (HICs).[1,5,6] In LMICs, including sub-Saharan Africa (SSA), epilepsy prevalence is nearly three times higher than that in HICs, with SSA facing the highest burden, where epilepsy is a leading cause of neurological DALYs.[7]

Increased incidence in LMICs, particularly SSA, is often attributed to factors such as poor living conditions, high infection rates (cerebral malaria, meningitis, neurocysticercosis, *Onichocerca volvulus*), febrile convulsions, and inadequate obstetric practices.[5,8,9] In these areas, there are challenges in accurately diagnosing epilepsy, as defined by the International League Against Epilepsy (ILAE) as two unprovoked seizures occurring more than 24 h apart.[10] Resource-limited settings often lack neurodiagnostic capabilities and clinical expertise, which, combined with cultural stigma and the under-recognition of non-convulsive seizures, contribute to inaccurate or incomplete epidemiological data.[10,11] In SSA, the active epilepsy prevalence is estimated at around 9 cases per 1000 people. However, the figures show significant variability, with incidence rates ranging from 18.6 to 320 per 100 000 people and lifetime prevalence ranging from 4.5 to 49 per 1000 people.[5,12]

Ghana exemplifies the critical deficit in data on epilepsy epidemiology, prevalence, and incidence within SSA. The actual burden of epilepsy in Ghana remains unclear at the national level. Existing data are limited to one or two rural community-based studies, both conducted in the country's middle belt. Although one of these studies estimated prevalence and identified risk factors for active convulsive epilepsy (ACE) in

Kintampo,[13] the other focused on estimating ACE prevalence in onchocerciasis-endemic districts of Tain and Wenchi.[14] These studies were geographically limited to the distinctive sociodemographic, cultural, and environmental characteristics of the Middle Belt, which differ from those of Southern Ghana, which is more urbanized. It has diverse ethnic groups and practices that could influence epilepsy prevalence and risk factors. A study in this zone would provide a more complete understanding of epilepsy in the country, enabling targeted public health strategies for urban and rural areas. Epilepsy imposes a significant burden as one of Ghana's top five health issues and the most prevalent neuropsychiatric issue in rural areas. Still, targeted interventions are hampered by the lack of robust, up-to-date data.[15]

In settings where diagnostic challenges (limited clinical expertise, neurodiagnostic services, inconsistent terminology, varied methods) and systemic barriers (critically low neurologist density and large, significant diagnostic and treatment gaps) preclude medical record review,[16–18] Health and Demographic Surveillance Systems with community-based screening offer a viable alternative.[19–21] This approach improves diagnostic accuracy, identifies local risk factors, and includes underserved populations.[20,22,23] It is estimated that up to a quarter of the global epilepsy cases are preventable.[24] Thus, we aim to address critical data gaps by investigating the prevalence of epilepsy and its risk factors in southeastern Ghana to inform policy and interventions.

Key points

- The prevalence of active epilepsy in southeastern Ghana is 8.84 per 1000 people and is twofold higher in rural than in urban areas.
- A clear wealth gradient is evident, with the poorest people having a threefold higher prevalence than the wealthiest quintile.
- In children, fever-related convulsions and a history of severe malaria were significant predictors for developing epilepsy.
- For adults, head injuries, family history, and household ownership of animals were significant predictors of developing epilepsy.
- There is urgent need for poverty alleviation and better management of modifiable risks such as head injury and febrile seizures.

2 | METHODS

2.1 | Study setting

This community-based study was conducted in the Shai-Osudoku and Ningo-Prampram districts in the Greater Accra Region. The districts, carved from the former Dangme West district in 2012, are located along Ghana's southeastern coast.[25] The population comprises diverse ethnic groups, predominantly Ga-Dangme, Akan, and Ewe. Shai-Osudoku is primarily rural, with livelihoods centred on farming, petty trading, and livestock rearing. Ningo-Prampram is peri-urban, with key economic activities including fishing, cattle herding, small-scale trading, commercial driving, artisanship, and construction.[26–28]

Both districts fall within the boundaries of the Dodowa Health and Demographic Surveillance System (DHDSS), managed by the Dodowa Health Research Centre. The DHDSS database—tracking demographics, socioeconomic status, health service utilization, and vital events through unique resident identifiers—served as the sampling frame and participant-tracking system.[26–28] The study was conducted in two districts in the Greater Accra Region (Figure 1).

2.2 | Study design

We employed a community-based cross-sectional door-to-door survey with a nested matched case–control study. We targeted long-term residents within the DHDSS catchment area to assess epilepsy epidemiology and context-specific risk factors. This work was part of the broader multi-country Epilepsy Pathway Innovation in Africa (EPInA) project (https://epina.web.ox.ac.uk/home) across three African countries: Tanzania, Kenya, and Ghana.

2.3 | Survey instrument development and validation

A culturally appropriate 17-item epilepsy screening questionnaire, adapted from existing tools and capturing convulsive and non-convulsive seizures, was developed. The instrument underwent forward translation from English into the targeted local languages (Asante Twi and Dangme), which are the dominant languages spoken in the study area, followed by back-translation into English. The final version was subsequently reviewed and refined by local neurologists.

