Original Research Article

Systematic Approach of Earthquake Awareness Analysis in Bangladesh

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Abstract: Bangladesh has encountered a serious and recurring threat from earthquakes. The goal of this study is to determine how much earthquake awareness there is among students nationwide. Our initial objective is to provide an overview of the earthquake risks Bangladesh is prone to, including discussions of previous seismic events and any recently identified threats or scientific advancements. Then, analysis was done with the information collected through survey. The analysis reveals a range of outcomes, from encouraging results to unsettling possibilities. Fifty percent of people have clear idea regarding earthquake and fifty percent people are doubtful on the earthquake issue. Furthermore, though eighty six percent people have idea what to do during earthquake but fourteen percent people have no idea what to do during earthquake. The survey and the result show a variety of outcome. The awareness regarding the earthquake preparedness has increased significantly but not up to the mark. More activities should be implemented for the achievement of the awareness level.

Keywords: Recurring threat, Earthquake awareness, Range of outcomes, Earthquake-related knowledge, Targeted suggestions, Awareness level.

1. Introduction

It is widely acknowledged that Bangladesh, which falls in South Asia between latitudes 20.35°N and 26.75°N and longitudes 88.03°E to 92.75°E, is prone to several natural disasters. Bangladesh was positioned 5th globally for risk level and 10th overall for risk to natural catastrophes in the Asia Pacific Disaster Report of 2015[1]. A variety of natural disasters, like as cyclones, floods, droughts, earthquakes, and riverbank erosion, hit the country every year. Research has demonstrated that earthquakes are one of these that Bangladesh is particularly prone to[2].

Bangladesh is one of the most geologically unstable regions in the globe due to its advantageous location at the meeting point of three tectonic plates: Eurasia, India, and Burma. Figure 1 shows the scenario in the map. Since obtaining its independence in 1971, Bangladesh has had more than 250 earthquakes, some of which possess a magnitude greater than 6.0[3,4]. These earthquakes have varied in intensity from catastrophic to moderate. Despite earthquake occurrences are naturally unpredictable, thorough research, critical analysis, giving warnings, and putting pre-disaster preparedness and post-disaster management approaches into action can considerably reduce loss of life and property[4]. The Bangladeshi government is aware of this and has launched many initiatives to raise awareness of it[4].

Research emphasizes a risk of earthquake-related fatalities, emphasizing the necessity of taking preventative measures[5]. Although earthquakes are a common occurrence in earthquake-prone regions,

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it is crucial to assess seismic hazards, comprehend ground conditions, and develop infrastructure that is earthquake-resistant[5]. Due to their location near tectonic boundaries, certain parts of Bangladesh, such the northeast, have a higher risk of earthquakes[6]. However, other parts of the nation are still relatively safe.

It is crucial to stress that even while Bangladesh does have seismic dangers, particularly in some locations, effective efforts to reduce seismic risk can significantly reduce potential destruction. In order to protect people and property in the case of an earthquake, risk considerations must be acknowledged and combined with knowledgeable engineering practices and disaster management techniques.

The objective of the study is to

(1) Analysis the present scenario of the earthquake awareness

(2) Scrutinize the present scenario awareness related preparedness among the mass people.

(3) Compare the change of the awareness scenario with the past time

(4) Recommended for the awareness preparedness activities to increase the awareness level

