FULL-LENGTH ORIGINAL RESEARCH

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Prevalence of epilepsy in Bangladesh: Results from a national household survey

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Abstract

Objective: To determine the prevalence and types of epilepsy in Bangladesh.

Methods: We conducted a nationwide population-based cross-sectional survey among Bangladeshi population of all ages, except children under one month. We surveyed 9839 participants (urban, 4918; rural, 4920) recruited at their households using multistage cluster sampling. Trained physicians with neurology background confirmed the diagnosis of suspected epilepsy cases identified by interviewer-administered questionnaires. We reported the overall and sex, residence, and age

groups-specific prevalence of epilepsy per 1000 populations with 95% confidence interval.

Results: The national prevalence of epilepsy per 1000 was 8.4 (95% CI 5.6-11.1), urban 8.0 (4.6-11.4), and rural 8.5 (5.60-11.5). The prevalence in adult males and females was 9.2 (5.7-12.6) and 7.7 (3.6-11.7), respectively. The prevalence in children aged <18 years (8.2, 3.4-13.0 was similar to adults (8.5 (5.4-11.4). Among all epilepsy cases, 65.1% had active epilepsy. Their (active epilepsy) prevalence was 5.8 (3.5-8.1). Of them, 63.4% were not receiving treatment. Moreover, those who received allopathy treatment, 72.5% had low adherence leading to a high treatment gap.

Significance: Our findings out of this first-ever national survey were similar to other Asian countries. However, the prevalence of active epilepsy and treatment gap were considerably higher. This study serves useful evidence for tailoring interventions aimed to reduce the burden of epilepsy—primarily through targeted community awareness program—and access to antiepileptic treatment in health facilities in Bangladesh.

KEYWORDS

active epilepsy, adults, children, epilepsy type, perception, treatment gap

1 | INTRODUCTION

Epilepsy is a chronic disease of the brain that affects around 50 million people worldwide.[1] Although epilepsy is one of the world's oldest recognized conditions—misinterpretation, discrimination, and social stigma[2] are very common. Importantly, epilepsy predisposes people to injuries as well as premature deaths. It poses severe consequences, including poor quality of life and financial hardship to individuals, their families, and society. Epilepsy constitutes 0.5% of the global burden of disease. Therefore, the World Health Organization (WHO) recognizes it as a major public health problem.[1]

Although prevalent all over the world, 80% of the people with epilepsy live in developing countries.[3] At least 50% of cases begin at childhood or adolescence,[4] albeit it can occur at any age. A recent review on epilepsy in 23 Asian countries including Bangladesh reported the lifetime prevalence of epilepsy from 1.5 to 14.0 per 1000 population.[5,6]

Patients with epilepsy in developing countries hardly get any effective treatment.[7] Therefore, many epilepsy cases remain active. Because of the chronic nature of the disease, many people do not continue treatment, or they cannot afford the cost of medicine. Therefore, the epilepsy treatment gap remains very high all over the world, irrespective of economic status. It ranges from 10% in high-income countries up to 75% in low-income countries.[8]

Studies on epilepsy were conducted in small communities[9,10] or hospitals[11,12,13] in Bangladesh. There is no nationally representative study in Bangladesh for informing programs and policies. Therefore, we, for the first time,

Key Point

- No national-level survey in most of the countries including Bangladesh and most reporting data for adults with convulsive seizures
- This survey reported the nationally representative data on prevalence of epilepsy both in adults and children
- Prevalence of generalized tonic–clonic seizure, complex partial seizure, absence, myoclonic, infantile spasm, etc, is reported
- Epilepsy treatment gap in Bangladesh is very high and warrants public health interventions.

conducted a population-based household survey to determine the national prevalence of epilepsy in Bangladeshi population in all ages. We also estimated the epilepsy treatment gap and adherence to treatment.