Validation involved consecutively enrolling confirmed cases of active epilepsy and controls (healthy relatives or individuals with other conditions) from outpatient units

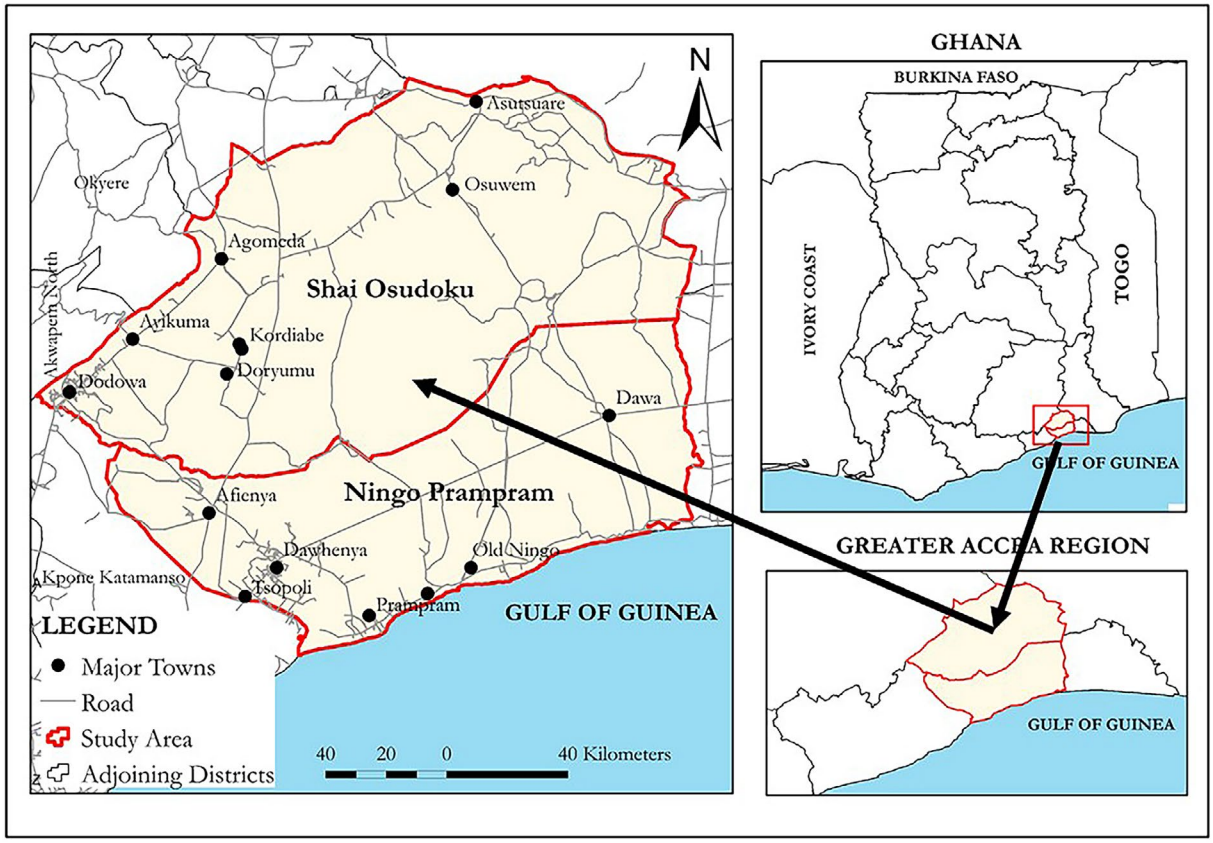

FIGURE 1 Map of Ghana showing the two study districts. The figure illustrates the location of Shai-Osudoku and Ningo-Prampram districts within the Greater Accra Region of Ghana, including major towns, road networks, and adjoining districts.

in the districts and Korle-Bu Teaching Hospital. Cases and controls were matched geographically and ethnically. The validation process confirmed the questionnaire's diagnostic accuracy and detailed information on the process is described elsewhere.[29]

2.4 | Pre-survey activities

Stakeholder consultations secured community acceptance and addressed epilepsy-related stigma concerns. Data collectors with DHDSS and with community experience underwent a 10-day training programme led by local neurologists. Training covered knowledge of seizures and epilepsy, standardized terminology, and questionnaire administration (using role-plays and videos). Follow-up sessions occurred after fieldwork commenced.

2.5 | Participant recruitment and screening procedure

Household screening employed a three-stage approach, using a validated questionnaire to recruit and confirm active epilepsy cases (Figure 1). At Stage 1, all eligible household members were targeted for screening. The survey was administered to household heads, adult mothers, or knowledgeable household members, defined as adult who were residents of the household familiar with the health status of all household's usual members. These participants completed a 7-item screen in their preferred language for all usual household residents, including those temporarily absent at the time of the visit. Information for children was provided by a parent or primary caregiver residing in the household. One affirmative response constituted a positive screen. To minimize non-response, three contact attempts, including evenings and weekends, were made before classifying households as migrated or unavailable. At Stage 2, individuals screening positive at Stage 1 received a follow-up 10-item questionnaire administered by field supervisors at home to enhance specificity. Individuals screening positive at Stage 2 underwent clinical assessment by physicians and neurologists at Stage 3. Electroencephalography (EEG) was used to classify seizures and identify epilepsy syndromes. We used the standard ILAE definition of epilepsy, defined as "at least two unprovoked (or reflex) seizures occurring more than 24 hours apart."[10]

The participant recruitment and three-stage screening process is shown in Figure 2.

