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Research Paper

Impact of Earthquake Magnitude on Lives Lost During Shock

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Abstract
Earthquake is one of the catastrophic natural disasters in the history of mankind which consumed hundreds and thousands of human lives every year. Attitude of man in handling natural environment make earthquakes inevitable. The study was design to examine the impact of earthquake magnitude on lives loss during earthquakes. Data adopted for study are solely secondary data which include; journals, textbooks, published and unpublished document. Sampled was derived using purposive sampling techniques, earthquakes that lives were loss during their occurrence characterized with 6.0Mw and above were selected as sample. Regression analysis, maps QGIS software, tables and graphs were used for data analysis in study. The result of the research indicate a fair relation among studied variables. Figure 1 Multiple R=0.073, Figure multiple=0.454 and Figure multiple R=0.452. Multiple R determine the nature of relation between study variables, the close the value of multiple R is to 1 the strong the relationship. Which means fair relationship exist between earthquake magnitudes and live loss during 1990-2019 earthquakes. And R2 result Figure 1, 1% of the lives lost during earthquakes 1990-1999 are determine by earthquake magnitude, R2 result in Figure 4 indicated 21% of the lives lost during earthquakes 2000-2009 are determine by earthquake magnitude and R2 result in Figure 6 demonstrate 20% of the lives loss during earthquakes 2010-2019 are determine by earthquake magnitudes. Significant F results are Figure 1 significant F =0.613, Figure 4 significant F=0.001 and Figure 6 significant F=0.0004. Two out of the three significant F result indicated that the result of the research is reliable while one result indicated that the result is less reliable. However, the result of the research signifies, other factors such as population density of the area where the earthquakes occur, the geological structure of the areas where the earthquake take place, the time at which the earthquake occur i.e. night or during daylight and precipitation also trigger earthquakes in a few kilometer depth influence number lives lost during earthquake.

Keywords
Earthquakes, intensity, Lives, Death and Locations

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1. Introduction

According to Savinddra Singh 2014, an earthquake is a major demonstration of the power of the tectonic forces caused by endogenic thermal condition of the interior of the earth. An earthquake is a motion of the ground surface, ranging from a faint tremor to a wild motions capable of shaking building apart and causing gaping fissures to open the ground.

Earthquake is a form of energy which is produce in form of wave motion transmitted through the surface layer of the earth in widening circles from a point of sudden energy release, the 'focus'. Focus is the place where earthquake is originated, which is always hidden inside the earth but the depth varies from place to place. While place on the ground surface which is perpendicular to the buried 'focus' or 'hypocenter' recorded the seismic waves for the first time is called epicenter. The magnitude or intensity of energy released by an earthquake are measured by Richter magnitude scale or Mercalli intensity scale. The seismic waves move away from the source of earthquake (focus or hypocenter) in form of (i) primary waves or pressure waves (P waves), (ii) secondary, shear or transverse waves (S waves) and (iii) long waves or surface waves (L waves). These seismic waves are recorded with the help of an instrument seismograph or seismometer at the epicenter (Singh, 2014).

The huge destruction and the shocked number of death in the 1999 Izmit earthquake was due to several factors such as: a lot of large structures build astride of the fault (hence the fault rapture torn them apart), heavy disposal of liquid which weakened soil, construction of substandard structures and existence of multi storey residential buildings affected with earthquake as a result of poor ground condition, substandard construction materials, lack of good engineering and poor housing policy and regulation system (Marza, 2004).

The 2015 Gorkha Nepal earthquake caused tremendous damage and losses. To acquire useful information regarding this tragic incidence, an earthquake destructive investigation team was set up. The uniqueness aspect of the team was that genuine earthquake destructive data were obtained 6-11 days after the main shock. To know the clear image of the destructive effects of 2015 Nepal earthquake, the seismotectonic setting and regional seismicity in Nepal and analyses aftershock information and ground motion data. An the result shows majority of the buildings affect were stone/brick masonry structures with no seismic detailing and most RC structures are undamaged. This indicate that standard structural design is an essential factor influence earthquake risk (Goda et al., 2015).