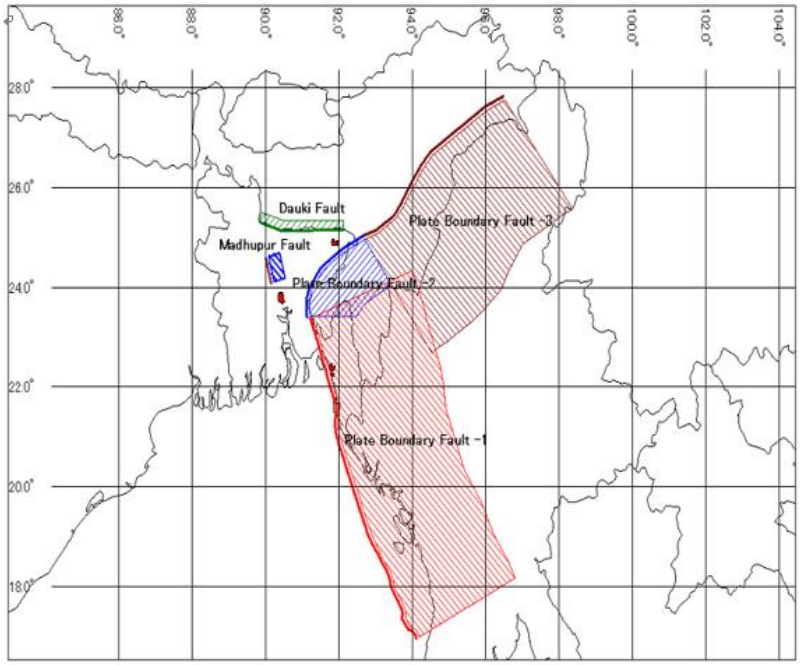

Figure 1 The major fault line in Bangladesh[9]

2. Methodology

According to the University grant commission website, in Bangladesh, there are a total of fifty-four (54) governmental bodies overseeing administration and more than 100 privately funded universities that have received approval from the University Grants Commission (UGC). Although the difficulty finding exact numbers, it is very likely that there are now more students than the five million limits [7].

It was challenging to conduct separate analyses of each response from university students. As a result, a comprehensive set of questions was first created for evaluating earthquake awareness. The questions were compiled into an online form with detailed response options using Google Forms. Through the application of social media sites such as Facebook, we connected with students from other colleges and academic areas.

There were two sample collection stages. First one is taken in recent time 2023 among the members of the Save the people from the earthquake and environmental disaster (SPEED)-a nonprofitable voluntary organization, students from Bangladesh University of Engineering and Technology (BUET), Dhaka Medical College, and Dhaka University with students from several school, college and different occupations. Around two hundred and twenty-three people give their feedback in Google form.

The research work "Earthquake risk in Bangladesh and Evaluation of Awareness Among the University

Students, July 2018 published in Journal of Earth Science & Climatic Change[8] was done in 2018, and additional data or a questionnaire were obtained for comparison purposes. A total of four hundred 400 students from 40 various colleges and medical schools answered the questions. For a simpler reading experience, the survey questions were initially provided in Bengali; after the survey was finished, they were translated into English. A parallel procedure was used to increase result accuracy. The University of Chittagong students that participated in this initiative submitted an additional 400 responses, or about 2% of the total student body. The actual level of earthquake awareness was then determined by carefully analyzing and comparing the data that had been gathered[8].

Evaluating a level of earthquake awareness among general students, in contrast to those enrolled in disciplines or departments that provide courses related to earthquakes, seismology, or other geological phenomena (such as geography and soil science), was an essential consideration throughout this project. In 2018, the study carried out from early January to mid-February[8].

The whole purpose of the study was to evaluate the present condition of awareness of earthquake among the people of Bangladesh. Again, taking the data from 2018 provides a comparison between the level of awareness between 2018 and 2023.

3. Seismicity in Bangladesh and problem hazards

Due to continuous upheavals in Southeast Asia and Bangladesh's vicinity to the active Himalayan front, the country frequently regards large, catastrophic earthquakes. These earthquakes, which frequently have eight or higher in magnitude, are brought about by several seismic reasons. Along the Himalayan front, there is an elevated probability of earthquakes of this magnitude, which would cause severe shaking that would directly impact the nation. A large portion of Bangladesh is likely to experience damaging moderate to powerful earthquakes, based upon historical data[9].

Large earthquakes can have long-lasting financial, social, and political effects despite being less frequent than severe floods. These effects are made worse by the vast delta and sediment-filled basins of the country[9]. Five tectonic fault zones that are capable of producing devastating earthquakes in Bangladesh have been identified in a 2009 CDMP report:

- Madhupur fault zone
- Dauki fault zone
- Plate boundary fault zone-1
- Plate boundary fault zone-2
- Plate boundary fault zone-3

Figure 2 lists the largest earthquake magnitudes that may happen based on fault features, length, and historical information from different tectonic blocks.

