

Public Beliefs about Lightning in Malaysia

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Abstract— Outcomes of a comprehensive survey on public beliefs in Malaysia with regard to the nature of lightning and lightning safety have been presented. A questionnaire survey is done among 100 respondents, comprised of an equal number of participants from each gender. Despite the sample being biased towards educated layers of the society, the concepts of a sizable fraction of the sample are in contradiction with accepted scientific norms. Only 54% of the sample indicated disagreement with incorrect statements in the questionnaire. The percentage that agreed with correct statements is slightly below 50%. Such information plays a vital role in developing lightning safety guidelines for a given region. It is advisable to plan the safety modules in line with these beliefs, at least at the initial stage, rather than having myth-busting type approaches from the right beginning.

Keywords— lightning, safety, beliefs, human risks, injuries, Malaysia, religion

I. INTRODUCTION

Being a South East Asian country in the tropics, Malaysia experiences an annual mean lightning ground flash density of 13.9 flashes per square kilometer per year (nearly 139 thunder days per year) [1]. Thus it is treated as a country with a very high lightning density. In some parts of the country, the isokeraunic level may even exceed 230 thunder days per year [1, 2]. Such large numbers of lightning occurrences, naturally pave the way to quite a significant volume of lightning related deaths and injuries per annum [1].

Several recent studies have argued that there may be many factors other than the ground flash density that could influence the number of lightning fatalities in a given region per unit time [4-6]. Geographical and topographical features, demographic distribution and population density, housing structures, and sociological factors are a few of them. Sociological aspects include community professions (e.g. inland fisheries industry), workplace activities (eg. outdoor construction work), economic status, urban-rural ratio, educational level, and religious practices etc., which are most often interrelated.

In the last decade many studies have been done on sociological aspects of lightning accidents on the African continent [7-11], whereas few were done in South Asia [12, 13] and Latin America [14, 15]. These studies have paid attention to various sociological aspects that could be helpful to refine safety modules, applicable to the relevant regions of concern. One of

the key factors to be taken into account in developing safety guidelines for a country or a community, is the public beliefs about lightning, which has not been taken into account in most of these investigations.

Being a fascinating atmospheric phenomenon, divine powers have been attributed to lightning for several millennia by many communities in the world [16, 17]. A majority of these beliefs defined lightning as a weapon used by the divine powers to punish “bad” people on earth. Thus, often the survivors of lightning incidents were murdered, tortured, or banished from the community, branding them as sinners. Such beliefs and consequential punishments still exist at different levels of severity in communities that live in various parts of the world [16]. These traditions should carefully be taken into account when introducing lightning safety guidelines. Thus it is important to understand the community beliefs in lightning and the depths of the roots of those beliefs when deciding to approach to such community.

There are only a very few methodical surveys that have been done on the current day sociological aspects of lightning in the world [18-22]. Out of these, only [18] and [19] have done the investigations on the myths and beliefs about lightning of members of the public in the respective countries; Rwanda and South Africa, both on the African continent. No such surveys have been done in the Asian context so far. Against this backdrop, this work has been conducted to fill this vacuum in the scientific literature.

II. METHODOLOGY

A questionnaire survey was conducted in the urban city of Serdang, Selangor in Malaysia, in April/May 2019. The survey was similar to many such studies that were found in the literature that investigates public perceptions and attitudes [23]. Although, the 100 respondents were interviewed in a city close to both the trade capital Kuala Lumpur and the administrative capital, Putrajaya, the respondents may originally be from various other parts of Malaysia; both peninsular Malaysia and Saba/Sarawak.

The composition of the respondents is given in Table 1. Initially, 107 people were interviewed, however as seven respondents were reluctant to provide full information, we considered only those questionnaires that were complete. The number 100 and the equal numbers from the two genders were not intentional. However, one advantage of having 100

respondents, is that the numbers in the other classifications and results represent the percentage itself. The sample is somewhat biased towards educated layers of the population as you may notice under Education level in Table I. The median value of the age, which is 27, reflects that the respondents are in general below their middle-age. In Malaysia, almost the entire Bumi population is Muslim. Most Chinese are Buddhists and Indians are Hindus. All ethnic groups could speak, read and write in Bahasa Malaysia, although their mother tongue may be different (Chinese, Tamil or Hindi). Therefore the questionnaire was prepared in Bahasa Malaysia, thus, some statements in the questionnaire may be slightly different from the English translation. This questionnaire in Bahasa could be provided on request for any interested party. For the brief statistical analysis presented in this paper, the software SPSS has been used.