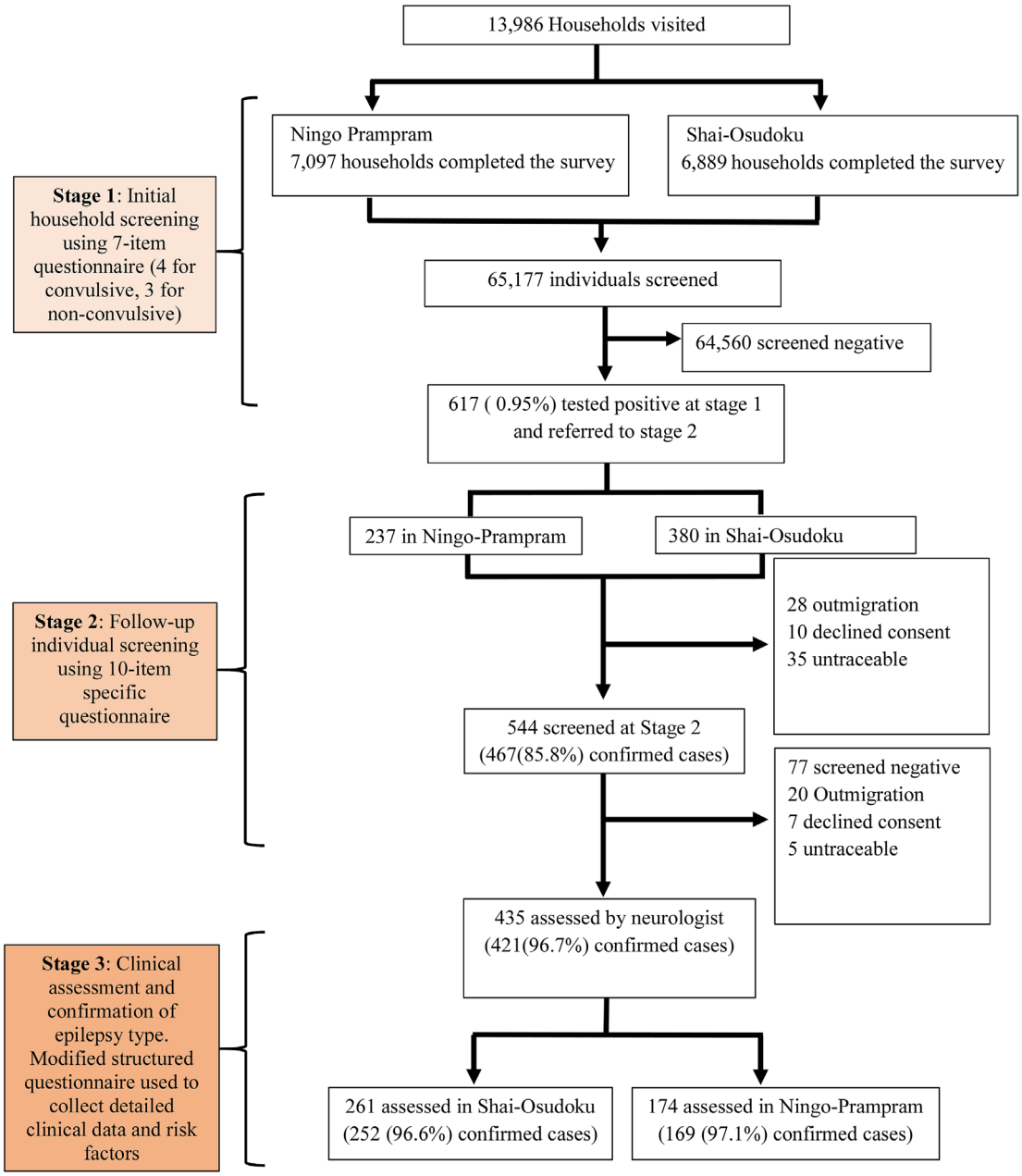

FIGURE 2 Flow chart of participants' recruitment and three-stage epilepsy screening process. A total of 65 177 individuals were screened at Stage 1 using a validated household-level questionnaire. Of these, 617 (.95%) screened positive and were referred to Stage 2. At Stage 2, a total of 544 individuals were screened using a detailed questionnaire, of whom 467 (85.8%) remained suspected cases. At Stage 3, 435 were clinically assessed by a neurologist, and 421 (96.7%) were confirmed as epilepsy cases. Attrition occurred due to out-migration, refusal to consent, and inability to trace participants.

2.6 | Case and control identification

The cases were individuals with clinically confirmed active epilepsy identified through the three-stage screening. Controls were screen-negatives or caregivers of identified cases. Using the DHDSS database, of the 421 people identified with active epilepsy, 366 were eligible for recruitment into the case–control study. Three hundred twelve healthy subjects were selected randomly from the database of individuals who screened negative during Stage 1 as potential controls. Exact matching was used to select controls that matched the cases. A "case" referred to any participant who returned a positive result, whether from household surveys or confirmed through clinical assessments. All cases underwent the three stages of the screening process, regardless of prior diagnosis or reported history of epilepsy. Final case determination was based solely on clinical assessment and confirmation by a neurologist at Stage 3. A "control" was defined as anyone who did not screen positive at

any stage. Two subsets of the dataset were created: one for cases and one for controls. For each age–sex combination in the case dataset, the frequency was recorded, and an equivalent number was selected randomly from the corresponding age–sex combination in the control dataset. This exact-matching technique was feasible because the control dataset contained a large number of participants, whereas the cases accounted for less than 1% of the entire dataset. Controls were selected using frequency matching by age group and sex to ensure comparability with cases. The final number of controls was determined based on available eligible individuals who met the inclusion criteria and consented to participate. Given a larger pool of potential controls in the DHDSS database, we prioritized matching quality and feasibility over maximizing control recruitment. Controls are also difficult to recruit, as they may not want to be associated with any disease. This yielded two analytic cohorts: (i) children and adolescents (≤16 years); and (ii) adults (≥17 years).

2.7 | Data collection

Data were collected electronically using the KoboCollect application (v2023.2.4) on Android devices. Participants were administered a structured questionnaire. Cases provided additional detailed information using a modified instrument adapted from the Studies of Epidemiology of Epilepsy in Demographic Surveillance Systems (SEEDs)[23] covering: clinical data, seizure details, epilepsy type; socioeconomic status, dietary habits; and medical history (e.g., febrile seizures, perinatal complications, family history of epilepsy [first and second degree], meningitis, measles, head injuries, hypertension, diabetes, stroke [adults], alcohol use, smoking [adults]). Separate questionnaires were used for participants aged ≤16 and ≥17 years. For children or cognitively impaired individuals, caregivers provided information. Case interviews took place in health facilities after the clinical assessment and control interviews were conducted at home.