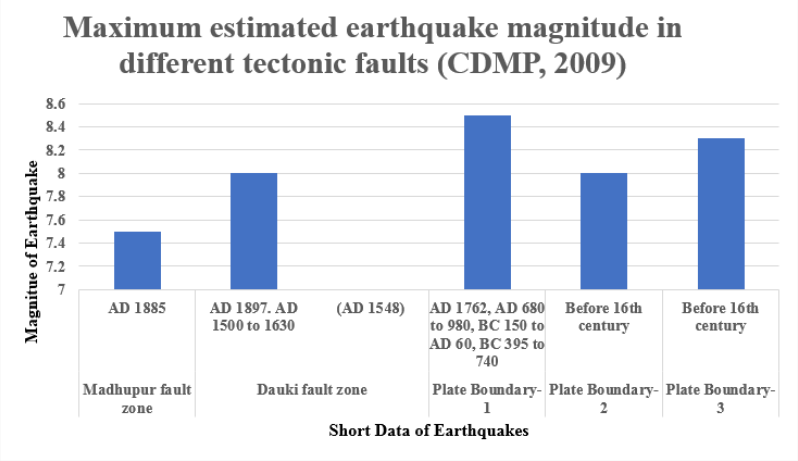

Figure 2 Maximum estimated earthquake magnitude in different tectonic faults (CDMP, 2009)

An overall tectonic map of Bangladesh is shown in Figure 3, highlighting the linear epicenter distribution along the Dauki fault system and the random distribution in other parts of the country[9]. Epicenters are arranged in weak zones with surface or subsurface faults, according to this map's analysis. The majority of documented events are mild (magnitudes 4 to 6) and take place at shallow depths, which suggests recent movements in the layers of sediment above. Major events in the northeastern Surma basin are influenced by the Dauki fault system, but shallow displacement is shown by events close to the Madhupur tract by faults separating the block from alluvial deposits[9]. For details regarding the main fault lines affecting Bangladesh's seismic activity, see Table 1.

Table 1 Bangladesh's seismic activity

Date	Place of earthquake	Magnitude	Destructions
13 November,1997	Chittagong	6.0	It caused minor damage around Chittagong town.
12 July,1999	Maheshkhali Island	5.2	Severely felt around maheshali island and the adjoining sea.
7 July,2003	Kolabunia union of barkal upazila, rangamati district	5.1	Houses cracks and landslides.

The Epicenters (approximately) of the historical earthquakes in Bangladesh and its surrounding regions are shown in Figure 3 and the Earthquake epicenter locations with their magnitude are shown in Figure 4[9].

4. Present scenario on earthquake awareness in Bangladesh

Bangladesh, which was formerly categorized as a third-world country, has lately moved into the category of developing nations. The nation's educational system is frequently criticized, yet succeeding administrations are actively working to raise the bar[10]. Numerous government initiatives have been made to spread awareness about earthquakes and their catastrophic effects.

The government of Bangladesh has committed to being prepared by designating March 10 as National Disaster Preparedness Day. Forty-three (43) textbooks covering grades 3 to 10 now incorporate information on earthquakes and disaster-related issues within the framework of the National Curriculum. Advanced earthquake and disaster management courses have been introduced in around seventeen17 public and private universities to better equip students with information[8].

Furthermore, earthquake and disaster management topics are now required components of the curriculum at government training facilities. The government uses short videos and documentaries to reach the public while using internet and print media to spread awareness[8].

Challenges continue even as understanding among Bangladesh's people is improved. This is undoubtedly a difficult task, but it is nonetheless important. Although frequently limited to industries like education or geographical areas like Dhaka, there has been extensive research on earthquake preparedness and awareness[8]. These research' findings have prompted worries.

For instance, Ahmed's research[10] showed that inhabitants of Sylhet, one of Bangladesh’s most vulnerable areas, have little knowledge about earthquakes, with just 23% of respondents showing a thorough comprehension of the risks and effects of seismic events. In a similar vein, Ziauddin’s study[11] on earthquake preparedness in Dhaka city’s schools highlighted a serious lack of understanding among both pupils and their parents.

Different organizations are contribution for the awareness regarding earthquake such as Scout, Guide, UNINESCO, Save the people from the Earthquake and Environmental Disaster (SPEED) etc.