Most of the interviews were conducted outside the working hours of the respondents, in a relaxed and friendly atmosphere. A few are conducted through online communication. The only condition set for the respondents, was not to use the internet browsers on their mobile devices while responding to the questionnaire. On a few occasions the questions were further clarified on request without providing any information that could bias the responses. All respondents were treated anonymous (they were not required to identify themselves by name).

Table I: Description of the respondents

Gender	
Male	50
Female	50
Total number	100
Age (in Years)	
Min	21
Maximum	71
Median	27
Ethnic Group	
Malay or Bumi	83
Chinese	11
Indian	6
Religion	
Islam	82
Christian	3
Buddhist	8
Hindu	7
Atheist	1
Education Level	
Pre- University	21
Bachelor's Degree	60
Master's Degree	11
Doctor of Philosophy	8
Occupation	
Student	48
Government sector	17
Private sector	12
Self-employed	9
Retired	14

III. RESULTS AND DISCUSSION

The questionnaire started with two general questions aimed at understanding the level of exposure of the respondents to lightning effects. As these questions were rather vague, many respondents asked for further clarifications. In such cases, we defined *close range* as the distance at which you would be able to see a lightning flash damaging an object or injuring/affecting a person or animal. Note that the 28 “No, I haven't” responses could be cases where the respondents could not remember any encounters of lightning occurrence at close range, rather than they have not really encountered such. The effects of lightning at home also needed further explanation to many respondents. We defined these effects as any catastrophic damage to a housing structure or equipment in the house and/or any injuries to a living being inside the house. Catastrophic damage is the consequential effect that take place immediately after the lightning flash so that the damage can clearly be attributed to the relevant lightning occurrence. Note that 72% of the respondents have experienced lightning in the proximity and 32% of them have experienced some form of lightning damage or injuries at their homes. These numbers indicate that lightning is a significant natural disaster in Malaysia, so that it should be taken into account in the development of national disaster mitigation policies.

Table II: Respondents' exposure to lightning effects

Have you ever seen lightning at a close range	
No, I haven't	28
Yes, Once	23
Yes, a few times	49
Has your home been affected by lightning?	
No	68
Yes	32
If it has been affected, then how many times?	
Once	19
Twice	9
3 times	2
More than 3 times	2

The rest of the questionnaire has two parts. The first consists of 18 questions, given in the form of statements, with the objective of getting an idea of the respondents' awareness of the nature and safety aspects of lightning. The first eight statements are scientifically inaccurate and the next 10 are in line with the present day knowledge. In the questionnaire these questions were randomly arranged, without making any divisions, thus, the respondents were unaware of the nature of the statement.

The participants were given five choices for each statement. They had to select only one of the five. The five choices are; strongly disagree, disagree, undecided, agree and strongly agree. In our analysis we assigned weight factors of 1 to 5 to the choices in the same order as above (refer Table III and Table IV).

Table III: Responses for the 18 statements given in the questionnaire

Statement		Disagree	Undecided	Agree
Scientifically Unacceptable Statements				
1	Lightning is caused by supernatural powers.	48	29	23
2	Lightning can be controlled and be invoked upon enemies using chants, prayers and by making sacrifices.	76	17	7
3	Thunder is a sign that the God is angry.	69	16	15
4	Lightning victims are people with bad luck.	56	18	26
5	Lightning is a weapon sent by God to kill demons on earth.	69	13	18
6	Assuming you are out in the open during a thunderstorm with nowhere to take shelter, lie flat on the ground.	20	28	52
7	Lightning is a bright ball of fire.	67	20	13
8	Lightning is a flow of bright light.	30	25	45
Scientifically Acceptable Statements				
9	Lightning is a flow of electricity.	7	19	74
10	When thunder roars, stay indoors and away from windows.	4	15	81
11	During a thunderstorm, you should keep at least 3m distances to trees/fences.	10	17	73
12	CPR can help lightning victims to survive	40	32	28
13	Avoid having an open shower during a thunderstorm.	20	33	47
14	Lightning can travel through the plumbing system.	32	33	35
15	Lightning can travel through concrete floors or walls.	49	25	26
16	If you hear thunder before you reach counting to 30, go indoors.	26	49	25
17	Suspend activities for at least 30 minutes after the last clap of thunder.	18	48	34

Table III depicts the results in a summarized form where we have counted the first two choices under disagree, third choice as it is (undecided) and the last two choices as agree. The first five statements were designed to check the beliefs of respondents with regard to lightning, whereas the 6th statement describes a dangerous practice in thunderstorm conditions, due to the hazard of step potentials. Statements 7 to 9 are on the nature of lightning and the last 9 statements (plus the 6th statement) check the lightning safety awareness of the respondents. Table IV shows the statistics of cumulative weight factors of the responses.