2.7.1 | Definitions

- *Fever-related convulsion (febrile seizure):* positive if the child had one or more convulsions with a high fever or elevated body temperature (≥38°C) between the ages of 6 months and 5 years, without evidence of intracranial infection.
- *Cerebral or severe malaria: Plasmodium falciparum* infection, as reported by the caregiver or documented in a medical record, accompanied by impaired consciousness, seizures, or other features of severe disease, such as severe anemia, respiratory distress, hypoglycemia, or organ dysfunction.
- *A first-degree relative:* an individual's parents, siblings, or children.
- *Cats in the household:* the presence of one or more cats living within the household compound or sharing the living environment with household members.
- *Pigs in the household:* the presence of pigs being raised within the household compound or kept in proximity to the dwelling.
- *Head injury:* a history of head trauma resulting in loss of consciousness, confusion, vomiting, hospitalization, or any persistent neurological symptoms, as reported by the participant or caregiver.
- *Birth complications:* adverse events occurring during delivery, including prolonged or obstructed labor, birth asphyxia, need for resuscitation, low Apgar score, preterm delivery, or neonatal intensive care admission, as reported by the mother or recorded in health documents.

2.8 | Statistical analysis

Data were cleaned in KoboToolbox and Microsoft Excel 365, and then analyzed in Stata/SE 17. Continuous variables (e.g., age) were categorized and categorical variables presented as frequencies and percentages. Household socioeconomic status was derived using principal component analysis and ranked into quintiles (poorest to richest).

Crude prevalence was estimated as Stage 3 confirmed cases divided by the Stage 1 screened population (with 95% confidence intervals [CIs], stratified by district). Attrition-adjusted prevalence used inverse probability weighting (IPW) to correct for losses across screening stages. Stratified estimates were computed by age, sex, district, and sub-district. Prevalence estimates were standardized for age and sex using the 2021 Ghana Population and Housing Census,[30] with additional adjustment for National Health Insurance status. In the risk factor analysis, for each age cohort (≤16 and ≥17 years), univariate logistic regression identified candidate variables ($p < .05$) associated with epilepsy. Multivariable logistic regression estimated adjusted odds ratios (aORs) with 95% CIs for significant exposures ($p < .05$), controlling for confounders. Modified Poisson regression with (robust standard errors) estimated prevalence ratios for demographic factors. Nonparametric tests (Kruskal–Wallis and χ^2) were used to compare distributions where appropriate.

3 | RESULTS

3.1 | Participant characteristics and screening outcomes

A total of 13 985 households participated. A slightly higher proportion of participants resided in Ningo-Prampram (50.7%). The demographic characteristics of participants are detailed in Table 1. Screening identified 65 177 individuals at Stage 1, of whom 617 (.95%) met criteria for Stage 2 screening. In Stage 2, 467 of 544 suspected cases (85.8%) were still identified as suspected epilepsy cases. At the clinical assessment stage (Stage 3), 421 of 435 suspected cases (96.8%) were confirmed as epilepsy.

3.2 | Epilepsy prevalence

The crude prevalence of suspected epilepsy at Stage 1 was 9.5 cases per 1000 people. In Stage 2, a total of 467 of 544 suspected cases (85.8%) remained identified as suspected epilepsy cases, with no significant sex differences ($p < .945$). At the clinical assessment stage (Stage 3), 421 of 435 suspected cases were confirmed as epilepsy. The overall prevalence of epilepsy, adjusted for attrition, was 8.84 cases per 1000 people (95% CI: 8.00–9.68). Prevalence varied significantly by district. Shai-Osudoku had twice the prevalence of Ningo-Prampram (12.30 cases per 1000 people; 95% CI: 10.80–13.80) and was associated with a higher risk of mortality (HR (Hazard Ratio) = 1.32; 95% CI: 1.07–1.61). Sub-district prevalence ranged from 14.85 cases per 1000 people in Osuwem (95% CI: 10.55–19.15) to 4.74 cases per 1000 people in Prampram (95% CI: 3.45–6.04).

Prevalence peaked among individuals 20–29 years of age (11.44 cases per 1000; 95% CI: 9.30, 13.59), with higher burdens observed among adolescents, young adults, and middle-aged adults. Males had a significantly higher prevalence (10.53 cases per 1000 people; 95% CI: 9.17–11.89) than females (7.44 cases per 1000 people; 95% CI: 6.40–8.48). Age- and sex-standardized prevalence estimates varied across subgroups, with higher prevalence among males than females and a peak among young adults.

A strong inverse correlation existed between household socioeconomic status and epilepsy prevalence. Prevalence was substantially higher among the poorest wealth quintile (17.37 cases per 1000 people; 95% CI: 14.21, 20.54) than among the richest quintile (5.54 cases per 1000 people; 95% CI: 4.37, 6.70), demonstrating a progressive decrease with increasing wealth. Table 1 details the prevalence of epilepsy by demographic characteristics.

The median age of people with active epilepsy was 24 years (interquartile range [IQR]: 13–35), and the median age at onset of seizures was 11 years (IQR: 3–19).

Screening outcomes and prevalence of epilepsy by sociodemographic and economic characteristics in study districts are presented in Table 1.

3.3 | Risk factors for epilepsy

Logistic regression analyses identified different risk factors for epilepsy across various age groups. Among those 16 years and younger, fever-related convulsions (aOR: 94.75; 95% CI: 17.40–515.96; $p < .001$) were the most significant and consistent risk factors for epilepsy. A history of cerebral or severe malaria (aOR: 1.03; 95% CI: 1.01–1.06; $p < .003$) was also a significant independent risk factor for epilepsy. Male children had a significantly higher likelihood (aOR: 2.78; 95% CI: 1.12–6.88; $p < .027$) of developing epilepsy after adjustment. Factors that lost significance after adjustment (potential confounding) were: mother ever had a stillborn child; mother had hypertension; mother had seizures; household members have epilepsy; head injury; siblings with seizures; difficulty crying at birth; and difficulty feeding after birth. Education, mother's history of malaria, family history, immunization status, and ownership of cats, dogs, or pigs were not significant in either model.