2 | MATERIALS AND METHODS

2.1 | Study type and population

We conducted this nationally representative population-based cross-sectional household survey among the Bangladeshi population of all ages (except children aged <1 month) from January 2017 to May 2017. A total of

10 080 randomly selected respondents were enrolled to this survey based on the sample size calculated using the formula $[z^2 P (1-P)/d^2]$,[14] where z is the confidence level (1.96); assuming a prevalence of epilepsy in Bangladesh as 2.0%[15]; and margin of error d, half of prevalence (1%).[16] The initial sample size was 753 adjusted by a number of layers (urban-rural, male-female, and children-adults), design effect (1.5), and anticipated response rate (0.9) to get the final sample size of 10 040. Finally, we rounded it to 10 080 to recruit equal number (5040) from urban and rural areas to ensure minimum numbers for these two reporting domains.

2.2 | Study area and selections of PSUs

We selected respondents using a multistage geographically clustered sampling technique. Samples were drawn from 72 primary sampling units (PSUs) based on probability proportional to size of the administrative divisions of Bangladesh. Half of these PSUs were drawn from urban and half from rural areas as per classifications used by the national statistical office, the Bangladesh Bureau of Statistics. Bangladesh Bureau of Statistics provided us the PSU maps. To obtain the desired sample size, 140 households were selected from each PSU.

We selected PSUs randomly based on the concepts of population density proportion to the geographical location of 19 older districts of Bangladesh. Data collection started from the first household and then continued consecutively till the 140th household. From each household, only one respondent was selected. If a household had more than one eligible candidate, only one respondent was selected randomly by using the Kish Table.[17] For maintaining a sex ratio of 1:1, every odd household number was allocated for a male and even for a female respondent. Subsequently, the selected individuals (10 080) were invited for an interview at their home.

2.3 | Field team members and their training

Department of Neurology and Paediatric Neurology, National Institute of Neurosciences and Hospital (NINS) conducted the survey. The Institute is a tertiary care center for teaching, research, and clinical and surgical care of patients suffering from different neurological disorders. A group of expert neurologists and neurosurgeons renders these services.

We assigned seven field teams—composed of one field organizer and two enumerators led by one research physician in each team—for data collection. Research physicians had residency training in neurology. Field organizers and enumerators had at least a bachelor's degree and experience of conducting national-level surveys. We trained the field team for four days, using a manual, on the data collection

procedures and clinical identification of epilepsy cases before deployment to the field. Video demonstration was done for various types of epilepsy and non-epileptic cases mimicking epilepsy. Case demonstrations were done with in- and outpatients of the NINS.

2.4 | Data collection tool

We used the interviewer-administered questionnaire developed jointly by International League Against Epilepsy/ International Bureau for Epilepsy/ WHO[18] with country-specific adaptations, which was designed for administration by an interviewer. The questionnaire was validated in China and Brazil. It was applied, an adapted one, in two phases: 1) screening interview done by field enumerators to identify suspected cases to screen by applying first part; and 2) a confirmatory interview done by research physicians on the suspected epilepsy cases identified by enumerators to confirm the diagnosis of epilepsy. Further, we added five new questions to the second part to document types of seizures. Additional questions were included to obtain information on drug used to treat epilepsy, drug adherence, and perceptions related to epilepsy. The questionnaire was reviewed through four consultative meetings among relevant experts with technical guidance of WHO. Questionnaire was translated into Bangla, emphasizing the local meaning of terms in various locations of the country. Before finalization, the questionnaire was pretested in one urban and one rural non-participating PSUs. A brief training of the field team was repeated after the pretest.