Chan, 2008, most media and the international community have testified and made positive recommendation on China effort in handling Sichuan earthquake event, one of the most catastrophic natural disaster of the 21st century. One of the important issues China need to address in long term health issues such as sensitivity to demographic data and its effects for affordable treatment and restoring of mental health.

The successful tackling wide spread of infectious disease and making essential public health facilities adequately available such as safe water and food were commendable, and the efforts made by volunteers and local organization heroic. However, while the immediate rescue and response was managed in a swift and effective manner, the lack of emergency readiness and fully equipping medical staff to face the challenges of a natural disaster in a severe-risk geographic area should alarm an important lesson on how to improve future policy for managing disaster. Finally, as in other major disasters and human-security crises, the traumatic incidence will be inevitably fade into the background and be forgotten by the media as other world events unfold. The most difficult challenge in 2008 will be for the public to celebrate the Beijing Olympics while remembering the plight of those survivors who face long-term consequences and must rebuild their lives and communities (Chan, 2008).

There is bias in earthquake fatality estimates in many instances, which led to an earthquake fatality syndrome, i.e., a rather large inconsistency exist between official estimate and the informal guesstimates. Therefore, in this respect, the current note is a rebuttal to the formal fatality toll of the Izmit earthquake of August 17, 1999, Mw (HRV) = 7.5 based on a new look at all available data and constraints. The reason of the present note is to get a decent estimate of the Izmit earthquake fatality by assembling, discussing and critically evaluating various pieces of information related to the incidence (Marza, 2004).

The Izmit earthquake fatality estimated is almost 2.5 times larger than the official one. This death toll was contrasted against available indirect data as: quantity of plastic bags requested to seals the corpses, amount and severity of building damage, life loss in other comparable size events strike in resembling vulnerability environments, etc. Eventually, it is speculated that the 45,000-fatality appraisement is probably only a lower bound of a decent estimate. Besides the Izmit fatality estimate we worked out or discussed some others afferent characteristics as: the injuries-to-fatalities ratio close to one, hence a rather unusual ratio; property loss and the subsidiary fatalities from related and dependent events (843 lives lost due to subsequent Düzce, Turkey, main shock of November 12, 1999, Mw (HRV) = 7.1 and roughly 10 fatalities inflicted by four aftershocks of the Izmit main shock (Marza, 2004).

Five moderate (magnitude 6) earthquakes with similar features have occurred on the Park field section of the San Andreas Fault in central California since 1857. The future moderate Park field earthquake is expected to occur before 1993. The Park field prediction experiment is designed to examine the detail of the final stage of the earthquake preparation process; observation and reports of seismicity and aseismic slip related with the last moderate Park field earthquake in 1966 constitute much of the basis of the design of the experiment (Bakun and Lindh, 2015).

To aid decision-making on improving strategies of historic city centres, loss estimation techniques are required, good for application to masonry buildings. The project involved a survey of 200 buildings to study structural features and condition, mapped using a GIS system, followed by analysis of key collapse mechanisms to define static collapse loads under horizontal forces for each building. The outcome, obtained in terms of earthquake ground motions likely to produce equivalent damage, led to the development of vulnerability functions for the case study, confirmed by comparison with functions derived from statistical analysis of world-wide destructive reports and with destructive reports of the 1755 Lisbon earthquake. The method is used to predict the decrease in losses achieved by the introduction of low cost unobtrusive strengthening techniques, such as tie-rods connecting facade walls to floors and cross-walls. Cost benefit analysis, considering only structural costs, indicates that the return on the investment would be considerable (D'Ayala et al., 1997).

Earthquake give rise to landslides in the areas they occurred, each of which may be greater than 625 square meters and that total area of the landslides may surpass hundred square kilometers. Almost all the slope failure site are located to the right of the Che-Lung-Pu fault. However, for those landslides of fault scarp failure, the sliding mass moved to the western direction of Che-Lung-Pu fault. Among all the landslides triggered by Chi-Chi earthquake, the most tremendous and dramatic are four: Tsao-Ling rockslide, Juo-Feng-Err-Shan dip slope failure, stripping of Juo-Juo-Fong (99 peak) and the Ku-Kuan to Te-Chi section (mileage 34k to 62k) of the central Cross-Island Highway. The outcome of the Tsao-Ling rockslide, Juo-Feng-Err-Shan dip slope failure reveal that the chance of reoccurrence is very high for those huge scale landslides. Numerous highway slopes have been weakened, or even fractured, by the shaking of Chi-chi earthquake. Rock falls occurred during subsequent, aftershocks and new earthquakes. Debris flows take place from time to time due to heavy rainfalls (Hung, 2000).

