Bangladesh Medical Res Counc Bull 2024; 50: 135-140 DOI: 10.3329/bmrcb.v50i3.78144

RESEARCH PAPER

Epidemiology of Lightning Related Deaths and Injuries in Bangladesh in 2018

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Abstract

Background: A lightning strike is an electric discharge between atmosphere and an object. It can produce severe injuries and deaths. Worldwide, mortality from lightning is estimated at between 0.2 and 1.7 deaths per 1000000 population, affecting mainly the young and people who work outdoors.

Objective: The study was designed to find out the epidemiology of lightning related deaths and injuries in Bangladesh in 2018.

Methods: The cross sectional descriptive study or content analysis was carried out in Mymensingh Medical College, Bangladesh from November 2019 to April 2020. The contents of reports on lightning events occurred in 2018, published in three top circulated daily national newspapers were analyzed with SPSS version 22.0.

Results: A total of 247 lightning events were reported in 2018. A total of 379 persons were affected by lightning strikes. Mean age of the affected persons was 33.74 years with a standard deviation of 16.13 years. Majority (317, 83.6%) were male and the remaining 62 (16.4%) were female. Majority (111, 29.3%) of the affected persons were farmer. Most of the event (120, 48.6%) occurred in the month of May followed by in April (50, 20.2%) and September (28, 11.3%). Majority of the lightning (74, 30.0%) stroke in the field, while 45 (18.2%) stroke in river, pond, lake or in the haor areas. Maximum lightning events 73 (29.6%) occurred in the evening; followed by 56 (22.7%) in the morning and 23 (9.3%) at night. Out of 379 affected persons, 296 (78.1%) died and 83 (21.9%) were injured but survived. Lightning related mortality was 1.8 deaths per 1000000 population in Bangladesh in 2018.

Conclusion: Lightning related mortality in Bangladesh in 2018 was 1.8 deaths per 1000000 population which was much more higher than 0.9 deaths per 1000000 population in 2010. The incidence of thunderstorms are increasing in Bangladesh and often farmers working in the field and people on the road are affected. Policy makers should take necessary steps to decrease the events of lightning and to minimize the mortality and morbidity due to lightning strikes. People should be aware of danger of lightning and stay safe while lightning strikes.

Key words: Epidemiology, Lightning, Injuries, Deaths, Bangladesh.

Introduction

A lightning strike is an electric discharge between the atmosphere and an object. They originate in a cloud and discharged into the ground. About 25% of all lightning events worldwide strike between the atmosphere and earth-bound objects.[1] Strikes of lightning can cause severe injuries.[2] These have a mortality rate of between 10% and 30%. Up to 80% of survivors have sustaining long-term injuries. Nerves and muscles may be directly damaged by the high voltage which produce holes in their cell membranes. The process is called electroporation.[3]

In 2014 researchers found that lightning strikes were expected to raise by 12% for every degree Celsius of warming. They forecast to have a 50% increase in lightning events by the end of the century.[4] Several climatologists warned that erratic climate changes are producing more water evaporation from the ocean and land. As a result, clouds and rainfalls are increasing which are the potential for lightning storms. They also assumed that as the global temperature is raising, more explosive lightning events will occur in future. Government of Bangladesh (GOB) perceived its importance and has added lightning strikes to the list of official types of disasters of Bangladesh in 2016.[4]

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According to National Fire Protection Association, 70% deaths happen in direct lightning strike. Side flash happens while standing near a tree. Similar consequences like direct strike occur when the victim is in contact with the struck object. Morbidities or injuries include burns and paralysis which are usually temporary. A number of deaths were reported to have occurred from telephone usage while lightning.[4]

Growth of population of a country and destruction or disappearance of many tall trees are related to raising the number of deadly lightning strikes. In addition to this, increasing use of metal farm equipment in the open fields, using telephones or mobile phones during lightning, taking shelter near electrical power towers or metal cellphone towers, standing under trees during electrical storms and many other causes are responsible for increased lightning related deaths in Bangladesh.[4] Global mortality due to lightning was estimated in between 0.2 and 1.7 deaths per 1000000 population. It is affecting mainly the young and the people who work outdoors.[5,6] Over 20000 people are affected by lightning and several thousand surrender to their injuries every year.[7] Another research report showed worldwide lightning killed some 2000 people each year.[8]