2.5 | Operational definitions

We defined epilepsy as having two or more unprovoked epileptic seizures occurring twenty-four hours apart.[19] Epileptic seizures were confirmed and classified according to the International League Against Epilepsy Guidelines for Epidemiologic Studies on Epilepsy.[20] Active epilepsy was defined as two or more unprovoked epileptic seizures on different days in the prior year that are disabling to the individual.[21] The epilepsy treatment gap is the difference between the number of people with active epilepsy and the number whose seizures are being appropriately treated in a given population at a given point in time, expressed in percentage.[21]

2.6 | Data collection

The field organizers prepared the field activities at the study sites including the listing of the households as per the study protocol and selection of the respondent for interview by using Kish Table.[17] The enumerators interviewed

the selected individual (for minor, a senior member of the household) at their households for sociodemographic data, and information on suspected epilepsy applying the screening questionnaire. The suspected individuals were then interviewed by research physician. If respondents were not found at home, two recalls were made to recruit them. Research physicians took guidance, if necessary, from the divisional and central level investigators through video calls to confirm the diagnosis of suspected cases. Furthermore, to validate the recruitment of cases, the physician interviewed 1-in-14 non-suspected cases in each PSU. They also applied the 4-point Morisky Medication Adherence Scale (MMAS-4) for assessing the adherence to drug treatment of epilepsy cases.[22] Divisional investigators were the focal persons of their respective divisions to ensure that quality data were collected. Investigators and WHO technical team visited PSUs for supporting the field team, and randomly checked completed questionnaires, and re-interviewed several of participants.

2.7 | Data analysis

We weighted the data with a waiting variable so that the results conform to the population of Bangladesh in 2011[23] considering selection probabilities of PSU, household, sex, and individuals within the household. Calibration was done to replicate population distribution.[24] The sum of all calculated weights reflected a total population of approximately 127 million.

Percentage and mean (or median and interquartile range) were calculated for categorical and continuous data, respectively, as appropriate. The prevalence of epilepsy was calculated per 1000 with 95% confidence interval. We presented the data for sexes, location of residence, and age groups (children and adults) as per the design of the study. The data on medication adherence were presented into three categories: high adherence (score 0), medium adherence (score 1-2), and low adherence (score 3-4) as per the analysis guide of the MMAS-4.[22]

2.8 | Ethical considerations

We obtained ethical approval from the Ethical Review Committee of the National Institute of Neurosciences and Hospital and Bangladesh Medical Research Council. Consent and assent were obtained as per the guidelines of the Bangladesh Medical Research Council. For children under 12 years, information was obtained from their parents. Prior written consent (or thumb impression) of each respondent was obtained using consent or assent (from parents whose children were less than 12 years) form as appropriate. We maintained confidentiality of information at all stages.

3 | RESULTS

3.1 | Sociodemographic background of the subjects

Of the 10 800 invited people, 9838 participated (response rate, 97.6%). As per design of the study, almost half of them (4988) were female and half of them (4920) were from rural areas (Table 1). All subsequent data presented are weighted for national population and, hence, absolute numbers are not given. Of the total, less than half (44.8%) were children (1 month to 17 years), with mean (standard deviation) age of 8.7 (5.0) years. The mean age of the adults was 40.1 (15.7) years, and 30.4% reported no formal education. The majority of children (92.2%), aged 7-17 years, were enrolled in school. The occupational background has been analyzed for those aged 7 years or older (n = 8731) because children below 7 years do not have any occupation. Their schooling starts at the age of 5-6 years. The occupations in adult included industrial worker/ day laborers (18.1%) and professional work including business (8.6%). Among women, more than half (55.0%) were homemakers. More than a third (37.8%) of them were living in houses made of brick-concrete completely (*pukka* house) or partially (semi-*pukka*). Rest of the houses was made of tin, bamboo, polythene, gunny bag, straw, wood, etc (*kuccha* house).

3.2 | Screening questions and validation of diagnosis

Nine questions were asked to all participants to suspect a history of epilepsy (Table 2). Among them, 255 (2.5%) screened positive for suspected epilepsy. Out of the nine screening questions, the most commonly appreciated response was the uncontrolled involuntary movement of hands or legs (16.4%), which was followed by fall with the loss of consciousness (13.1%) and contact with surroundings (8.4%).