2. Materials and Methods

The data use in the study are solely secondary data; related journals, magazines, textbooks, reports, published and unpublished document have been consulted to draw literatures of the paper. Sample of the research was derived using purposive random sampling techniques, 161 earthquakes from 1990-2019 with record of death and magnitude ranging 6.0Mw and above were drawn as samples. Regression analysis techniques, maps generated from QGIS software, tables and graphs have been for analysis of the study.

2.1 Causes of Earthquake

The relationship between relief amplitudes of the seafloor and earthquake occurrences indicate that some seamount chains riding on the Pacific seafloor have cause an effect on medium depth seismic events along the IBM. A hypothesis has proposed that the seamounts or surrounding seafloor with high degree of fracture may transport numerous hydrous minerals into the deep and may cause variation of thermal structure compared to the seafloor where no seamounts are sub-ducted. Fluids from the seamounts or surrounding seafloor are released to trigger earthquakes at medium-depth. Deep events in the northern and southern Mariana arc are likely affected by a horizontal propagating tear parallel to the trench (Kong et al., 2018).

Singh, 2014, earthquake are caused due to disequilibrium in any part of the crust of the earth. A number of causes have been assigned to cause disequilibrium in the earth crust such as;

1. Volcanic eruptions
2. Faulting and folding
3. Up warping and down warping
4. Hydrostatic pressure of man-made water bodies like reservoirs and lakes
5. And tectonic plates movement

2.2 Earthquake Magnitude

Earthquake magnitude, energy release, and shaking intensity are all related measurements of an earthquake that are often complicate with one another. Their dependencies and relationships can be confused, and even one of these concepts alone can be complicating. The time, location, and magnitude of an earthquake can be determined from the data recorded by seismometer. Seismometers record the vibrations from earthquakes that travel through the Earth. Each seismometer records the shaking of the ground directly beneath it. Sensitive instruments, which greatly magnify these ground motions, can detect strong earthquakes from sources anywhere in the world. Modern systems precisely amplify and record ground motion as a function of time (Dewey, 2017).

The implication of maximum earthquake magnitude for every region or local zone is very essential in the evaluation of seismic destructive effects. The size of the maximum magnitude is decisive in the forecast of the damage effects of seismic activity. The maximum magnitude may be estimated: (1) by using the highest fault area that can covered by a single event; (2) by the magnitude truncation in the detected seismicity for the originated zones in which the return period for the peak magnitude is shorter than the observation period; or (3) by statistical study of the catalog (Zobin, 2017).

Zürich Assembly have adopted magnitude good words in 1967 which had both a bracing and a stimulating problems on magnitude deciding and related study. From 1967 onwards, one magnitude research paper has appeared on the average almost every week, thus making this parameter the most studied one in seismology. New equipment and improved accurate methods, e.g., regarding instrumental equipment and interpretation techniques, have made it possible to improve earlier achievements. The use of magnitude scales has been extended in all respects, e.g., with regard to epicenter distances, focal depths, wave types and wave periods. Magnitude frequency relations have become the most investigated equations within seismology, observationally as well as theoretically. They have been widely used, e.g., for estimating the highest magnitudes of upcoming earthquakes an essential item in earthquake prediction. The magnitudes provide important information on other source parameters, such as strength of wave, fault length, seismic time. Relations between various types of magnitude yield valuable information on source properties. For instance, relations between magnitudes based on body and surface waves are used for efficient discrimination between earthquakes and underground explosions (Båth, 1981).