Only a few studies have been conducted on lightning in Bangladesh. These studies revealed that the number of lightning incidents in the Bangladesh is quiet high.[9,10] A study showed that in Bangladesh, the incidence of lightning fatalities was 0.9 per 1000000 population per year, which was higher than in developed countries.[11] In Bangladesh, some 1,476 people died as a result of lightning strikes during 2010-2016.[12] Before 1981, Bangladesh witnessed thunderstorms or lightning on average nine days of each May. It was found that after that time the number of lightning strikes in Bangladesh increased to an average of 12 days of each May.[12] The Ministry of Disaster Management and Relief set up some sensors in Dhaka, Chattogram, Tentulia in Panchagarh, Badalgachi in Naogaon, Mymensingh, Sylhet, Khulna's Kayra, and Patuakhali which are capable of pinpointing lightning-prone areas and providing early warnings on incidence of lightning.[13]

This study was designed to find out the epidemiology of lightning related deaths and injuries in Bangladesh in 2018. The study results will help the government to identify population at risk, to enlist the danger areas of lightning and to take necessary measures to minimize the devastating effects of lightning. It will also help people to be aware of danger of lightning.

Materials and Methods

The cross sectional descriptive study or content analysis was carried out in Mymensingh Medical College, Bangladesh during the period of November 2019 to April 2020. The contents of reports on lightning events occurred in 2018, published in three top circulated daily national newspapers of Bangladesh were analyzed to fulfil the objectives of the study. Three daily Bangla newspapers of top circulation- namely The Daily Bangladesh Protidin, The Daily Ittefaq and The Dialy Prothom Alo were selected purposively for the study. All issues of the selected newspapers of the year 2018 were included in the study. Selected newspapers were collected from District National Library of Mymensingh and from local newspaper seller. Data collectors went through all the reports on lightning and recorded the necessary information on the pre-designed checklist or data sheet. Collected data were input into SPSS version 22.0. Qualitative variables were summarized by percentage and quantitative variables were summarized by mean and standard deviation. No physical or psychological risk was associated with the study as the study did not involve any human subject.

Results

Content analysis was conducted with the reports on lightning events published in all issues of three national daily newspapers of Bangladesh in 2018.

The study results revealed that a total of 247 lightning events were reported in the selected newspapers. About half (117, 47.4%) of the events of lightning were reported in the Daily Bangladesh Protidin followed by 56 (22.7%) in the daily Ittefaq and 55 (22.3%) in the Daily Prothom Alo Eleven (4.5%) lightning events were reported both in the Daily Ittefaq and the Daily Bangladesh Protidin. Six (2.4%) events were found in both the daily Prothom Alo and the Bangladesh Protidin. Two (0.8%) lightning events were reported in all the three newspapers (Table I).

Table I: Lightning events reported in the top 3 (three) circulated daily newspapers of Bangladesh in 2018 (n=247)

Newspaper	Number (n)	Percent (%)
The Bangladesh Protidin	117	47.4
The Daily Ittefaq	56	22.7
The daily Prothom Alo	55	22.3
The Daily Ittefaq and The Daily Bangladesh Protidin	11	4.5
The daily Prothom Alo and The Bangladesh Protidin	6	2.4
The daily Prothom Alo, The Daily Ittefaq and The Bangladesh Protidin	2	0.8
Total	247	100.0

Among 247 lightning events, maximum (120, 48.6%) occurred in the month of May. Fifty (20.2%) events occurred in April and 28 (11.3%) in September. Reported lightning events of June, July and August were 23 (9.3%), 15 (6.1%) and 6 (2.4%) respectively (Table II). Maximum 73 (29.6%) occurred in the evening; followed by 56 (22.7%) in the morning and 23 (9.3%) at night. In case of 95 (38.5%) events, the time of lightning strikes was not mentioned in the reports.

Table II: Distribution of lightning events and affected persons by month in 2018

Month	Lightning events		Affected persons	
	Number (n)	Percent (%)	Number (n)	Percent (%)
March	3	1.2	9	2.4
April	50	20.2	66	17.4
May	120	48.6	177	46.7
June	23	9.3	34	9.0
July	15	6.1	22	5.8
August	6	2.4	7	1.8
September	28	11.3	58	15.3
October	2	0.8	6	1.6
Total	247	100.0	379	100.0

Maximum (52, 21.1%) lightning events occurred in Dhaka division. Thirty nine (15.8%) events occurred in Khulna and 38 (15.4%) in Sylhet division. Reported lightning events of Mymensingh, Rajshahi and Rangpur were 27 (10.9%), 27 (10.9%) and 26 (10.5%) respectively. Twenty one (8.5%) events occurred in Chittagong and the lowest 17 (6.9%) occurred in Barishal division (Table III).