Physicians with neurology background re-interviewed the 255 screen positive respondents and 86 were confirmed as epilepsy. Screening was 100.0% sensitive and 98.3% (75.7-81.4) specific. In addition, we calculated an accuracy of 80.75% (78.0-83.2). We alert the reader to interpret these values with caution as only a small proportion of negatives were re-interviewed by the physicians. In addition, response of the caregivers for children to the screening questions could be underreported for epilepsy without convulsion.

3.3 | Prevalence of epilepsy

As mentioned above, 86 patients had confirmed epilepsy. The overall prevalence of epilepsy per 1000 was 8.4

Sociodemographic characteristics	All (n = 9838)	Male (n = 4850)	Female (n = 4988)
	number, unweighted		
Age group			
<18 y	2870	2241	629
≥18 y	6968	2609	4359
Residence			
Urban	4918	2431	2487
Rural	4920	2419	2501
	percent, weighted[a]		
Age group			
<18 y	44.5	40.6	47.5
≥18 y	55.5	59.4	52.5
Residence			
Urban	27.7	28.1	27.5
Rural	72.3	71.9	72.5
Educational level of adults (age ≥ 18 y)			
No formal education	30.4	27.5	33.0
Any primary (1-5 y)	25.9	25.3	26.4
Any secondary (6-10 y)	28.5	26.8	29.9
Higher secondary and above (≥11 y)	15.2	20.4	10.7
Primary occupation[b]			
Professional Occupation[c]	8.6	17.0	2.2
Industrial worker/ day laborer[d]	18.1	36.0	4.6
House work	31.4	0.0	55.0
Unemployed/ retired	5.0	8.0	2.8
Student	32.9	31.3	34.1
Others[e]	4.1	7.8	1.3
Main house made of			
Brick/concrete	37.8	36.1	39.2
Other than brick/concrete[c]	62.2	63.9	60.8

TABLE 1 Sociodemographic characteristics of the survey population

[a]Weighted to census population of Bangladesh in 2011

[b]For ≥ 7 y.

[c]Professional occupation includes service on desk, doctor/ engineer, business.

[d]Industrial worker/day laborer: day laborer, garment and industrial worker, farmer, rickshaw/van puller.

[e]Others: car driver, field worker, police/defense/guard, shopkeeper, weaver.

Made of tin, bamboo, polythene, gunny bag, straw, wood.

(5.7-11.1), in urban 8.0% (4.6-11.4), and rural 8.5% (4.9-12.1; Table 3). The prevalence in females was 7.7% (3.6-11.7) and in males 9.2% (5.9-12.6). The prevalence was also similar between children 8.2% (3.4-13.0) and adults 8.5% (5.5-11.4). Among the confirmed epilepsy cases, 56 (69.2%) had active epilepsy (defined by two or more unprovoked epileptic seizures on different days in the last one year). Its prevalence was 5.8 (3.5-8.1) per 1000 (Table 3), which was similar across sexes, age groups, and rural-urban areas of residence.

3.4 | Types of epilepsy

Among 86 confirmed epilepsy cases, almost seven in ten (67.2%, 51.3%-82.9%) had generalized epilepsy followed by partial epilepsy (28.6%, 12.5%-44.7%), and unclassified (4.2%; Table 4). This pattern was persistent across sex, age, and residence categories. Among the generalized epilepsies, tonic-clonic (54.3%), absence (7.45), tonic (3.9%), and myoclonic (1.6%) seizures were prevalent. Among the partial types, we found partial seizure secondary generalized

TABLE 2 Results of screening per 1000 (95% confidence interval)[a]