Figure 3 Epicenters (approximately) of the historical earthquakes in Bangladesh and its surrounding regions. Here A, B, C etc. are representing earthquakes[8]

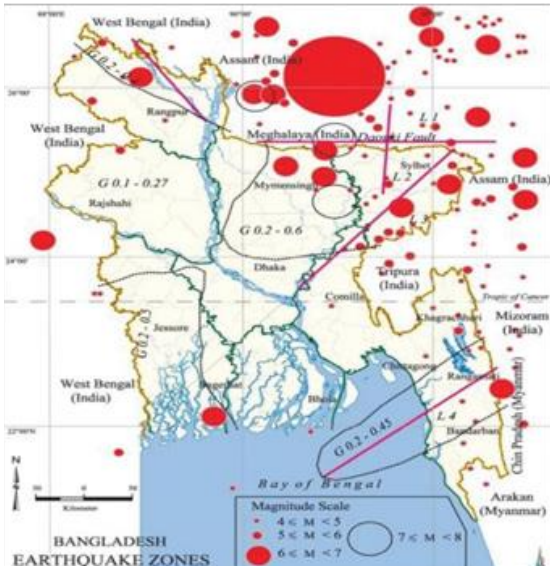

Figure 4 Earthquake epicenter locations with their magnitude[9]

5. Results and analysis

A survey was conducted on different types of people of different occupations. The result shows that 50% people in Bangladesh have clear idea regarding earthquake and 50% people are doubtful whether they have clear idea or not. The Figure 5 shows the result. This result is significant in the sense that a country like Bangladesh, much prone to earthquake half of the educated people do not have the idea. This says that the awareness related issues should be emphasized and different earthquake awareness related activities should be promoted.

There was another question which is shown in Figure 6 “How much vulnerable is Bangladesh to Earthquake?” the result of the question says that 54.5% people think Bangladesh is extremely vulnerable, 36.4% people say moderately risky and 9.1% people think they don’t know about the scenario.

Another question was related to the earthquake education. It was about how much people are benefited or learned the earthquake issues from prescribed text books. The study shows that more than 73% people learned earthquake from text books which is shown in Figure 8. This is a very positive news regarding the earthquake issues in Bangladesh. Bangladesh government has taken different steps for the spread of awareness among the mass people. This result indicates that result.

Another question was “Have you ever seen the warning and the instructions to avoid the damage by the

earthquakes in TV or newspapers?" The Figure 7 shows that 72% people are seen instruction damage in TV or newspaper. This finding is again a positive idea as it indicated the media are much aware regarding earthquake issues.

