**Epilepsy treatment Gap in Nigeria: A multidimensional perspective on treatment and review of Literature**

**Abstract**

**Introduction**: Epilepsy is a chronic neurological disorder characterized by unprovoked recurrent seizure episodes. The treatment gap of epilepsy in Nigeria is high, and data on the magnitude and causes of the epilepsy treatment gap in Africa are sparse. This study aimed to determine the epilepsy treatment gap and possible causes among people.

**Methods**: This is a prospective cross-sectional study with 147 PWEs aged ≥16 years. The subjects were enrolled consecutively for 6 months met the inclusion criteria, and had clinically confirmed diagnoses of epilepsy based on the International League against Epilepsy (ILAE) criteria. Participants were scheduled and interviewed with a structured questionnaire.

**Results**: About 147 subjects were studied comprising 79 male (53.7%) and 68 female patients (46.3%) with a male-to-female ratio of 1.2: 1. Treatment adherence was poor as 88.4% missed their medication at least once within the 6 months and only 25.9% restricted themselves to only Orthodox treatment. About seventy-seven (89.5%) patients in our study who defaulted from clinic attendance used alternative medicine compared with 32 (52.5%) patients who were non-defaulters.

**Conclusion**: The study found treatment adherence to be poor, as the majority of our patients missed their medication and only very few restricted themselves to Orthodox treatment. The negative cultural beliefs can be improved by patient and community education.

**Keywords**: Epilepsy treatment, Gap, multi-dimensional, perspective

**Introduction**

Epilepsy is a neurological disease typified by recurrent seizures. It is the most common central nervous system disorder in Africa, caused by an abnormal, excessive, purposeless, and synchronized electrical discharge in the brain cells called neurons [1, 2]. It can vary from brief and nearly undetectable periods to long periods of vigorous shaking due to abnormal electrical activity in the brain [1]. These episodes can result in injuries, either directly, such as broken bones, or through causing accidents [1]. Epilepsy is a frequent chronic neurologic disorder that affects ~50 million people of all ages [3]. About 80% of people with epilepsy are found in developing countries, where it is a major public health problem, not because of its health implications alone, but also because of its social, cultural, psychological, and economic connotations [1]. It is also important to note that about 60% of patients with Epilepsy receive no anti-epileptic treatment [4]. About 25 million people have been reported to have epilepsy in Africa, and the majority of these people do not receive appropriate care [5]. The disease is further worsened in the region by shortages of trained health workers, limited diagnostic and treatment equipment, sociocultural beliefs, and people who are suffering from Epilepsy are grossly discriminated against; it is believed that the stigma associated with the disease kills even faster than the disease itself[6]. Studying epilepsy in Africa reinforces our understanding of the disease, encourages health interventions, and promotes healthcare in the region[7]. The prevalence of epilepsy in Sub-Saharan Africa and Latin America is particularly high, with respectively, 15 and 18 per 1000 people affected, compared to 6 per 1000 people in Asia, and less than 8 per 1000 people in Europe and North America [8]. Epilepsy is associated with important medical, psychological, economic, and social consequences for the affected individuals and their families as well as their communities. Indeed, the socio-cultural implications of epilepsy, including taboo, stigma, and exclusion, are well known [9]. Moreover, persons with epilepsy (PWE) are confronted with socio-cultural and health barriers, resulting in insufficient access to treatment, especially anti-epileptic medications (AEM) [10, 11. Due to superstitions and cultural beliefs, epilepsy is often stigmatized and misunderstood in many African communities [12]. People with epilepsy are seen as possessed by evil spirits or witches, which can lead to discrimination and exclusion from society [13]. This stigma can also prevent individuals with epilepsy from seeking appropriate medical treatment, leading to further health complications [14]. Frequent epileptic seizures are the most challenging hurdle that people with epilepsy encounter, making these people unemployed, divorced, marginalized, isolated, and celibate[15]. Not only that, but also low self-esteem, overprotective parents, decreased school attendance, and lack of academic ambition caused people with epilepsy to struggle academically [16]. All these hurdles or obstacles met by these people with epilepsy bring about a low quality of life. It is necessary to implement a variety of strategies to increase awareness and lessen the stigma surrounding epilepsy. These include educating those who have the condition and their families, participating people with epilepsy and their families in clinical research studies and surveys, and forming partnerships with the entertainment industry to ensure that accurate information about epilepsy is spread [5]. Implementing these strategies will lessen the stigma associated with epilepsy, help people with epilepsy and their families cope with the condition and its effects, and promote the inclusivity of these people in society because they will be able to participate and play their part fully.