Factors associated with epilepsy in children (≤16 years of age) are presented in Table 2.

Among adults, 17 years and older, the strongest and most consistent independent risk factors (significant in unadjusted and adjusted models) of epilepsy were household members having epilepsy (aOR: 6.21; 95% CI: 2.56–15.11; $p < .001$), family history (aOR: 3.55; 95% CI: 1.13–11.19; $p < .03$), and head injury (aOR: 24.45; 95% CI: 3.07–194.60; $p < .003$). Ownership of animals exhibited context-dependent significance. Household cat ownership was significant in both models, but the effect was reduced after adjustment (aOR = 1.76; 95% CI: 1.101–2.81; $p < .018$), and likewise, for household pig ownership (aOR: 2.26; 95% CI: 1.09–4.66; $p < .027$). Education and alcohol use were significant protective factors against epilepsy. Higher education (aOR: .43; 95% CI: .34–.56; $p < .001$) was associated with a significantly lower risk of epilepsy than lower education. Similarly, alcohol use (aOR: .42; 95% CI: .26–.71; $p < .001$) was associated with a significant reduction in the likelihood of epilepsy.

No controls had a stroke, but 3.9% of cases had a stroke, suggesting that it is a likely important risk factor for adult-onset epilepsy that could not be estimated with standard methods in this analysis.

TABLE 1 Screening outcomes and prevalence of epilepsy by sociodemographic and economic characteristics in the study districts.

	Stage 1 screening outcome, *N* (%)			Stage 2 screening outcome, *N* (%)			Clinical assessment outcome, *N* (%)			Prevalence per 1000 people (95% CI)	Standardized prevalence, per 1000 people*
	No epilepsy	Suspected cases	*p*-value	No epilepsy	Suspected cases	*p*-value	No epilepsy	Suspected cases	*p*-value		
No. of persons screened	64 560 (99.1)	617 (.9)		77 (14.2)	467 (85.8)		14 (3.2)	421 (96.8)		8.84 (8.00, 9.68)	
District											
Ningo-Prampram	36 728 (99.4)	237 (.6)	<.001	27 (13.2)	177 (86.8)	.634	5 (2.9)	169 (97.1)	.763	6.19 (5.25, 7.12)	_
Shai-Osudoku	27 832 (98.7)	380 (1.3)		50 (14.7)	290 (85.3)		9 (3.4)	252 (96.6)		12.30 (10.80, 13.80)	_
Area											
Asutuare	5784 (98.9)	64 (1.1)	<.001	3 (5.3)	54 (94.7)	<.001	5 (10.4)	43 (89.6)	.161	10.06 (7.07, 13.04)	_
Ayikuma	9240 (98.6)	129 (1.4)		9 (7.9)	105 (92.1)		1 (1.1)	89 (98.9)		12.83 (10.17, 15.49)	_
Dawa	13 549 (99.4)	85 (.6)		6 (8.0)	69 (92.0)		3 (4.5)	64 (95.5)		6.43 (4.86, 8.00)	_
Dodowa	8728 (98.6)	128 (1.4)		27 (24.1)	85 (75.9)		2 (2.6)	76 (97.4)		12.03 (9.38, 14.68)	_
Ningo	8545 (99.3)	60 (.7)		1 (1.8)	54 (98.2)		1 (1.9)	52 (98.1)		8.28 (6.04, 10.51)	_
Osuwem	4080 (98.6)	59 (1.4)		11 (19.3)	46 (80.7)		1 (2.2)	44 (97.8)		14.85 (10.55, 19.15)	_
Prampram	14 634 (99.4)	92 (.6)		20 (27.0)	54 (73.0)		1 (1.9)	53 (98.1)		4.74 (3.45, 6.04)	_
Age (years)*											
<10	11 149 (99.4)	65 (.6)	<.001	9 (15.3)	50 (84.7)	<.001	4 (8.2)	45 (91.8)	.024	5.38 (3.79, 6.96)	1.31
10–19	14 475 (99.1)	133 (.9)		8 (6.7)	112 (93.3)		2 (2.0)	99 (98.0)		9.56 (7.71, 11.40)	2.07
20–29	12 770 (98.9)	137 (1.1)		10 (7.9)	116 (92.1)		1 (.9)	116 (99.1)		11.44 (9.30, 13.59)	2.07
30–39	9578 (98.9)	105 (1.1)		15 (16.3)	77 (83.7)		2 (2.9)	68 (97.1)		9.89 (7.59, 12.19)	1.42
40–49	6493 (99.1)	57 (.9)		5 (10.6)	42 (89.4)		1 (2.7)	36 (97.3)		7.52 (5.08, 9.97)	.70
50–59	4390 (98.9)	48 (1.1)		12 (24.0)	38 (76.0)		4 (11.8)	30 (88.2)		8.32 (5.20, 11.44)	.48
60+	5436 (98.9)	60 (1.1)		18 (36.0)	32 (64.0)		0 (.0)	27 (100.0)		6.47 (3.99, 8.95)	.42
Age (years), Median (IQR)	24.0 (10.5–37.5)	26.0 (13.5–38.5)	<.001	37.0 (18.5–55.5)	25.0 (13–37)	<.001	31.0 (15.5–46.5)	24.0 (13–35)	.983		

TABLE 1 (Continued)