Table III: Distribution of lightning events and affected persons by administrative divisions of Bangladesh in 2018 (n=247)

Division	Lightning events		Affected persons	
	Number (n)	Percent (%)	Number (n)	Percent (%)
Dhaka	52	21.1	72	19.0
Khulna	39	15.8	60	15.8
Sylhet	38	15.4	62	16.4
Mymensingh	27	10.9	54	14.2
Rajshahi	27	10.9	39	10.3
Rangpur	26	10.5	35	9.2
Chittagong	21	8.5	33	8.7
Barishal	17	6.9	24	6.3
Total	247	100.0	379	100.0

Maximum (74, 30.0%) occurred in the field. Forty five (18.2%) events occurred in river, pond, lake or in the haor areas; 20 (8.1%), 18 (7.3%) and 5 (2.0%) events occurred in street, house and under the tree respectively. Three (1.2%) lightning events occurred in the market and 2 (0.8%) lightning stroked in the school. In case of 80 (32.4%) lightning events the place of occurrence was not mentioned in the reports.

A total of 379 persons were affected by lightning strikes in Bangladesh in 2018. Among them maximum (298, 78.63%) were in the age group of 11 to 50 years. Children of age 10 years or below were 17 (4.5%). Forty nine (12.0%) affected persons were in the age group of 51-60 years. Old aged people of age 61-80 were 15 (3.9%). Mean age of the affected persons

was 33.74 years with a standard deviation of 16.13 years. Among 379 affected persons majority (317, 83.6%) were male and the remaining 62 (16.4%) were female (Table IV).

Table IV: Socio-demographic characteristics of the affected individuals (n=379)

Socio-demographic characteristics	Number (n)	Percent (%)
Age* group in years		
0-10	17	4.5
11-20	75	19.8
21-30	91	24.0
31-40	77	20.3
41-50	55	14.5
51-60	49	12.0
61-70	10	2.6
71-80	5	1.3
*Mean ± SD = 33.74 ± 16.13 years		
Gender		
Male	317	83.6
Female	62	16.4
Occupation		
Farmer	111	29.3
Student	66	17.4
Fisherman	24	6.3
Housewife	17	4.5
Day labourer	16	4.2
Pre-school children	5	1.3
Businessman	1	0.3
Govt. Service	1	0.3
Not mentioned in the report	138	36.4

It was observed that majority (111, 29.3%) were farmer. Sixty six (17.4%) were students followed by 24 (6.3%) were fisherman, 17 (4.5%) housewife, 16 (4.2%) day laborer and 5 (1.3%) were pre-school going children. Each 1 (0.3%) were businessman and government service holder (Table IV).

Among 379 affected persons, maximum (72, 19.0%) were from Dhaka division. Sixty two (16.4%) were from Sylhet and 60 (15.8%) from Khulna division. Fifty four (14.2%), 39 (10.3%) and 35 (9.2%) affected persons were of Mymensingh, Rajshahi and Rangpur respectively. Thirty three (8.7%) affected persons were from Chittagong division and the lowest 24 (6.3%) were from Barishal division (Table III).

Maximum (177, 46.7%) were affected in the month of May. Sixty six (17.4%) were affected in April and 58 (15.3%) in September. Affected persons in June, July and August were 34 (9.0%), 22 (5.8%) and 7 (1.8%) respectively. Nine (2.4%) were affected in March and 6 (1.6%) were affected in the month of October (Table II). Among 379 affected persons maximum 117 (30.9%) affected in the evening; followed by 76 (20.1%) in the morning and 40 (10.6%) at night (Figure 1).

The majority of the persons were affected in the field; 65 (17.2%) were affected in the river, pond, lake or haor. Thirty three (8.7%) persons were affected in the street, 37 (9.8%) in the house, 6 (1.6%) under the tree, 8 (2.1%) in the market and 5 (1.3%) in the school. In case of 124 (32.7%) affected persons place of occurrence was not mentioned.

A total of 379 persons were affected by lightning strikes in Bangladesh in 2018. Among them 296 (78.1%) died and 83 (21.9%) were injured but survived (Figure 2).

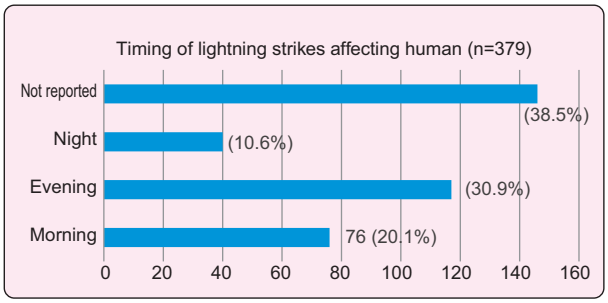

Figure 1: Bar diagram showing timing of lightning strikes affecting human in Bangladesh in 2018 (n=379).