**SUBJECTS AND METHODS**

This is a prospective study of adult (≥16 years) patients with epilepsy seen at the neurology clinic of the University College Hospital, Ibadan, Nigeria. Epilepsy was defined procedurally as two or more non-febrile seizures unconnected to acute metabolic disorders, and alcohol or drug withdrawal. The features of the seizures were obtained from the patients and an observer. The subjects were enrolled consecutively from May 2008 to March 2009 and met the inclusion criteria. We excluded: - patients with questionable diagnoses or who did not give consent. We regarded those who missed any of their monthly clinic appointment as defaulters. Poor compliance was considered as a separate but continuous period of drug abstinence or failure to take the recommended dosage correctly [17]. We did not use the pill counting method as drugs were not provided by us. There was no means to determine serum drug levels. We enrolled 150 patients, of whom three were unable to complete the study.

The minimum sample size of this study was determined by using the formula:

 **N**= **[Z2 PQ/D2]11**

Where **N** is the desired sample size.

**Z** is the standard normal deviate, usually set at 1.96 (or more simply at 2), which corresponds to the 95% confidence level;

 **P** is the proportion in the target population estimated to have a particular characteristic (here p=0.10 as the overall prevalence of epilepsy in Nigeria was 100/1000 (10.0%) [18];

**Q** is 1-P = 0.9; and

**D** is the Degree of accuracy desired, usually set at 0.05.

The calculated sample size was 138, with 10% attrition about a total of 147 participants were enrolled for the study.

 .

 Ethical clearance was obtained from the University of Ibadan/University College Hospital Ibadan Ethical Committee.

**Study Protocol**: At the end of each recruitment, the patient was assigned to be seen monthly for the succeeding six months. Information was collected using a questionnaire that included: - Socio-demographic data, cost of transportation, estimated distance from the clinic, different treatment Modalities of respondents**,** types of treatment received by patients, whether orthodox or alternative medicines or combined and Predictors of adherence to Orthodox treatment were determined. Answers were obtained by direct interview of the patients with epilepsy and/ or their parents/relatives. The motive of the questioning was elucidated to the patients, and local languages were sometimes used through a translator for those who did not understand English. Each interview took about 10-20 minutes, and any unclear answers were cross-checked carefully.

**Definitions**

The various terms applied in the study were defined as follows:

**Epilepsy treatment gap (ETG):** The difference between the number of people with active epilepsy and the number whose seizures are being appropriately treated in the population at the time of the study is expressed as a percentage. This definition included both diagnostic and therapeutic deficits [27].

**Diagnostic gap:** The number of people with epilepsy who have not been diagnosed in a health facility as having epilepsy at the time of the survey [27].

**Therapeutic gap:** The proportion of people with epilepsy who were appropriately diagnosed but inappropriately treated and still have active epilepsy [27].

**Active Epilepsy:** The occurrence of two or more unprovoked seizures on different days in the prior year [27].

**Appropriate treatment:** Treatment of recurrent seizures with regular use of AEDs, irrespective of the type of AED, about seizure classification [27].

**PWEs:** People with Epilepsy

**ASMs:** Anti-seizure medications

**AED:** Anti-epileptic drug

**SSA:** Sub-Saharan Africa

**Statistical analysis:** Analysis was done using a statistical package for social sciences (SPSS) version 25.0.1. Categorical data were calculated as frequencies and percentages. Continuous data were described as mean-value (standard deviation). Association was tested using the chi-square test and by calculating the odds ratio with a 95% confidence interval. A p-value less than 0.05 was considered statistically significant. Logistic regression (multivariate analysis) was applied to find out the significant independent predictors predicting adherence to Orthodox treatment only.