Zobin, 2017, significant magnitude greater than Mw 4.5 volcano-tectonic earthquakes are very rare; only three greater than or equal to Mw 7.0 events were recorded during the 20th century. The study of 32 important earthquakes associated with volcanic eruptions of 20th century permit us to come up with the following results about seismic hazard of volcanic activity: The highest magnitude Mw was estimated to be 5.4 for earthquakes related to central eruptions, 7.0 for caldera collapse, 5.9 for central eruptions accompanied by flank and/or fissure eruptions, 7.1 for flank and/or fissure eruptions with absent of central eruptions, and 5.9 for submarine eruptions. For seismicity just before the eruption, the maximum magnitude of earthquakes was approximated to be equal to Mw 7.1; for seismicity at the initial stage of eruption, equal to Mw 7.0; for paroxysmal stage of eruption, equal to Mw 5.6; and for final stage of eruption, equal to Mw 6.1. It is shown that the recurrence time of eruptions of the same type of volcano associated with essential earthquakes was more than 100 years for majority of studied events.

2.3 Factors Influencing earthquakes Magnitude

Tarasov and Randolph, 2011 the nature of geological structure of earth surface influence earthquake activities, in contrast to relatively soft rocks, intact hard rocks failed in mode II can increase their brittleness dramatically (hundreds of times) with rising limiting stress. The brittleness variation in this case follows a typical pattern of initially increasing, reaching a maximum and then ultimately decreasing. The hardness of the rock affect the embrittlement of existing rock. A shear rupture mechanism shows that the embrittlement results from reduction of friction within the rupture zone with rising restricting stress. Transient "negative friction", which can be generated within a certain range of limiting stress renders rocks super brittle. The similarity in variation of rock brittleness with restricting stress, and aftershock activity with depth, leads to the supposition that the aftershock process can be caused by generation of new faults in the intact rock mass surrounding the main fault where super brittle behaviour determines the depth range of earthquake activity.

Fluids are known to be of major importance factors for the earthquakes generation because pore pressure variations affect the strength of faults. Thus they can initiate earthquakes if the crust is close enough to its critical state. Based on the observations of the isolated seismicity below the densely monitored Mt. Hochstaufen, SE Germany, we are now able to demonstrate that the crust can be so close-to-failure that even tiny pressure variations associated with precipitation can trigger earthquakes in a few kilometer depth. We find that the recorded seismicity is highly correlated with the calculated spatiotemporal pore pressure changes due to diffusing rain water and in good agreement with the response of faults described by the rate-state friction law. Evidence for rainfall-triggered earthquake activity, Geophys (Hainzl et al., 2006).

Tarasov and Randolph, 2011 introduce new approach to explain the specific variation of aftershock activity with depth. Before unexplored properties of hard rocks grow in brittleness with rising restricting pressure with super brittle behavior for conditions corresponding to the depth of highest earthquake activity give grounds to earthquake depth activities to reflects rock brittleness variation with depth. It also proposes specific brittleness indexes to determine rock brittleness during post peak failure. Characteristic features of super brittle conditions are defined. Experimental results obtained for rocks of different hardness show that the effect of rock embrittlement due to confining pressure increases with increase of rock hardness.

Study found that deepest-depth earthquakes with high magnitudes 6Mw and above show variation with seasons, which depend on the area searched. The main results indicated strong evidence that the causes for the hinder enhancements along the period investigated were due to the tectonics activities also, not only the season. Therefore, if the inquiry was about an area in Northern Hemisphere, the season in Northern Hemisphere is different from the season in the Southern Hemisphere. Also, higher latitudes in the Northern Hemisphere or around the Equator, displayed seasonality similarly where the tremors appear to increase during the spring and summer. This did not occur to the Southern Hemisphere where disturbances and anomalies occurred without showing much connection to the seasons in the analyzed period. However, some of the regions presented periodicities independent from the seasons (Hagen et al., 2018).

According Duma and Ruzhin, 2003, Statistical analyses demonstrate that the tendency of earthquake incidence taken place in many earthquake regions strongly depends on the time of day that is on Local Time. This also applies to strong earthquake activity. Moreover, present observations reveal an involvement of the regular diurnal variations of the Earth's magnetic field, usually known as Sq-variations, in this geodynamic process of changing earthquake activity with the time of day. The article tried to quantify the forces which result from the interaction between the induced Sq-variation present in the Earth's lithosphere and the regional Earth's magnetic field, in order to determine the influence of the tectonic stress field and on seismic activity. A reliable model was obtained, which indicates there is involvement high energy in this process. The effect of Sq-induction is compared with the results of the high scale electromagnetic experiment, where a giant artificial current loop was activated in the Barents Sea.