Screening questions on	Sex			Age group		Residence	
	All (n = 9838)	Male (n = 4850)	Female (n = 4988)	Child[b] (n = 2870)	Adult (n = 6968)	Rural (n = 4920)	Urban (n = 4918)
Uncontrolled movements of arms and legs ever	16.4 (12.8-19.9)	15.6 (10.9-20.2)	16.9 (11.7-22.2)	15.4 (9.4-21.3)	17.2 (13.3-21.1)	17.3 (12.9-21.6)	14.1 (8.2-19.9)
Fall and loss of consciousness due to seizure	13.1 (9.4-16.7)	9.4 (6.1-12.7)	15.9 (9.6-22.3)	10.5 (5.2-15.9)	15.1 (10.7-19.5)	10.5 (5.2-15.9)	15.1 (10.7-19.5)
Tongue bite due to loss of consciousness	5.7 (3.6-7.7)	4.3 (2.2-6.31)	6.8 (3.4-10.1)	5.2 (1.8-8.5)	6.1 (3.9-8.2)	5.2 (1.9-8.5)	6.1 (3.9-8.2)
Fall with injury due to loss of consciousness	6.8 (4.5-9.1)	5.1 (2.6-7.6)	8.1 (4.6-11.6)	4.2 (1.6-7.4)	8.9 (5.5-12.1)	4.2 (1.1-7.4)	8.8 (5.6-12.1)
Urinate/ defecate due to loss of consciousness	4.7 (2.9-6.4)	4.3 (2.1-6.6)	4.9 (2.2-7.7)	4.5 (1.2-7.9)	4.8 (2.8-6.8)	4.5 (1.2-7.9)	4.8 (2.8-6.8)
Twitching of arm, leg or face due to seizure	5.6 (3.6-7.6)	6.3 (3.6-9.1)	5.1 (1.9-8.2)	4.7 (1.6-7.8)	6.3 (3.9-8.8)	4.7 (1.6-7.8)	6.3 (3.8-8.8)
Loss of attention/ cease conversation or work and stare vacantly	8.4 (5.9-11.0)	8.3 (5.1-11.4)	8.5 (4.3-12.8)	10.1 (5.1-15.1)	7.1 (4.1-10.0)	10.1 (5.1-15.1)	7.1 (4.1-10.0)
Repeatedly drop things unmindfully due to shaking of hands	5.0 (3.1-6.9)	5.2 (2.7-7.8)	4.9 (2.3-7.5)	4.8 (1.9-7.7)	5.2 (2.6-7.9)	4.8 (1.9-7.7)	5.2 (2.6-7.9)
Someone informed that s/he has epilepsy	4.3 (2.9-5.8)	5.8 (2.7-8.9)	3.2 (1.6-4.8)	3.6 (1.0-6.3)	4.9 (2.9-6.9)	3.6 (2.9-6.9)	4.9 (2. 9- 6.9)
Total screening status ("yes" to ≥ 1 among nine screening questions)	24.9 (19.9-29.9)	22.0 (16.6-27.4)	27.2 (18.9-35.4)	23.6 (16.5-30.8)	25.9 (20.4-31.5)	24.1 (17.8-30.4)	27.0 (19.9-29.5)

[a]In total 255 screen positive participants

[b]1 month - <18 y old

TABLE 3 Prevalence of epilepsy and active epilepsy per 1000 (95% confidence interval) by age group, sex, and residence

Age group	All (n = 9838)	Sex		Age group		Residence	
		Male (n = 4850)	Female (n = 4988)	Child[a] (n = 2870)	Adult (n = 6968)	Rural (n = 4920)	Urban (n = 4918)
Epilepsy (n = 86)	8.4 (5.7-11.1)	9.2 (5.9-12.6)	7.7 (3.6-11.7)	8.2 (3.4-13.0)	8.5 (5.5-11.4)	8.5 (4.9-12.1)	8.0 (4.6-11.4)
Active epilepsy (n = 56)	5.8 (3.5-8.1)	6.2 (3.3-9.1)	5.5 (1.8-9.2)	5.2 (1.3-9.0)	6.3 (3.8-8.8)	6.4 (3.3-9.5)	4.3 (1.8-6.7)

[a]1 month-<18 y old.

(14.9%), complex partial (9.1%), and simple partial (4.6%) seizures. We did not find any case of infantile spasm.