**Results**

**Socio-demographic characteristics of Respondents**

The 147 subjects studied comprised 79 male (53.7%) and 68 female patients (46.3%) with a male-to-female ratio of 1.2:1. Their ages ranged between 16-88 years, with a mean of 33.89(16.45) years. The majority of the patients were young male adults below forty years of age. Twenty-eight patients (19.0%) completed primary school education, 80 (54.4%) completed secondary school, 35 (23.8%) patients completed tertiary education, and four of them had no formal education. One hundred and twenty patients (81.6%) were residents of urban settings, and the rest came from nearby rural communities. Most of the subjects belonged to the low-income group. Unemployed school children (students) predominated and accounted for 36.0 % (table 1)

Table 1: Socio-Demographic Information on Respondents

|  |
| --- |
| Socio-demographic information n=147(%) |
| Ages (Years)Mean 33.89±16.45Range 16-88Age group<20 33(22.4)20-39 68(46.3)40-59 31(21.1)60-79 14(9.5)>80 1(0.7)Age group1<40 101(68.7)>40 46(31.3)GenderMale 79(53.7)Female 68(46.3)Educational StatusNo Formal 4(2.8)Primary 28(19.0)Secondary 80(54.4)Tertiary 35(23.8) Educational Status1Poorly Educated 112(76.2)Tertiary Educated 35(23.8)Occupation Students 53(36.0)Apprentice 32(21.8)Traders 25(17.0)Civil Servants 15(10.2) Farmers 8(5.4)Self-employed 8(5.4)Housewife’s 3(2.1)Others 3(2.1) Residence Urban 120(81.6)Rural 27(18.4)Monthly Income(naira)No Income 29(19.7)0-10,000 14(9.5)10,001-25,000 34(23.1)25,001-50,000 45(30.6)50,001-100,000 18(12.2)100,001-150,000 4(2.7)150,001-300,000 2(1.4)>300,001 1(0.7)Monthly Income1(naira)≤50,000 122(83)>50,000 25(17)Monthly Cost of Medication(Naira)≤3,500 116(78.9)>3,500 31(21.1)Cost of Transportation to the clinic(naira)≤200 109(74.1)>200 38(25.9)Estimated Distance to the Clinic≤10Km 85(57.8)>10Km 62(42.2) |

**Different Treatment Patterns of Patients**

About 76.2% of participants were placed on carbamazepine, and a majority (85%) of them were on monotherapy for less than 10 years (77.6%). Treatment adherence was poor as 88.4% missed their medication at least once within the 6 months, and only 25.9% restricted themselves to only Orthodox treatment (Table 2).

**Table 2. Different treatment Patterns of respondents**

|  |
| --- |
| Treatment approach n=147(%) |
| Antiepileptic drugs PrescribedCarbamazepine 112(76.2)Phenytoin 23(15.6)Phenobarbitone 8(5.4)Sodium Valproate 3(2.1)Pregabalin 1(0.7)Number of Antiepileptic Drug Combinations One 125(85.0)Two 21(14.3)> Two 1(0.7)Duration of treatment(years)≤10 114(77.6)>10 33(22.4)Adherence to treatmentIs the dose taken appropriately? Yes 136(92.5)No 11(7.5)Is the pill count correct?Yes 139(94.6)No 8(5.4)Were you given information/Counseling on adherence?Yes 137(93.2) No 10(6.8)How many times did you miss your medication in the last 6 months?None 17(11.6)≥ One 130(88.4)Types of TreatmentHerbal and Orthodox 12(8.2)Spiritual Healing and Orthodox 53(36.1)Herbal, Spiritual healing and Orthodox 44(29.9)Orthodox Only 38(25.9)Orthodox and Alternative treatmentOrthodox only 38(25.9)Alternative treatment 109(74.1) Patients New 37(25.2)Old 110(74.8)  |

**Relationship of Pattern of treatment with Socio-demographic characteristics, estimated distance, cost of transportation, and clinic attendance of the participants**