UDQ worldwide study showed, of the initial condition with magnitude greater than or equal to 2.5, there is evidence of seasonality at the Northwest Pacific, less reason for the Southwest Pacific, and none for the Southeast Pacific. Such outcome can't be considered final or generalized for earthquake seasonality around the world. At this juncture, there are several confining our studies. It is important to make other parameters more flexible in our calculation to enable a better statistical investigation. For instance considering different depths will put the system at point to make more possible comparism. The only problem will always be those points near the equator where one part of the events occurs in the Northern Hemisphere and the other in the Southern Hemisphere; it makes complicate to precise seasons on the locations searched. Southern Hemisphere showed periodicity of events during the period analyzed to any magnitude searched (Hagen et al., 2018).

2.4 Consequences of Earthquake

The study proved that a level of survey more detailed than a bare GNDT Level 1 is essential to give a concrete assessment of the vulnerability of the building materials. This is related to the necessity of considering many peculiarities of various structures if a proper representation of the seismic performance of the building equipment is to be attained. It is believed that as a result of this experience an "improved" GNDT Level 1 form could be designed, to be used in similar exercises successfully. Although a more extensive survey could be useful, the chosen size of the sample seemed adequate to a first definition of proper vulnerability function and probability damage distribution. The historic information on one hand and the use of limit state analysis on the other proved essential tools to the definition of the vulnerability function. A convergence of strategy options in favour of low-cost intervention using modern versions of traditional techniques, e.g. tie rods, to attach the facades to the floors beams or to the cross walls, would have a very significant effect on vulnerability. This is especially true of the taller buildings, 4 to 6 storeys high.

Marza, 2004, the highest intensity topped at 10-11 (EMS-98) in a series of towns along the fault rupture. The number of buildings heavily damaged can be used to indirectly estimate the fatality figures. If we infer that only one in two of the housing units that been affected by intensive damage caused one life lost it follows that at least 46,500 people were killed. Thus, we feel that under the above unbearable situation the true lives lost could be even higher than the estimate outline above. Another way that can be used for judgment, which may be more reliable is to make comparisons with fatality amounts for similar size events hitting in comparable demographic and vulnerability environments. It should also be called to mind that in 1939 another N. Anatolian fault earthquake, the Erzincan event of December 26 (Mw = 7.6, cf. Pacheco and Sykes, 1992), killed 30,000 to 45,000 estimated fatalities. Consequently, as the earthquakes of 1939 and 1999 can be comparable in size but the demographic density considerably change, the current lives lost estimate for 1999 event one may gain only a lower bound of the true figure, note that this comparison corroborates well with the inference based on the number of intensively destruction of housing units. Considering the variance involved and the statistical uncertainty implied by the so-called objective statistical sampling we infer that our death toll estimate has an ad-hoc confidence level of 90% probability (Zc = 1.57, where the Zc is the critical-Z variable for normal distribution, which was tacitly assumed as holding). Pacheco and Sykes (1992)

Although the numbers used in the cost benefit analysis are in a number of ways speculative and subject to a high degree of precariousness, they advise that for historical town centre areas such as the Alfama District there would be a relatively fast 'return' on the financial investment in pre-earthquake strengthening in saved reconstruction costs. But even more important would be the benefits of prevention of life and of the city's cultural heritage which are beyond estimation in pure financial terms. An essential task of the project was also the sharing and deliberation on the outcome of the study with local authorities and professionals active in the area. These meetings showed that the topic of seismic upgrading of historic town centres is felt as crucial by all parties involved in their prevention and conservation activities. The need to improve the general level of awareness in the public and the specific technical knowledge in the professionals has also been recognised and the issue of common guidelines was frequently raised (D'Ayala et al., 1997).

Wang et al., 2008 the Chinese government, with aid from Chinese citizens, businesses, and international communities, is working on a recuperation that we expect to be completed by publication time. An important investment should be made. Although a survey and frequent monitoring is needed to gather direct evidence of the impact of the earthquake on wildlife and habitats in this region, ecological and biodiversity care also need to be considered when recuperation design and future development take place. We advise the following actions be taken.