	Stage 1 screening outcome, *N* (%)			Stage 2 screening outcome, *N* (%)			Clinical assessment outcome, *N* (%)			Prevalence per 1000 people (95% CI)	Standardized prevalence, per 1000 people*
	No epilepsy	Suspected cases	*p*-value	No epilepsy	Suspected cases	*p*-value	No epilepsy	Suspected cases	*p*-value		
Sex*											
Female	35 376 (99.1)	306 (.9)	.014	38 (14.3)	227 (85.7)	.904	7 (3.5)	194 (96.5)	.796	7.44 (6.40, 8.48)	3.77
Male	29 184 (98.9)	311 (1.1)		39 (14.0)	240 (86.0)		7 (3.0)	227 (97.0)		10.53 (9.17, 11.89)	5.19
Has valid health insurance											
No	19 904 (99.1)	180 (.9)	.736	25 (12.6)	174 (87.4)	.364	,5 (3.1)	156 (96.9)	.118	8.49 (7.06, 9.93)	2.65
Yes (NHIS)	42 659 (99.0)	420 (1.0)		47 (14.4)	280 (85.6)		9 (3.4)	253 (96.6)		9.01 (7.97, 10.05)	6.16
Yes (Other)	504 (99.2)	4 (.8)		2 (28.6)	5 (71.4)		0 (.0)	4 (100.0)			_
Unknown	1493 (99.1)	13 (.9)		3 (27.3)	8 (72.7)		0 (.0)	8 (100.0)			_
Household wealth quintile**											
Lowest	8731 (98.4)	146 (1.6)	<.001	13 (9.6)	122 (90.4)	.360	1 (.9)	113 (99.1)	.134	17.37 (14.21, 20.54)	_
Low	9888 (98.9)	109 (1.1)		11 (11.8)	82 (88.2)		1 (1.3)	78 (98.7)		10.67 (8.32, 13.02)	_
Medium	11 200 (99.1)	106 (.9)		15 (15.6)	81 (84.4)		3 (3.8)	75 (96.2)		9.08 (7.03, 11.12)	_
High	13 339 (99.2)	105 (.8)		16 (17.0)	78 (83.0)		4 (6.1)	62 (93.9)		6.31 (4.75, 7.88)	_
Highest	21 143 (99.3)	140 (.7)		20 (17.1)	97 (82.9)		5 (5.5)	86 (94.5)		5.54 (4.37, 6.70)	_

Note: Where frequencies do not add up (rarely), the outstanding refers to the small residual difference when category frequencies do not add up to the total due missing response for some variables during data collection. The total of the wealth quintiles does not add up to the total screened, largely due to poor or no response to some variables required to establish the wealth index. Adjustment done for variables that are relevant to the information.

*Age- and sex standardised prevalence per 1000 people, standardized to the 2021 Ghana Population and Housing Census. **The total of the wealth quintiles does not ad up to the total number screened, largely due to poor or no response to some variables required to establish wealth index.

Sex, age, smoking, recreational drug use, chronic conditions, and loss of consciousness were not predictors of epilepsy among the adult group.

Factors associated with epilepsy in adults (≥17 years of age) in the study districts are presented (Table 3). Collectively, these findings indicate that epilepsy risk in the area is influenced by a combination of familial, environmental, and behavioral factors, with distinct patterns across age groups.

4 | DISCUSSION

This large-scale, community-based survey provides some insights into the prevalence and associated risk factors of epilepsy in Southeastern Ghana. Our findings contribute significantly to understanding the epidemiology of epilepsy within Ghana and the broader SSA context.

The estimated prevalence confirms the high burden of epilepsy reported previously in Ghana,[13,14] and aligns with the range previously observed in an SSA multi-site framework.[23] Although our prevalence is slightly lower than that reported from rural Kintampo,[13,23] this discrepancy is consistent with existing evidence, suggesting higher rates in rural settings compared to mixed peri-urban/rural areas like ours.[31] The significantly higher prevalence in Shai-Osudoku compared to Ningo-Prampram, and particularly within remote, forested areas of Shai-Osudoku, characterized by limited health care access, underscores the critical role of geography and health care factors. Proximity to well-equipped facilities that enable timely diagnosis and management of parasitic infections appears protective,

TABLE 2 Regression analysis of factors associated with epilepsy in children (≤16 years of age) in the study districts.

	%	%	Unadjusted		Adjusted	
Variables	**Controls**	**Cases**	**OR (95% CI)**	***p*-value**	**OR (95% CI)**	***p*-value**
Sex (male)	50.7% (54/107)	65.6% (72/110)	1.86 (1.08, 3.21)	.026	2.78 (1.12, 6.88)	.027
Education			1.01 (.99, 1.04)	.287	1.02 (.98, 1.05)	.354
Has mother ever had a stillborn child or the death of a baby within 7 days of birth	3.06 (3/98)	11.93 (13/109)	4.29 (1.18, 15.53)	.027	1.48 (.16, 13.31)	.728
Mother had hypertension	3.06 (3/98)	11.93 (13/109)	4.29 (1.18, 15.53)	.027	2.36 (.34, 16.38)	.384
Mother had seizures	48.98 (48/98)	44.03 (48/109)	.46 (.26, .79)	.006	.21 (.01, 3.43)	.273
Mother had malaria	3.06 (3/98)	3.67 (4/109)	1.21 (.26, 5.53)	.809	2.89 (.17, 49.35)	.462
Family history of epilepsy (first and second generations)	1.86 (2/107)	.93 (1/107)	2.04 (.67, 6.18)	.207	1.44 (.24, 8.71)	.69
House people with epilepsy	4.67 (6/107)	14.95 (16/107)	2.87 (1.08, 7.63)	.035	2.18 (.42, 11.29)	.353
History of head injury	0 (0/107)	10.28 (11/107)	1.03 (1.00, 1.05)	.019	1.01 (.98, 1.04)	.493
Immunization completed	53.06 (52/98)	58.72 (64/109)	1.26 (.73, 2.18)	.413	.76 (.29, 1.95)	.571
Fever-related convulsions	2.04 (2/98)	53.21 (58/109)	54.59 (12.81, 232.69)	<.001	94.76 (17.40, 515.96)	<.001
Siblings with seizures	1.02 (1/98)	12.84 (14/109)	14.29 (1.84, 110.86)	.011	4.34 (.28, 66.32)	.291
Cerebral or severe malaria	2.04 (2/98)	10.09 (11/109)	1.03 (1.00, 1.05)	.009	1.035 (1.01, 1.06)	.003
Have cats in the household	31.77 (34/107)	42.06 (45/107)	1.49 (.85, 2.59)	.163	1.72 (.64, 4.6)	.28
Have dogs in the household	20.56 (22/107)	17.76 (19/107)	.81 (.41, 1.59)	.537	.88 (.27, 2.87)	.829
Have pigs in household	9.34 (10/107)	13.08 (14/107)	1.42 (.59, 3.34)	.429	.55 (.12, 2.58)	.446
Home delivery	22.43 (24/107)	16.36 (18/110)	.68 (.34, 1.34)	.26	.50 (.16, 1.58)	.239
Difficult crying at birth	3.06 (3/98)	14.68 (16/109)	5.45 (1.54, 19.32)	.009	4.46 (.50, 39.66)	.18
Difficult breathing at birth	0 (0/98)	9.17 (10/109)				
Difficult feeding after birth	1.02 (1/98)	12.84 (14/109)	54.59 (12.81, 232.70)	<.001	11.71 (.52, 262.15)	.121
Seizure within the first month of life[a]	0 (0/98)	3.81 (4/105)				
Resuscitated immediately after birth[a]	0 (0/98)	7.92 (8/101)				
Neonatal complications[a]	0 (0/98)	20.18 (22/109)				