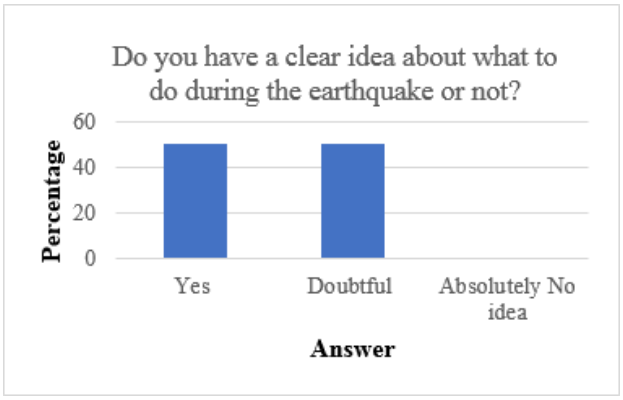

Figure 5 Clear idea regarding earthquake

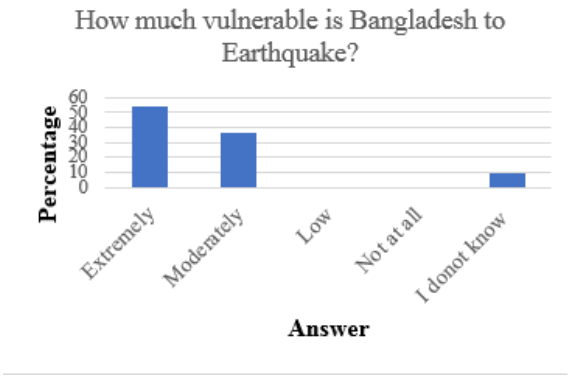

Figure 6 Bangladesh's vulnerability

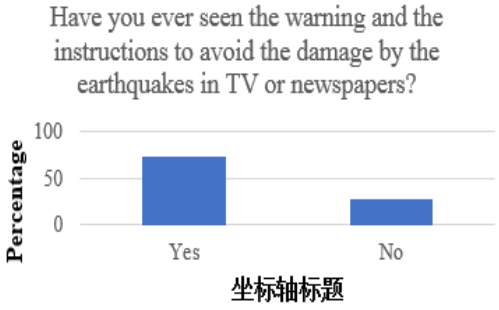

Figure 7 Warning on TV or Newspaper

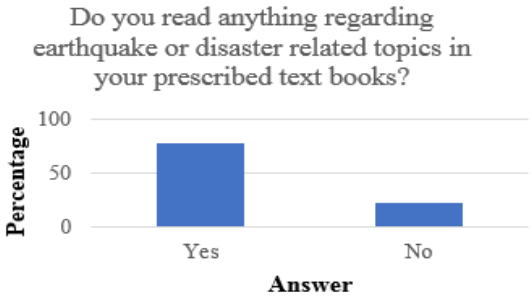

Figure 8 Earthquake Topic In Text Books

The Figure 9 shows the change of the result on the 2016 & 2023 how much people have a clear idea about what to do during the earthquake or not. The result shows that with the passage of time less people think about the idea related to earthquake. Again, the percentage of doubtful people whether they have the idea or not. The positive result is that only 1% people have absolutely no idea about earthquake.

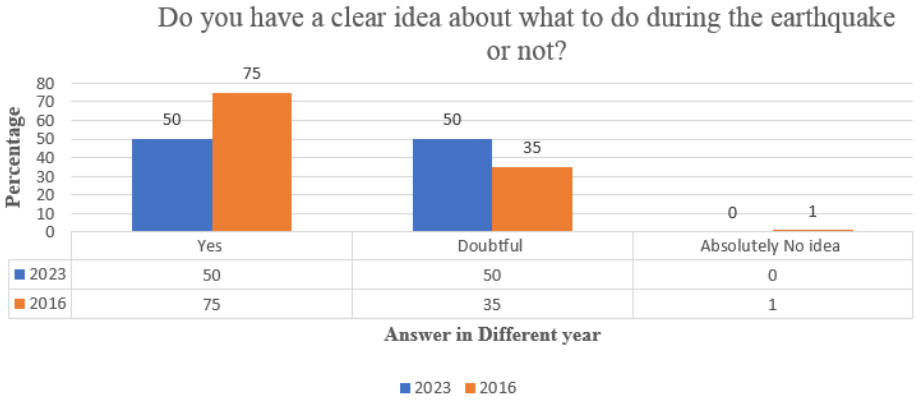

Figure 9 Change of the pattern on Earthquake with Time

This graph, figure 10, shows "Have you ever seen the warning and the instructions to avoid the damage by the earthquakes in TV or newspapers?" The result indicates that there is a decline face. Now a days people use mobile phone, social media more that TV. So, awareness related activities will be more effective on different social media platform.

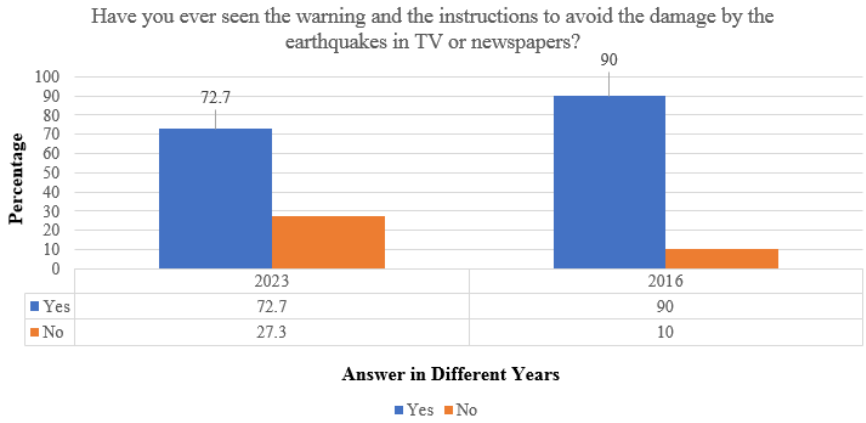

Figure 10 Change of Delivering message pattern change

This Figure 11 shows the percentage of "what to do during earthquake?" The result shows that 86% people know what to do and 14% people don't know. The right result (Figure 12) shows the percentage of "Parents awareness on Earthquake". The result shows that 92% parents have idea and 8% parents don't know. An earth prone country like Bangladesh this percentage (14%) is alarming because this unawareness may cause a great havoc.