3.5 | Knowledge and treatment

Three-fourth (75.9%, 64.7-87.0) of our sample knew that epilepsy is a disease. More than half (58.0%, 49.0-67.1) believed that epilepsy improves with allopathic medication (data not shown). Despite this, treatment situation was very poor (see below) because many people were not aware of their diagnosis.

Among those who had epilepsy, appropriate antiepileptic treatment with allopathic medicine using appropriate dosage was 4.7%, and the rest had either inappropriate drug (31.9%) or no treatment (63.4%) was received (Table 5). Therefore, 95.3% had treatment gap (the percentage of people with active epilepsy who are not being appropriately treated or not treated at all). Among those who were receiving treatment, allopathic medicine was taken by 78.3%. The commonly allopathic used drugs, in descending order, were valproic acid (39.4%), phenobarbitone (12.6%), and carbamazepine (4.6%). Others were phenytoin, clonazepam, diazepam, and topiramate as a single drug or in combination.

We have estimated adherence to treatment among those who were receiving allopathic treatment. Despite high level of knowledge, treatment adherence was poor. According to the MMAS-4, 72.5% had a low level of adherence to antiepileptic treatment (Table 5). Poor adherence among the epilepsy patients was mainly because they did not know that allopathic medications are effective for epilepsy, and high price of these medicines (data not shown).

3.6 | Factors associated with treatment gap

We have done bivariate contingency table analysis to examine the relationship of age, sex, residence, education, and house type with treatment gap (Table 6). None of them had statistically significant relation with treatment gap. Then, we have done multivariate logistic regression analysis (data not shown) having all independent variables in the model to find out relationship of a variable, adjusted for all other variables in the model, with treatment gap. This analysis also confirmed that there is no statistically significant relation of any of these variables with treatment gap.

4 | DISCUSSION

This is the first household survey in Bangladesh that reports national prevalence of epilepsy and active epilepsy in both adults and children. We report that the prevalence of epilepsy in Bangladesh is 8.4 per 1000 population. This is similar to other South Asian countries: Thailand (7.2),[25] Nepal (7.3),[26] Pakistan (10),[6] Sri Lanka (9.0),[27] and India (5.7).[28] Unlike the national surveys elsewhere, the present survey obtained data not only for GTCS but also other types of seizures. To our knowledge, this is the first country-level household survey that reported the prevalence of epilepsy both in adults and children.

The diagnosis of epilepsy in children is very challenging because of varied clinical manifestations which may mimic other non-epileptic events that may result in either over/ under diagnosis.[28] In addition to social stigma in this growing child—which has to be borne throughout life—minor seizures like absence, atonic seizure, or aura of complex partial seizures may be overlooked by parents/ caregivers. Usually prevalence is more in children than adult and it is also more common in developing countries. In our study, the prevalence of epilepsy in children is almost equal to adult, which needs more exploration. However, we think that the caregiver who gave information about minor children at screening stage might have underreported non-seizure features of epilepsy due to ignorance or stigma. In developed countries, the prevalence of epilepsy follows a bimodal distribution with the first peak in childhood and another in older age.[28] We have not seen such a double-peak in our sample. Our adults are younger, compared to population of developed countries, to demonstrate such as peak.

The most frequently observed seizure was GTCS followed by partial epilepsy. These observed frequencies are similar

TABLE 4 Types of epilepsy according to sex, age, and residence groups in Bangladesh

| Types of epilepsy | All (n = 86) | Sex | | Age group | | Residence | |
		Male (n = 47)	Female (n = 39)	Child[a] (n = 33)	Adult (n = 53)	Urban (n = 40)	Rural (n = 46)
Generalized	67.2 (51.3-82.9)	68.3 (50.7-85.9)	66.1 (39.3-92.8)	54.9 (25.6-84.2)	76.7 (63.7-89.8)	61.4 (37.4-85.4)	69.2 (49.2-89.3)
Partial	28.6 (12.5-44.7)	26.7 (10.1-43.4)	30.3 (2.8-57.8)	39.7 (9.0-70.3)	19.9 (7.7-32.2)	28.8 (10.1-47.4)	28.5 (7.7-49.4)
Unclassified[b]	4.2 (-)	4.9 (-)	3.6 (-)	5.5 (-)	3.3 (-)	9.8 (-)	2.2 (-)

[a]Children are 1 month- < 18 y of age.