Ninety-nine (90.0%) of participants were old patients who used alternative treatment when compared with 10 (27%) patients who were newly recruited. The association between new and old patients with a pattern of treatment was statistically significant (p-value 0.0001, 95%CI =9.34-63.23) (table 3)Thirty-nine (84.0%) patients whose ages were more than 40 years used alternative medicine compared to (69.3%) patients less than 40 years of age. The association between the age of the patients and the pattern of treatment was statistically significant (p-value 0.034, 95%CI =0.99-6.12) (table 3). Fifty-six (82.4%) female patients were treated with alternative medicine compared to 53(67.1%) male patients. The association between the sex of the patient and the pattern was statistically significant (p-value 0.027, 95%CI = 1.05-4.95) (table 3). Ninety-three (83.0%) patients with poor educational status used alternative treatment when compared with 16 (45.7%) patients with tertiary educational status. The association between educational status and clinic default was statistically significant (p-value 0.0001, 95%CI = 0.075-0.39) (table 3). Fifty-one (82.3%) patients who reside more than 10 kilometers from the clinic were treated with alternative medicine compared to 58 (68.2%) who reside less than 10 kilometers from the clinic. The association between distance from the clinic and the pattern of treatment was not statistically significant (p-value 0.06, 95%CI = 0.974.78) (table 3). Twenty-nine (76.3%) patients who spent more than ₦200 to transport themselves to the clinic used alternative treatment for their seizures compared to 80 (73.4%) who spent less than ₦200 to reach the clinic. The association between the cost of transport and the pattern of treatment was not statistically significant (p-value 0.83, 95%CI = 0.49-2.76) (table 3). Ninety-six (78.7%) patients with low levels of income were treated with alternative medicine compared with 12 (48.0%) patients with high levels of income. The association between the income of patients and the pattern of treatment was statistically significant (p-value 0.01, 95%CI = 0.12-0.72)(Table 3). Seventy-seven (89.5%) patients who defaulted from clinic attendance used alternative medicine compared with 32 (52.5%) patients who were non-defaulters. The association between attendance at the clinic and the pattern of treatment was statistically significant (p-value 0.0001, 95%CI = 3.30-18.21)(table 3).

**Table 3: Relationship of Pattern of treatment with Socio-demographic characteristics, estimated distance, cost of transportation, and clinic attendance of the participants**

|  |
| --- |
| Variables Treatment status(%)n=147 chi-square Pvalue 95% CI Orthodox only Alternatives  |
| PatientsNew 27(73) 10(27) 57.28 0.0001 (9.34-63.23)Old 11(10) 99(90)Age(years) 3.95 0.034 (0.99-6.12)≤40 31(30.7) 70(69.3)>40 7(15.2) 39(84.8)Gender 4.44 0.027 (1.05-4.95)Male 26(32.9) 53(67.1) Female 12(17.6) 56(82.4)Educational status 19.38 0.0001 (0.075-0.39)Poorly Educated 19(17) 93(83)Tertiary Educated 19(54.3) 16(45.7)Monthly Income(naira) 7.71 0.01 (0.12-0.72)≤50,000 26(21.3) 96(78.7)>50,000 13(52) 12(48) Cost of transport to the clinic(naira) 0.12 0.83 (0.49-2.76) ≤200 29(26.6) 80(73.4)>200 9(23.7) 29(76.3) Clinic default 25.59 0.0001 (3.30-18.21)Non defaulters 29(47.5) 32(52.5)Defaulters 9(10.5) 77(89.5)Estimated Distance to the clinic 3.68 0.06 (0.974.78)≤10km 27(31.8) 58(68.2) >10km 11(17.7) 51(82.3) |

**Predictors of adherence to Orthodox treatment**

The significant predictors of adherence to orthodox treatment from the logistic regression model were gender (p-value 0.03, OR=0.17), educational Status (p-value 0.002, OR=8.56), non-defaulters (p-value 0.005, OR=0.062), and new patients (p value0.001, OR=0.03. Newly recruited male patients who are tertiary educated are likely to attend the clinic regularly and adhere to orthodox treatment (table 4)