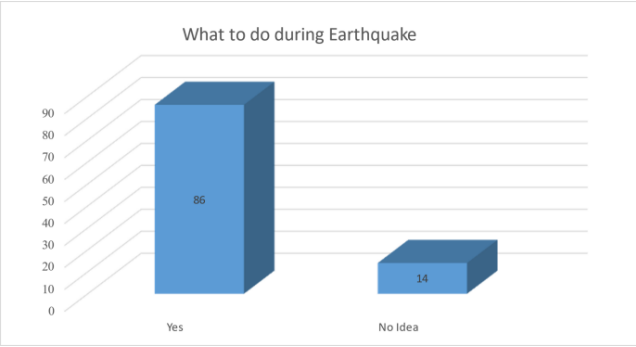

Figure 11 Idea on what to do

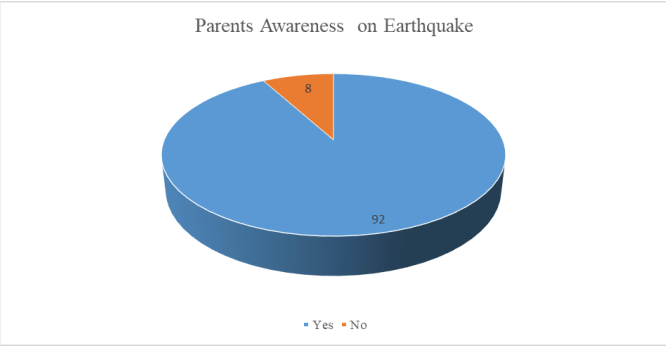

Figure 12 Awareness of parents

The Figure 13 shows the percentage of "Activities of Scouts and Guides". The result shows that 41% school or collages have active Scouts and Guides and 59% school or collages have not active Scouts and Guides. The right result in Figure 14 shows the percentage of "Standard Operating Procedure Awareness". The result shows that 94% are unaware and 16% are aware. This result shows that the earthquake related activities are not up to the mark in our schools and colleges.

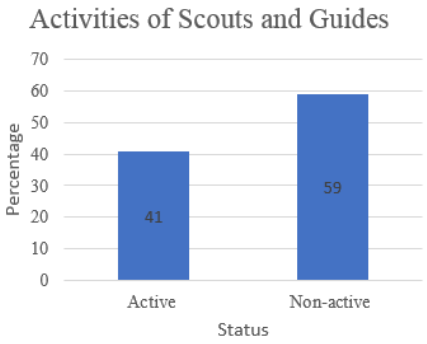

Figure 13 Activities of Scouts and Guides

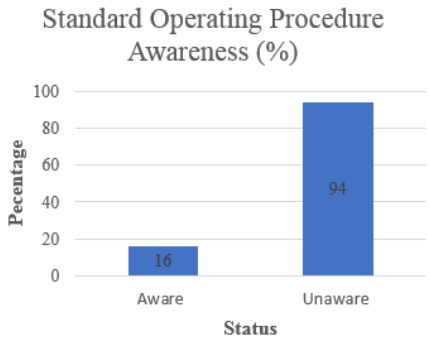

Figure 14 Standard Operation Procedures

The overall result of the study shows that's the awareness regarding earthquake preparedness is although increasing but the not up to the mark. The actives of Scout and Guide should be increased. The government

should encourage different voluntary organization such as Save the people from Earthquake and Environmental Disaster, earthquake awareness related organizations. Moreover, now a days people are not so much connected to the previous mode of entertainment such as TV, Cinemas and etc. so more awareness activities should be telecast on social media platform such as Facebook, Instagram etc.