[b]Confidence intervals are not given because of small numerators.

to other community-based surveys from several countries like China,[29] Egypt,[30] Pakistan,[31] Turkey,[32] and Cambodia.[33] However, one should keep in mind that the use of an electroencephalogram could provide different labeling of types of epilepsy. One has to appreciate that it is not yet a realistic choice in a developing country like ours, especially for a household survey.

More than half (60.7%) of persons with epilepsy did not receive any treatment, which is higher than the ILAE/IBE/WHO study in China (41%).[34] Among treatment recipients, majority (82.5%) had taken antiepileptic drugs, and only a small proportion (15.0%) used traditional medicine which was quite high in the Chinese study (42.7%).[35] Approximately 70% of epilepsy can become seizure-free once the most effective regime is used, but the evidence for medication adherence is suboptimal. Poor adherence to antiepileptic drugs is associated with increased mortality, emergency department visits, and hospitalizations, fractures, and head injuries. Seizure risk is also 21% higher among non-adherent.[36] Thus, non-adherence to antiepileptic drug therapy is a common and serious problem. One study reported a low or medium adherence in 58% of their subjects.[37] However, in our sample, we had 66.7% of the low adherence group alone. A recent meta-analysis on active epilepsy demonstrated the median prevalence of active epilepsy as 4.9 per 1000 for developed countries and 12.7 per 1000 and 5.9 in rural and urban studies in developing countries.[34] Our prevalence of 8.4 per 1000 falls within this range.

Earlier reports have suggested a treatment gap of more than 90% in many developing countries.[8] However, in a more recent systematic analysis found rates exceeding 75% in most low-income countries, 50% in most lower-middle- and upper-middle-income countries, and less than 10% in many high-income countries.[18] We observed very high (95.3%) treatment gap among active epilepsy cases in the current survey, which corroborates with findings from developing countries that ranged from 80.0% to 94.0%.[8] Treatment gap in our study is slightly higher than the Asian countries where the treatment gap ranges from 50% and 80%[6] in most countries. Despite knowledge on epilepsy and its appropriate treatment, non-adherence to antiepileptic medications is high. This denotes the need for counseling by healthcare providers to the epilepsy patients and their caregivers.

The present survey is the first-ever national study in Bangladesh that reports prevalence, in children and adults, and types of epilepsy. Our survey has high response rate in urban and rural areas which adds strength to this study. We reported data on the prevalence of epilepsy for only two age groups (children and adults) by urban and rural distributions. The current survey design and its calculated sample size did not permit to present the data on the prevalence of epilepsy

TABLE 5 Epilepsy treatment situation[a] according to age, sex, and residence

Treatment situation for active epilepsy	All	Sex		Age group		Residence	
		Male	Female	Child[b]	Adult	Rural	Urban
Treatment gap (n = 56)							
a. Appropriate antiepileptic drug treatment	4.7	10.0	0.0	8.7	2.0	3.0	11.2
b. Inappropriate antiepileptic drug treatment	31.9	42.6	22.7	28.1	34.6	32.5	29.8
c. Received no treatment	63.4	47.5	77.3	63.2	63.5	64.5	59.0
d. Treatment gap (b + c)	95.3	90	100	91.3	98	97.1	88.8
Treatment pattern sources[c] (n = 40)							
a. Allopathy	78.3	72.9	72.9	100.0	67.8	75.6	89.8
b. Homeopathy	1.5	0.0	4.4	0.0	2.3	1.9	0.0
c. Traditional *kobiraji*	20.2	18.8	22.7	0.0	29.9	22.5	8.2
Adherence to treatment[d] (n = 33)							
a. High Adherence (score = 0)	8.0	8.3	7.6	1.1	13.0	9.1	4.2
b. Medium Adherence (score = 1-2)	19.5	21.4	15.5	28.4	13.1	18.6	22.4
c. Low Adherence (score = 3-4)	72.5	70.3	76.9	70.5	73.9	72.2	73.4

[a]Results are given as percent; 95% confidence intervals are not reported because most of the cells are small.