Interestingly, despite the bias of the survey sample towards the educated layers of society, for each of statement 1-5, the response of agreement was slightly below 25% (the lowest rate of agreement was 24%, which is for the statement 2). Over 50% of the respondents believe that there is a supernatural power behind lightning strikes. Usually, in Malaysian society, the term “supernatural” implies divine power or divine involvement. The response to statement number two may not be a surprise on the African continent [19, 24], however it is new information that in Malaysia such beliefs are still prevalent among a sizable percentage of public (almost a quarter of the respondents). The responses to the statements 7 and 8 reflect that there is still a high proportion of the community that has no knowledge or

understanding of the nature of lightning. Statement number 9 also checks the same knowledge in a different way. The result was somewhat similar as over 25% have no clear idea about the electrical nature of lightning. The pattern of responses to statements 7-9 implies that there is a large percentage of respondents who thinks that lightning is a combination of several characteristics (eg. a flow of fire and light that has something to do with electricity).

Most lightning safety models strongly recommend the promotion of lightning safety awareness among the public as a key part of the safety module [14, 25]. However, prior to disseminating new information to create scientific awareness in a society, it may be important to understand people’s incorrect perceptions on the subject. In this respect, some misconceptions, such as statements 1-5, which may be based on religious beliefs, need extra attention. In many communities, one will find strong psychological inertia changing such beliefs.

The response to the ten statements on lightning safety are also alarming. Over 50% agreed with the dangerous practice of lying flat on ground during the thunderstorms (Statement 6). This may be due to the intuitive thinking that lightning can kill only by direct strikes and that the best way of avoiding that, is to keep the lowest posture. We did not test their awareness on the internationally accepted lightning safety posture in the

questionnaire. However, we had a verbal communication with all respondents regarding their knowledge on the pose to be adopted when caught outside with no nearby shelter, in the event of an approaching thunderstorm. Except for very few, they had not even heard about such a safety practice, thus inclusion of such statement in the questionnaire could have confused the respondents.

The majority of participants responded positively to statement number 10, which is adapted from the popular slogan in USA; “When lightning roars go indoors”. Those who disagreed, might have a religious belief behind their choice (that the divine powers will protect them from nature’s wrath wherever they are).

Table IV: Statistical parameters of responses given by 100 respondents; The weight factors given to the responses are; strongly disagree-1, disagree-2, Undecided-3, agree-4, strongly agree-5

The responses for scientifically unacceptable statements (1-8)	
Mean	2.23
Standard deviation	0.832
One sample t-test	t = -9.551, p < 0.00 *the mean is solid
The responses for scientifically acceptable statements (9-18)	
Mean	3.39
Standard deviation	0.496
One sample t-test	T = -8.268, p < 0.000 *the mean is solid

Among the respondents who have undecided, a few explained very correctly that the nature of the structure where they seek shelter, could have a high impact on the safety of the occupants thus they could not agree with a general statement such as number 10. These respondents are in line with the findings presented in the studies [26] and [27] and are a clear minority in the sample. We recommend the amendment of this slogan, especially when it is adopted in a third world scenario, where many housing structures in the underprivileged communities might not be lightning safe during a thunderstorm.

Statement number 11 was meant to probe the awareness among the respondents regarding side flashes from trees, which is one of the prevalent modes of outdoor lightning accidents in Asia (unpublished data by authors). The response was better (nearly 75% agrees) than that for many other safety related statements.

The most alarming fact could be inferred from the responses to statement number 12. Research done in the field of kerauna-medicine reveals that a vast majority of lightning strike victims (over 75%) could survive if they were attended in a timely manner by giving CPR [28]. Less than 30% of the respondents are confident that CPR could have positive impact on a lightning victim. We have to analyze the outcomes of this observations against the backdrop of the responses to the statements 1-5. Those who believe in divine involvement in lightning or are

uncertain of about such involvement may not have sympathy towards a lightning victim, as they may believe that it is a punishment by supernatural forces. This could make onlookers reluctant to help a lightning victim, believing that either the victim deserves the predicament or the person who extends a helping hand may also incur the wrath of the divine power.