**Table 4: Predictors of** **adherence to Orthodox treatment**

|  |
| --- |
| Variables B(regression coefficient) p-value odd ratio 95%CI for odd ratio Lower Upper |
| Age(years)≤40 -1.62 0.07 0.20 0.04-1.14>40 1GenderMale -1.77 0.03 0.17 0.04-0.84Female 1Educational Status Poorly Educated 2.15 0.002 8.56 2.17-33.70 Tertiary Educated 1Monthly Income(naira)≤50,000 0.95 0.23 2.60 0.54-12.39>50,000 1Cost of transport to the clinic≤200 -1.01 0.18 0.37 0.09-1.57 >200 1Cost of drug per month≤3,500 0.28 0.73 1.32 0.27-6.49 >3,500 1New and Old PatientsNew -3.51 0.001 0.03 0.01-0.14Old 1Clinic AttendanceNon-defaulters -2.77 0.005 0.062 0.01-0.43Defaulters 1Estimated Distance to the Clinic(km)≤10 0.68 0.43 1.97 0.36-10.82 >10 |

**Discussion**

Treatment of epilepsy is challenging in African patients due to several factors, including the low socioeconomic status of the residents and limited access to appropriate medication. A total of 147 subjects were studied, comprising 79 males (53.7%) and 68 females (46.3%), with a male-to-female ratio of 1.2:1. Their ages ranged from 16 to 88 years, with a mean of 33.89 (16.45) years. The majority of the patients were young male adults below forty years of age. Twenty-eight patients (19.0%) completed primary school education, 80 (54.4%) completed secondary school, 35 (23.8%) patients completed tertiary education, and four of them had no formal education. One hundred and twenty patients (81.6%) were residents of urban settings, and the rest came from nearby rural communities. Most of the subjects belonged to the low-income group (83%). In another similar study conducted in Ethiopia [19], out of 175 patients with epilepsy, 107(61.1%) were men, while 68 (39.9%) were female. The mean ages of the patients were 29.36 ± 12. About 100(57.1%) and 163 (93%) of the patients were urban dwellers and followers of Orthodox Christianity, respectively, while 108 (61.7%) of the patients had a monthly income of less than 20 USD. In another recent retrospective study conducted among PWEs attending three hospitals in Western Nigeria, there were fewer male participants [445 (47.4%) vs. 495 (53.6%)] than females, with a higher mean age of onset (35.19 ± 21.10) [20]. In our study, about 76.2% of participants were placed on carbamazepine, and the majority (85%) were on monotherapy for less than 10 years (77.6%). This is consistent with the study[20] with the majority of participants receiving Anti-Seizure Medications(ASMs) were on monotherapy (73.2%), with Carbamazepine(79%) being the most frequently prescribed medication as also seen in this study, which conforms with the guidelines of ASM use that favors monotherapy over polytherapy in achieving seizure control and improving the quality of life. The studies of Ezeala-Adikaibe *et al*conducted in the eastern part of Nigeria and Sanya and Musa [30]conducted in the Ilorin middle belt of Nigeria showed that carbamazepine was also the most commonly prescribed drug for epilepsy in those areas. In the study of Al-Zakwani *et al*[30]in Oman (Arabian Peninsula), the most common AED refill was sodium valproate (35.4%), followed by carbamazepine (30.8%) and lamotrigine (9.7%). However, none of the newer AEDs such as lamotrigine, levetiracetam, tiagabine, topiramate, and zonisamide, were used in these patients in our study, probably because of the cost and their unavailability in the country at that time. In our study, treatment adherence was poor as 88.4% missed their medication at least once within 6 months, and only 25.9% restricted themselves to only Orthodox treatment (table 2). The medication characteristics of the participants found in the previous study showed that 336 (35.7%) of the 940 PWEs recruited were not on medications, which raises questions about the therapeutic and diagnostic gaps in epilepsy in SSA countries. Additionally, the scarcity of essential medicines contributes to this problem, leaving many patients without access to vital treatments. The reported size of the epilepsy Treatment Gap varies widely from 23% to 100%, though there has been a progressive decline in SSA countries generally [21],[22], [23]. They found, that nearly a third of the participants did not receive ASM prescriptions; an immediate explanation for this cannot be attributed to the serious Treatment Gap, which may be worsened by other determinants of non-adherence to medication. The Treatment Gaps documented in another study range from 23% to as high as 90% [24]. Delayed presentation and seeking of alternatives to medicines, such as healing homes, herbalists, and other spiritual mission houses, have been attributed to the high rates of Treatment Gaps witnessed in low- and middle-income countries as witnessed in this Study where treatment adherence was poor as 88.4% missed their medication for at least once within the 6 months, and about 74.1% of them prefer Alternative medicine (Table 2). There are dramatic global differences in the care of epilepsy between high- and low-income countries, as well as between rural and urban settings [25][26] may have also contributed, as many of our participants were poorly educated(76.2%) and with low monthly incomes (83%). There is a substantial epilepsy TG in Nigeria, as indicated by Owolabi et al. on this issue. In SSA countries, the shortage of trained healthcare specialists, especially in rural areas, has broadened the burden of TGs in epilepsy. However, a recent approximation of the TGs in SSA countries indicated that the total prevalence was about 68.5% (95% confidence interval (CI): 59.5%–77.5%). Studies conducted in various parts of Nigeria have revealed epilepsy TGs ranging from 12.2% to 96%, which are comparable to the average value of 68.5% obtained in general for SSA countries and in our study, where over 80 % of them have poor adherence to their Medication for various reasons.