[b]Children are 1 month-< 18 y of age.

[c]Those who are taking any treatment out of 86 diagnosed epilepsy patients.

[d]Based on Morisky Medication Adherence 4 point scores in those who are taking allopathy treatment.

TABLE 6 Treatment gap according to the sociodemographic factors among patients with active epilepsy[a] (n = 56) in Bangladesh

Sociodemographic factors	Treatment gap, weighted %		
	Yes	No	P[b]
Age			
Children (age < 18 y)	91.3	8.7	.55
Adults (>=18 y)	98	2.0	
Sex			
Male	90.0	10.0	.29
Female	100.0	-	
Residence			
Rural	97.0	3.0	.67
Urban	88.8	11.2	
Education			
None or primary	94.3	5.7	.99
Above primary	96.9	3.1	
House type			
Brick/concrete	95.3	4.7	.99
Other than brick/ concrete[c]	95.4	4.6	

[a]Active epilepsy was defined as two or more unprovoked epileptic seizures on different days in the prior year that are disabling to the individual (20).

[b]Chi-square test with Yates correction.

[c]Made of tin, bamboo, polythene, gunny bag, straw, wood.

by further age groups and geographical areas (eg, division). In addition, we could not validate diagnosis against any electro-physiological method.

5 | CONCLUSION

Our survey documented the high burden of active epilepsy, treatment gap, and no-adherence to medication. The primary generalized tonic-clonic seizure is the most prevalent type of epilepsy found in both children and adults. These findings underscore the importance of health system interventions to mitigate this burden. Raising public awareness, early detection, and reducing the treatment gap through the essential health services package could be a pivotal strategy. Training of health workforce and supply of medicines may contribute substantially to the welfare and safety of patients with epilepsy in line with the WHO Mental Health Gap Action Programme/ mhGAP.

CONFLICTS OF INTEREST
None of the authors has any conflict of interest to disclose. The authors alone are responsible for their views expressed in this article, which do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated. 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.

AUTHOR CONTRIBUTION

The study was conceptualized by Professor Quazi Deen Mohammad (DM), Professor Dr Narayan Chandra Saha (NS), Professor Mostafa Zaman (MZ), and Professor Md Badrul Alam (BA). Literature review was accomplished by NS, MZ, Dr Azimul Haque (AH), Dr Rajib Narayan Chowdhury (RC), and Dr Ferdous Hakim (FH). Study design and sampling were prepared by MZ, Mohammad Moniruzzaman (MM), and NS. Study proposal, questionnaire with translation into Bangla and field testing, training manual were drafted, and training was conducted by NS, MZ, MM, AH, RC, Dr Ariful Islam (AI), Dr Mohammad Enayet Hussain (EH), Dr Yamin Shahriar Chowdhury (YC), and AH. The proposal and ethical aspects were critically reviewed by Dr Nazneen Anwar (NA). The data collection, supervision, and quality assurance measures were taken by all investigators, especially Drs Shakawat Hossain, Mahmood Ahmed Chowdhury, Matiur Rahman, Bikash Kumar Majumder, Abdus Salam, Amitabh Sarker, and Md Kafiluddin. Data cleaning, weighting, and analysis were done by Mr Rijwan Bhuiyan (RB) and FH under guidance of MZ. Results were critically interpreted by MZ, MM, and BA. NS conceptualized prepared the first draft of the manuscript which was reviewed, revised and finalized by MZ, NA, DM, BA, MM, and FH with feedback from all authors. DM is the guarantor of data.

CONSENT TO PUBLISH

All authors consented to the publication of this manuscript.

DATA AVAILABILITY STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on a reasonable request.

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