Statements 13 and 14 checks the awareness of exposure to lightning energy through water both outdoor and indoor. Whereas statement 13 is a well-known possibility of getting injured due to lightning, the information in statement 14 needs further scientific investigation. However, until such scientific evidence strengthens the statement, it is a good idea to accept it as true. It is not an encouraging that in both cases, less than 50% agreed with the statement.

Statement no 15 seems a little awkward in its English translation - we intended to check the awareness of respondents regarding the possibility of having a side-flash from a wall to a person inside the structure, when it is struck by lightning (from outside) and the step potential hazard that is possible even when a person is on a concrete floor. Such incidents are not uncommon in Malaysia. Again, the agreement was merely a quarter of the total participants.

Statements 16 and 17 are popular lightning safety guideline practiced in developing countries, known as the 30/30 rule. The practicability of this rule in developing countries where a majority of population earn their living through daily or hourly wages is questioned in several studies. In our sample the awareness of the existence of such rule is less than 1/3 of the total participants. However, during the post-interview chats most of them stated that they would follow the rule if they knew it. This is in contrast to some other publics (e.g. Sri Lanka), where people knew about many lightning safety rules but they were not prepared to follow them due to various reasons [29, 30].

The nearly 75% agreement with the safety of electrical items (statement 14) reflects that the public is more concerned about their electronic valuables than their own personal safety.

The information in Table IV, depicts the average weight factors of the responses separately for the scientifically accepted and unacceptable statements. In both cases, we have solid mean values rejecting scientifically unacceptable facts and agreement with scientifically acceptable facts. However, the mean values are not overwhelmingly high in favour of the correct information on the nature and safety aspects of lightning.

The final part of the questionnaire had two optional questions. The responses given to these questions are listed in Table V. Only a few people responded to this part. The two questions were meant to get some feedback from the public on their way of thinking about reducing the lightning effects. The responses could be analyzed in detail in future studies.

Note that in this paper we have not categorized the responses according to gender, ethnic group, religion, education level or occupation, as it may need ethical clearance to be published. We plan to expand the sample size and analyze the data under these categories in the future, after obtaining the required ethical clearance. Awareness on the safety of livestock [31] will also be included in the future surveys.

Table V: Responses to the two optional questions in the questionnaire, given at the end.

Can you list out any beliefs in Malaysia which you think are wrong	
1	Thunder is a sign of a bad future event (omen)
2	Every electronic equipment must be turned off (not plugged off) during a thunderstorm
3	Husband of a pregnant wife is prohibited from going on fishing or hunting, otherwise can be struck by lightning
4	Lightning only targets the bad people
5	Lightning only strikes the eldest child of the family
6	It is safe to play outside when there is lightning
7	Staying outdoor during lightning will not elevate the lightning risk
8	Taking shelter under a tall tree during lightning is safe
9	Believing that lightning should not be scared of
Do you have any suggestions to rectify these wrong beliefs?	
1	Promote awareness, education material and knowledge on lightning phenomena
2	Change education system (include lightning awareness to school curriculum)
3	Promote awareness on dos and don'ts
4	Create lightning awareness through social media
5	Educate the public
6	Explain lightning to the public in scientific ways
7	Refer both science books and the religious book
8	Make scientific experiments and promote them among public
9	Provide scientific evidences for the public to accept the correct facts
10	Spread awareness on the importance of using weather forecast
11	Start to educate from primary school about lightning

IV. CONCLUSIONS

This study provides an insight into the lightning awareness of a sample of the public in a developing country with newly industrialized status. The sample is biased towards educated layers of society that live in urban Malaysia, thus the awareness of the total population may be well-below the outcomes of this study. The country has a high incidence of lightning damage, as per the information shown in Table II.

On average, nearly 54% of the participants disagreed with incorrect statements and nearly 50% agreed with correct statements. This is not a very healthy situation for a country, considering the bias of the sample towards educated society. A significant outcome of this study, is that 25% of the sample is uncertain whether the facts are true or false. This fraction of the sample could be easily educated with a proper awareness program.

As per the results of this study, we strongly advise the developers of lightning safety modules to be aware of the entrenched beliefs of members of the public. We deliberately refrained from using the term religious beliefs in this paper, as many of these misconception may not be related to the respondents' respective religions. They are rather attributed to their traditional thinking patterns and concepts of a particular community. The dissemination of scientifically accepted facts should be done without diminishing the beliefs of the communities.

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