Abbreviations: CI, confidence interval; OR, odds ratio.

[a]Indicates that an Odds ratio could not be estimated due to zero exposure in the control population.

highlighting access to care as a key determinant of regional prevalence variation. We found significant demographic patterning. The higher prevalence among males corroborates findings from Ghana and the wider SSA.[3,13,23,31,32] This sex-patterned prevalence likely stems from multiple factors, including a higher risk in males of head trauma from road traffic accidents and occupational hazards.[23,32] It may also involve underreporting or concealment due to sociocultural stigma that affects marriageability and social standing.[33–35] In addition, sex differences in health-seeking behavior may necessitate gender-sensitive approaches in public health interventions.

Age-specific prevalence peaked in the 20- to 29-year cohort, consistent with patterns seen across SSA,[20,23,36,37] and internationally.[3] This clustering in young adults, coinciding with Ghana's youthful population structure,[38] implicates factors such as head trauma, infectious diseases, and genetic predisposition. The lower prevalence in children raises concerns about potential underdiagnosis of non-convulsive seizures, emphasizing the limitations of symptom-based screening tools in extensive surveys and the need for age-tailored diagnostic methods.[39] By adjusting for variations in age and sex structure, the standardized estimates provide a more accurate basis for comparing the burden of epilepsy across different subgroups.

We observed pronounced variation in prevalence across locations, consistent with patterns observed elsewhere.[13,23,40] The burden of prevalence was disproportionately concentrated in remote, forest-adjacent areas with limited access to health care. This contrast underscores the critical impact of health care infrastructure. Areas with better-equipped facilities, such as Dodowa and Ayikuma, presented lower rates. This is likely due to improved neurological care, reduced barriers to timely presentation, and more effective management of risk factors, such as parasitic infections. These findings demonstrate that geographical location and health care accessibility are fundamental determinants of epilepsy prevalence. An inverse socioeconomic gradient was evident, with prevalence significantly higher among the poorest households than among the wealthiest. This pattern, consistent with global evidence,[41–43] underscores epilepsy as a disease of inequity. Socioeconomic deprivation increases exposure to infections, poor hygiene, malnutrition, and barriers to health care, elevating the risk of developing epilepsy and having worse outcomes. Critically, this inequity persists even in settings with universal health care,[42] emphasizing that epilepsy control requires not only universal access to care but also complementary livelihood empowerment and social protection strategies.

Risk factor analysis yielded significant insights. For children, histories of fever-related convulsions and cerebral or severe malaria were associated with epilepsy among this population, consistent with previous SSA evidence.[5,8,9,44] The findings are confirmation of recurrent febrile seizures and infections as the underlying risk of the early onset of certain types of epilepsy in young children in resource-limited settings.[45–47] This is reinforced by the finding of a complex age-specific relationship between children and epilepsy. The findings require a shift in history-taking, mandating clinical assessment of children with epilepsy in the setting and similar contexts. This includes a detailed, specific history of febrile seizures (number, duration, type, and age at onset) and malaria exposure (specifically probing for symptoms of severe or cerebral malaria). We found that male children had a higher risk of epilepsy, corroborating previous reports of a male predominance in incidence in early years.[47]

The risk factors for adults differed from those for children, shifting toward family history, environmental exposures, and adult-acquired conditions. Familial history and household members with epilepsy were robust predictors for adults, reinforcing the role of genetic predisposition and shared underlying exposures within families,[13,40,48,49] underscoring the need for targeted genetic research. Household ownership of pets, cats, and pigs was a modest risk factor. These factors are more likely proxies for parasitic infections. Although cats are known to carry *Toxoplasma gondii* (a parasite that, in rare cases, can cause brain lesions), pigs are linked to environmental exposure, particularly to neurocysticercosis.[50] However, more work is required to establish a direct causal link between animal ownership and epilepsy. Acquired insults such as head injury (strong risk factor) and potentially stroke were strong risk factors for epilepsy in the study context, and are well-established risk factors for epilepsy.[23,40,44,51] The rise of commercial motorbike use ("Okada"), provides affordable transport but remains a significant cause of head trauma. Consequently, prioritizing helmet use, enforcing traffic regulations, and enhancing post-injury care are crucial public health priorities to reduce epilepsy incidence.