Alternative Traditional practices predominate in Africa as a form of Antiepileptic treatment, as shown in our study. The majority of participants were old patients (90%), females (82.4%) more than 40 years old (84.8%), who used more alternative treatment than orthodox treatment. This is similar to another study in Southeast East Nigeria [27], where TG was about 76 % and major contributors were mainly people who were never diagnosed and those who stopped medication of their own volition may be due to other reasons as observed in our findings that the treatment modalities used by the persons living with epilepsy (PWE) in the community at the time of the survey were traditional (herbal medicines) treatment (55%), spiritual (healing churches) treatment (66%), and orthodox (AED) treatment (24%). These modes of treatment were used either as lone therapy or in various combinations, therefore affecting their compliance rate to Orthodox Therapy. Another study across 3 sites in Nigeria [28] supported this, they found that the possible factors associated with failure to access care include stigma, cultural beliefs, difficulty reaching a health facility, and non-acceptance of diagnosis. They found that factors associated with non-adherence include cultural beliefs, afternoon seizures, learning difficulty, and difficulty reaching a health facility [28]. About ninety-three (83.0%) patients in our study with poor educational status used alternative treatment compared to 16 (45.7%) patients with tertiary educational status. Level of education has shown a significant variation in the mean score of quality of life in the Epilepsy scale-31 (QOLIE-31) in a previous study [29]. This is similar to the survey conducted in Indonesia, South Korea, and Georgia, whereby the level of education was one of the predictors of quality of life in patients with epilepsy [29] as seen in our study where male gender and tertiary educational status correlate well with the use of orthodox medicine. This could be due to the influence of education on individual perception of their disease condition and adherence to their medications. About seventy-seven (89.5%) patients in our study who defaulted from clinic attendance used alternative medicine compared with 32 (52.5%) patients who were non-defaulters (p-value 0.0001, 95%CI = 3.30-18.21). This appears to connect with the findings in another study [30] where the majority (57.1%) of the patients were not regular in their clinic attendance and, as such, practiced alternative medicine. Siddharth Kharkar et al [31] concluded that it would appear that there is more to the apparent socio-demographic difference in epilepsy care than race and income per se: they suggest that there could be unmeasured clinical/personal patient features such as seizure severity or patient attitudes and beliefs influencing treatment outcomes.

**Conclusion**

Epilepsy treatment in Nigeria is bedeviled by a tremendous treatment gap and will require a multi-dimensional approach. We found treatment adherence to be poor, as the majority of our patients missed their medication and only very few restricted themselves to Orthodox treatment.

There was a significant association between clinic default and the practice of alternative medicine, probably due to sociocultural influences, while newly recruited male patients who are tertiary educated are likely to attend the clinic regularly and adhere to orthodox treatment.

Furthermore, above a third of the PWEs had TGs, which significantly identifies TG as one of the

factors mitigating optimal epilepsy treatment among the PWEs, underscoring the need for a multifaceted strategy to address such gaps. To mitigate such TGs, healthcare providers should prioritize eliminating stigma and increasing public awareness of the condition, improving accessibility to healthcare services, and ensuring affordability and availability of ASMs. We should sustain the epilepsy awareness program in the country through different indigenously developed projects, in tandem with our sociocultural and religious beliefs, which will be acceptable to us with the cooperation of the Federal Ministry of Health, civil societies, and traditional and religious leaders. We may be able to change the mindset of our people through this collaborative campaign on a long-term basis.