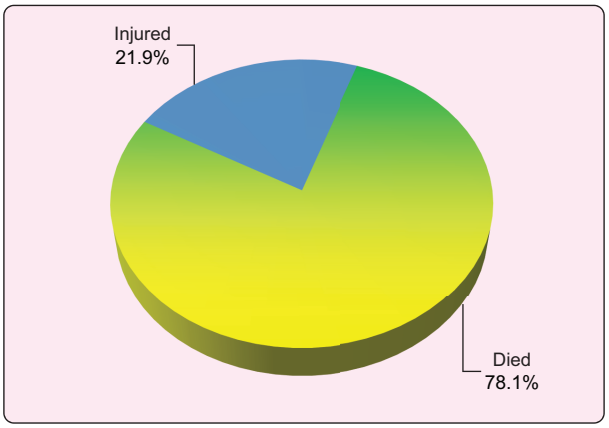

Figure 2: Effect of lightning strikes on human in Bangladesh in 2018 (n=379)

Total population of Bangladesh in 2018 was 161356039.[14] The study result revealed that a total of 296 people died due to lightning strikes in 2018. So, calculated mortality was (296/161356039X1000000) 1.8 deaths per 1000000 population.

Discussion

The Daily Star reported a total of 645 lightning related death in Bangladesh during 2010 to 2015 i. e. on an average 108 people died due to lightning strikes each year in Bangladesh.[15] This study found 296 deaths in 2018 which is much higher than the report of the Daily Star. The Daily Star report mentioned lightning strikes most in May in Bangladesh.[15] In this study the lightning events and the number of affected person were also highest in May as May is the month having more climatic events like heatwaves, rain and storms as well as lightning.

In this study male farmers were affected more by lightning because they frequently work in the field even during rain and storms. The study result revealed that a total of 296 people died due to lightning strikes in 2018. Mortality found in this study was 1.8 deaths per 1000000 population which was a bit higher than the worldwide mortality of 0.2 to 1.7 deaths per 1000000 population.[5,6] Another study in Bangladesh in 2010 found lightning related fatality rate as 0.9 deaths per 1000000 population per year[11] which was much lower than the findings of this study. This finding indicated the increase of mortality due to lightning in Bangladesh.

A study carried by the University of Berkeley in 2014, lightning strikes is expected to increase by 12% for every degree Celsius of warming, with a 50% rise in lightning expected by the end of the century.[4] The study results revealed that among the affected person 296 (78.1%) died and 83 (21.9%) were injured but survived. As per National Fire Protection Association, 70% deaths happen in direct strike.[4]

Lightning incidents are not often reported and no concrete report on lightning deaths was found in India but their scientists estimated the number was more than 3000 each year. In 2012, more than 130 deaths due to lightning were reported in Nepal. In South Africa on an average 260 deaths are reported each year. Even in the developed country like United States, tracking lightning incidents is tricky. As a result, there is no universal database to be mentioned or considered.[4] However, the number of deaths as a result of lightning is lower in the United States than in developing countries. Twenty three (23) people died in the United States due to lightning strikes as per reports of the National Oceanic and Atmospheric Administration of USA. Chandima Gomes who was the head of the Center for Electromagnetic and Lightning Protection Research at the University of Putra Malaysia, reported the losses of about 100 million USD each year in Malaysis.[4]

Conclusion

Lightning related mortality in Bangladesh in 2018 was 1.8 deaths per 1000000 population which was much higher than 0.9 deaths per 1000000 population in 2010. The incidence of thunderstorms are increasing in Bangladesh and often farmers working in the field and people on the road are affected. Policy makers should take necessary steps to decrease the events of lightning and to minimize the mortality and morbidity due to lightning strikes. People should be aware of danger of lightning and stay safe while lightning strikes. Further research is necessary to generate updated data on lightning and its effects on human and animal.

Acknowledgement

The authors express gratitude to the then authorities of Bangladesh Medical Research Council (BMRC) for accepting the research proposal and providing fund for conducting the research.

Conflict of Interest: No conflicts of interest.

Funding Source: Funding was provided by the Bangladesh Medical Research Council (BMRC)

Ethical Clearence: Bangladesh Medical Research Council (BMRC)

Submit Date: 03 December, 2024

Accepted: 13 March, 2025

Final Revision Received: 18 March, 2025

Publication: July 2025

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