The finding that higher education was protective aligns with evidence linking education to higher socioeconomic status, better health literacy, and greater access to care, reinforcing the need for awareness initiatives. The inverse association with alcohol use requires cautious interpretation. Although the data suggest a potential protective effect, this is likely explained by diagnosed individuals reducing their intake due to health concerns or medication interactions. This contrasts with established evidence identifying heavy alcohol use as a significant risk for epilepsy. Other behavioral factors (smoking, drug use) and chronic conditions showed no significant adjusted

TABLE 3 Regression analysis of factors associated with epilepsy in adults (aged ≥17 years) in the study districts.

	%	%	Unadjusted		Adjusted	
Variables	**Controls**	**Cases**	**OR (95% CI)**	***p*-value**	**OR (95% CI)**	***p*-value**
Sex (male)	43.90% (90/205)	49.6% (127/256)	1.258 (.87, 1.82)	.223	1.476 (.93, 2.34)	.099
Education			.479 (.39, .59)	<.001	.437 (.34, .56)	<.001
House people with epilepsy	3.4 (7/205)	18.34 (47/256)	6.361 (2.81, 14.41)	<.001	6.219 (2.56, 15.12)	<.001
Alcohol use	36.59 (75/205)	27.34 (70/256)	.652 (.44, .97)	.034	.425 (.26, .71)	<.001
Smoking	3.90 (8/205)	4.69 (12/256)	1.211 (.49, 3.02)	.681	1.633 (.49, 5.44)	.425
Recreational drug use	.98 (2/205)	3.52 (9/256)	3.698 (.79, 17.31)	.097	4.016 (.57, 28.43)	.164
Chronic condition	1.95 (4/205)	4.30 (11/256)	2.256 (.71, 7.19)	.169	1.41 (.39, 5.03)	.596
Loss of consciousness	.49 (1/205)	45.70 (117/256)	1.019 (.99, 1.04)	.064	1.006 (.99, 1.03)	.582
History of head injury	.49 (1/205)	12.5 (32/256)	29.142 (3.95, 215.19)	.003	24.451 (3.07, 194.59)	.003
Have cats in the household	30.24 (62/205)	46.88 (120/256)	2.035 (1.38, 2.99)	<.001	1.76 (1.10, 2.81)	.018
Have dogs in the household	18.54 (38/205)	32.81 (84/256)	2.146 (1.386, 3.33)	<.001	1.438 (.82, 2.52)	.206
Have pigs in the household	7.32 (15/205)	18.75 (48/256)	2.923 (1.59, 5.39)	<.001	2.262 (1.09, 4.66)	.027
Family history (first generations)	2.44 (5/205)	9.77 (25/256)	4.329 (1.63, 11.52)	.003	3.557 (1.13, 11.19)	.03
Consanguinity (blood relationship between parents)	6.25 (3/48)	22.73 (5/22)	4.7 (.40, 54.84)	.217		
History of stroke[a]	0 (0/205)	3.91 (10/256)				

Abbreviations: CI, confidence interval; OR, odds ratio.

[a]Indicates that an odds ratio could not be estimated due to zero exposure in the control population.

associations, possibly due to mediation by other variables or methodological limitations.

Several limitations warrant consideration. Potential underestimation of true prevalence may stem from the survey duration limiting revisits, resource constraints preventing full household coverage, and difficulties recognizing non-convulsive seizures despite screening efforts. Recall bias is a concern in the case–control study, particularly for early-life events. Social desirability bias may have led to underreporting of stigmatized behaviors (alcohol, drug use). The lack of serological and neuroimaging data precluded assessment of parasitic infections (e.g., neurocysticercosis) as risk factors. The study was carried out in two districts within the DHDSS, providing district-level population-based estimates that contribute to national evidence rather than serving as a national prevalence estimate.

However, key strengths enhance the validity of our findings. A neurology team confirmed the diagnosis (the gold standard), rather than relying on self-report or a diagnosis identified only at screening. The application of IPW to mitigate attrition bias in prevalence estimation, and the use of a large, representative household sample, ensure the generalizability of prevalence estimates and the identification of possible risk factors in the study population.

5 | CONCLUSION

Although numerically modest, epilepsy prevalence in southeastern Ghana places a disproportionate strain on public health due to various factors. Higher rates are observed among the poorest populations and among young adults with limited access to health care. Key risk factors include febrile seizures and severe malaria in children and acquired insults and infectious exposures in adults. Higher education appears protective. Effective control programs demand a multifaceted approach: improving access to care, injury prevention strategies, strengthening early childhood screening, developing gender-sensitive approaches, and, crucially, integrating poverty alleviation to address socioeconomic inequities. Future research should prioritize longitudinal designs, improved diagnostics, and investigation of specific parasitic and genetic contributions.

AUTHOR CONTRIBUTIONS

E.K.D., J.W.S., C.R.N., J.H.C., and P.A. conceived, designed, and supervised the study. E.K.D. and A.G. analyzed the data. E.K.D. drafted the manuscript with input from S.A., E.A., A.A., C.S., A.A., A.G., F.A., A.D.-A., and A.S. J.E.W., J.H.C., J.W.S., C.R.N., A.D.-A., and P.A.

provided critical intellectual input. All authors approved the final draft. P.A. is the guarantor.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

DATA AVAILABILITY STATEMENT

The data that support our findings are available upon reasonable request from bona fide researchers by contacting the corresponding author. The full datsets are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

The Ghana Health Service Ethics Review Committee (GHS-ERC 022/08/20) and the Dodowa Health Research Centre Institutional Review Board (DHRCIRB 95/08/20) approved the project. Study participants provided written informed consent. Community consent was secured through local leaders. Written informed consent was obtained from adults and minors, who provided assent with parental consent. Interviews were conducted in preferred languages (Dangme, Twi, and English) and, when necessary, with interpreters. Data were anonymized pre-analysis. Identified epilepsy cases were registered for clinical follow-up and future research.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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