The Figure 15 shows the percentage of annual, monthly, quarterly mock drill in the schools-colleges inside Dhaka and outside Dhaka and in rural areas. The overall result of this is not satisfactory. The result shows that in Dhaka, the capital of Bangladesh 28% annually, 61% quarterly, 11% monthly drills are performed. In case of other city outside Dhaka 76% annually, 22% quarterly, 2% monthly drills are performed. And In case of village areas 98% annually, 1% quarterly, 1% monthly drills are performed. Form the result it can be said that the occurrence of monthly drills is very low in number. But this should be increased. The percentage of quarter drill is also very low. This should be increased also. Although the annual drills are high in the overall scenario but there may be a limitation of the survey that there was not any option "No Drill at all". If this was there the surveys would convey more practical result. Again, the scenario outside Dhaka is not as good as expected and the scenario of the rural sides is very bad. More emphasize should be given on the rural sides.

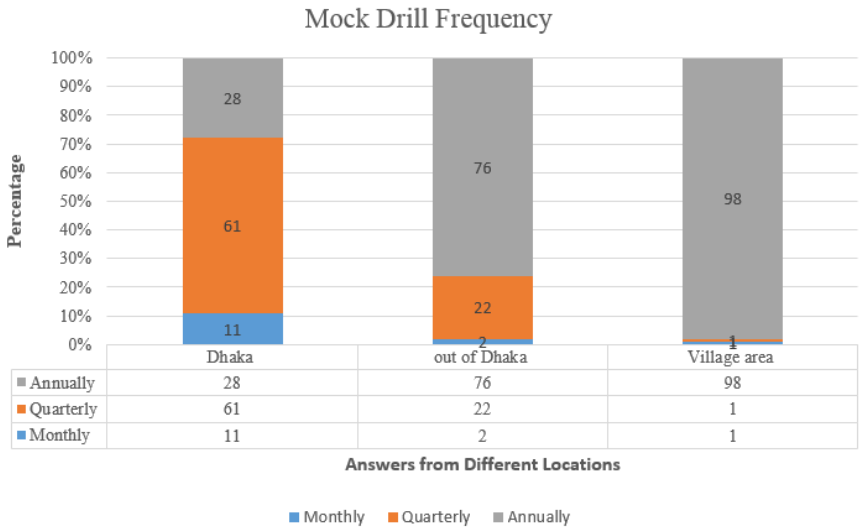

Figure 15 Mock Drill Frequency

The Figure 16 shows "Students awareness about special alarms". Only 6% students have the idea of special alarm. But 94% have do not any idea about the special alarm. This result is so alarming that although there are alarm facilities but during the situation 94% will not be benefitted.

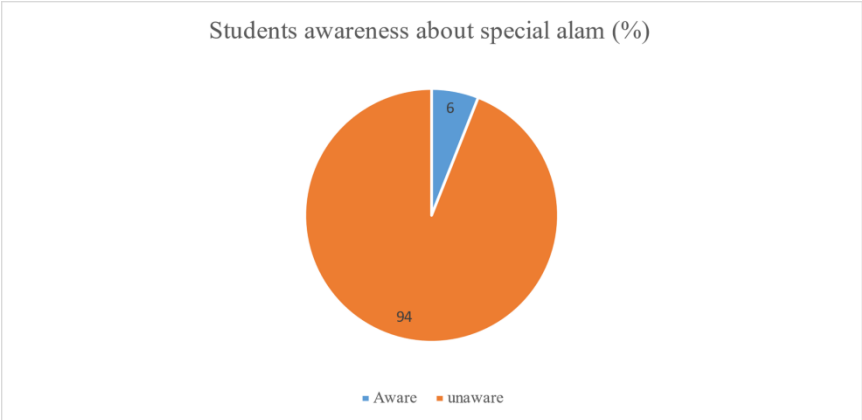

Figure 16 Students awareness about Special Alarm

6. Conclusions

The idea or awareness on earthquake has increased with the passage of time. The frequency of Mock Drill has increased significantly monthly and quarterly but the result outside Dhaka especially in rural areas should be more focused. Not only schools and institutions have the emergency alarm facility but also students are unaware of it. Bangladesh is a much prone to earthquake the government as well as the mass community should take the issues more seriously and take more drill or awareness related program. Though the awareness on parents shows some positive trend, the special attention should be given on the student's awareness in urban and rural area. The different voluntary and awareness relegated organizations should be engaged more actively to enhance the awareness activities.

Conflict of interest

The authors declare no conflict of interest.

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