**Study limitations**

The definition of appropriate treatment used in this study limited further evaluation of factors

such as sub-therapeutic dosage and use of AEDs for appropriate epilepsy syndrome/specific seizure types, as possible causes of the epilepsy treatment gap.

**REFERENCES**

1. World Health Organization. (2023, February 9): Epilepsy. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/ epilepsy.
2. Owolabi LF, Adamu B, Jibo AM, et al: Prevalence of active epilepsy, lifetime epilepsy prevalence, and burden of epilepsy in Sub-Saharan Africa from a meta-analysis of door-to-door population-based surveys. Epilepsy Behav 2020; 103 (Pt A):106846.
3. Ghosh S, Sinha JK, Khan T, et al. Pharmacological and therapeutic approaches in the treatment of epilepsy. Biomedicines 2021; 9:470.
4. Ba-Diop A, Marin B, Druet-Cabanac M, et al. Epidemiology, causes, and treatment of epilepsy in sub-Saharan Africa. Lancet Neurol 2014; 13:1029–44.
5. Bezawit Kassahun Bekele, et al: Epilepsy in Africa: a multifaceted perspective on diagnosis, treatment, and community support; Annals of Medicine & Surgery (2024) 86:624–627
6. Samia P, Hassell J, Hudson J, et al. Epilepsy research in Africa: a scoping review by the ILAE Pediatric Commission Research Advocacy Task Force. Epilepsia 2022; 63:2225–41.
7. OMS | Épilepsie. WHO [Internet]. World Health Organization; 2017; Available from: http://www.who.int/mediacentre/factsheets/fs999/fr/(Accessed 3 July 2018).
8. Housseini Dolo, et al: Community perceptions of epilepsy and its treatment in an onchocerciasis endemic region in Ituri, Democratic Republic of Congo; Infectious Diseases of Poverty (2018) 7:115 <https://doi.org/10.1186/s40249-018-0498-0>.
9. Maiga Y, Albakaye M, Diallo LL, Traoré B, Cissoko Y, Hassane S, et al. Current beliefs and attitudes regarding epilepsy in Mali. Epilepsy Behav. 2014; 33: 115–21.
10. Mahendran M, Speechley KN, Widjaja E. Systematic review of unmet healthcare needs in patients with epilepsy. Epilepsy Behav. 2017; 75:102–9. https://doi.org/10.1016/j.yebeh.2017.02.034.
11. Kisa R, Baingana F, Kajungu R, Mangen PO, Angdembe M, Gwaikolo W, et al. Pathways and access to mental health care services by persons living with severe mental disorders and epilepsy in Uganda, Liberia, and Nepal: a qualitative study. BMC Psychiatry. 2016; 16:305.
12. Nicholas A. Unlocking the hidden burden of epilepsy in Africa: Understanding the challenges and harnessing opportunities for improved care. Health Sci Rep 2023; 6:e1220.
13. Boling W, Means M, Fletcher A. Quality of life and stigma in epilepsy, perspectives from selected regions of Asia and Sub-Saharan Africa. Brain Sci 2018; 8:59.
14. Kaddumukasa M, Nalubwama H, Kaddumukasa MN, et al. Barriers to epilepsy care in Central Uganda, a qualitative interview and focus group study involving PLWE and their caregivers. BMC Neurol 2019; 19:161.
15. Agbetou M, Camara IF, Diallo LL, et al. Epilepsy and stigma in Africa: viewpoint of healthcare professionals and combat strategies. Seizure 2023; 107:172–6.
16. Hassen O, Beyene A: The effect of seizure on school attendance among children with epilepsy: a follow-up study at the pediatrics neurology clinic, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. BMC Pediatr 2020; 20:270.
17. Gosaye MekonenTefera, et al: Poor treatment outcomes and associated factors among epileptic patients at Ambo Hospital, Ethiopia; Gaziantep Med J 2015; 21(1):9-16.
18. Musa M. Watila, Salisu A. Balarabe et al: Epidemiology of Epilepsy in Nigeria; A Community based study from 3 Stites, Neurology 2021 Aug 17;97(7):e728-e738. Doi: 10.1212/WNL.0000000000012416. Epub 2021 Jul 12.
19. Abadi Kahsu Gebre and Amdemicheal Haylay: Sociodemographic, Clinical Variables, and Quality of Life in Patients with Epilepsy in Mekelle City, Northern Ethiopia; Behavioural NeurologyVolume 2018, Article ID 7593573, 6 pageshttps://doi.org/10.1155/2018/7593573.
20. Luqman Ogunjimi et al: Prescription patterns and therapeutic gaps among persons with epilepsy in Southwestern Nigeria; Frontiers in Pharmacology; 07 August 2024DOI 10.3389/fphar.2024.1430716
21. Komolafe, M. A., Sunmonu, T. A., Afolabi, O. T., Komolafe, E. O., Fabusiwa, F. O.,Groce, N., et al. (2012). The social and economic impacts of epilepsy on women in Nigeria. Epilepsy Behav. EB 24, 97–101. doi:10.1016/j.yebeh.2011.11.019.
22. Ogunrin, O. A., Adeyekun, A., and Adudu, P. (2013). Etiologies of epilepsy and health-seeking itinerary of patients with epilepsy in a resource-poor setting: analysis of342 Nigerian Africans. Seizure 22, 572–576. doi:10.1016/j.seizure.2013 .04.012.
23. Watila, M. M., Balarabe, S. A., Komolafe, M. A., Igwe, S. C., Fawale, M. B., Otte,W. M., et al. (2021). Epidemiology of epilepsy in Nigeria: a community-based study from 3 sites. Neurology 97, e728–e738. doi:10.1212/WNL.0000000000012416.
24. Assadeck, H., Toudou Daouda, M., Moussa Konate, M., Mamadou, Z., Hassane Djibo,F., Douma Maiga, D., et al. (2019). Clinical and etiological characteristics of epilepsy in people from Niger: a hospital-based study from a tertiary care referral center of Niamey, Niger. Epilepsia Open 4, 318–327. doi:10.1002/epi4.12325.
25. Owolabi, L. F., Owolabi, S. D., Adamu, B., Jibo, A. M., and Alhaji, I. D. (2020).Epilepsy treatment gap in Sub-Saharan Africa: a meta-analysis of community-based studies. Acta Neurol. Scand. 142, 3–13. doi:10.1111/ane.13246.
26. Singh, B., Mahajan, N., Singh, G., and Sander, J. W. (2022). Temporal trends in the epilepsy treatment gap in low- and low-middle-income countries: a meta-analysis; J. Neurol. Sci. 434, 120174. doi:10.1016/j.jns.2022.120174
27. P. O. Nwani, M. C. Nwosu,K. O. Enwereji, A. L. Asomugha, E. O. Arinzechi1, A. O. Ogunniyi; Epilepsy treatment gap: prevalence and associated factors in Southeast Nigeria; Acta Neurol Scand 2013: 128: 83–90 DOI: 10.1111/ane.12096.
28. S. Balarabe, M. Watilabi, M. Joseph, W. Ottedj, S. Igwe, M. Fawalef, G. Singhg, S. Josemir W: Epilepsy treatment gap and determinants of access to care in Nigeria; Journal of the Neurological Sciences 405S (2019) 105390.
29. Abadi Kahsu Gebre and Amdemicheal Haylay: Sociodemographic, Clinical Variables, and Quality of Life in Patients with Epilepsy in Mekelle City, Northern Ethiopia; Behavioural NeurologyVolume 2018, Article ID 7593573, 6 pageshttps://doi.org/10.1155/2018/7593573
30. Aduke E Ipingbemi: Management, treatment outcome and cost of epilepsy in a tertiary health care facility in northern Nigeria; Internet Journal of Medical Update. 2015 July;10 (2):25-36. doi: 10.4314/ijmu.v10i2.5.
31. Siddharth Kharkar, Jyoti Pillai, Dustin Rochestie, Zulfi Haneef: Socio-Demographic Influences on Epilepsy Outcomes in an Inner-City Population; Seizure 23 (2014) 290–294.