• Merged habitat restoration into the holistic recuperation design to maintain healthy habitat linkages and ecosystem condition. The reaction of wildlife to this earthquake is unknown. Therefore, taken care of extensive, complete habitat to prevent wildlife from unsafe locations is a basic consideration. There are good areas suited for habitat retrieval and link in the panda range.

• Future structural development need to take earthquakes into consideration. Structures such as roads and hydroelectric dams have economic benefits. Therefore, in an area where earthquakes are experienced frequently (almost one above 7.0 magnitude in 20 years), stricter strategic environmental assessment at the regional level and environmental impact assessment at the plan level need to be put in place and enforced. Current road building methods in this area often destroy vegetation, which led to more landslide in the areas and speed up the danger of river blockage and flooding during an earthquake.

• Land-use patterns and human habitation may likely change after a quake; thus, projects need extreme evaluation with ecological capacity in mind. Many remote, mountainous, residential areas are considered inappropriate for habitation, and current residents may opt to move to safer zones. Some of the existing means of livelihood, such as agriculture and tourism, may shrink in scale. Without careful planning and observation, peoples' livelihoods after an earthquake will likely be more devastating ecologically.

Goda et al., 2015, the Mw7.8 subduction earthquake occurred along the Main Himalayan Thrust arc and triggered several major aftershocks. The earthquake destruction was catastrophic, led the fatalities of over 8,500 and billions of dollars in economic loss. The study presented important earthquake field monitoring in Nepal in the aftermath of the Mw7.8 main shock. To gain deeper understanding of the observed earthquake damage in Nepal, the seismo tectonic setting and regional seismicity in Nepal were reviewed and available aftershock data and ground motion data were analyzed. In addition to ground motion data analysis, scenario shake maps were generated by trialing different combinations of applicable ground motion models and source-to- site distance measures to highlight the potential biases caused in estimated ground motion maps and prompt earthquake impact assessments for a large subduction earthquake.

- In Kathmandu, earthquake effects to ancient historical buildings was severe, whereas damage to the surrounding buildings was limited. The destroyed buildings were stone/brick masonry structures with wooden frames. The RC frame buildings performed well for this earthquake. This may indicate that ground motion intensity experienced in Kathmandu was not so intense, if compare with those predicted from probabilistic seismic hazard studies for Nepal. Therefore, a forethought is essentially related to future earthquakes in Nepal because the 2015 earthquake is not necessarily the worst-case scenario.
- The Kathmandu Basin is filled up by thick soft sediments. This has led to the generation of long-period ground motions in the Kathmandu Valley. Availability of earthquake engineering design considerations are necessary for decreasing potential of seismic risk to these structures.
- The building demolition in Kathmandu was concentrated to specific areas. It appeared that the building collapse sites were triggered by nature of local soil and lack of standard structural design. In this regard, micro zonation studies provide valuable idea on earthquake damage.
- Some buildings that were severely demolished by the main shock were collapsed as a result of aftershocks activities. The capability for aftershock forecasting, building evacuation procedure, building investigation and tagging, and buildings restoring and retrofitting need to be developed to mitigate the earthquake damage potential.
- In the mountain areas, several villages were scourged by the earthquake succession and major landslides were triggered. On occasion, landslides blocked roads, delinking remote villages. The unusual nature of the local transportation network in Nepal needs to be improved for enhancing the resilience of rural communities.

3. RESULTS AND DISCUSSION

The result of this research indicate that a relationship exist between earthquake magnitude and lives loss during an earthquakes.

Figure 3 Map show location of earthquakes that occurred 1990-1999 base on their coordinate on the real world, Figure 4 Map show location of earthquakes that occurred 2000-2009 base on their coordinate on the real world and Figure 5 Map show location of earthquakes that occurred 2010-2019 base on their coordinate on the real world.

Figure 1 Table present details of sampled earthquakes that occurred 1990-2019, the information the table is carrying include; earthquake magnitude in Mw scale, coordinates of the earthquakes, date of the earthquakes and lives lost during the earthquakes.

Figure 2 Table contain summary of earthquakes that occur 1990-2019 base on continents and oceania.

Figure 6 the regression analysis output of the research show (Multiple R =0.073) which indicate that a less relationship co-exist between earthquake magnitude and lives loss during 1990-1999 earthquakes. And (r2=0.01) shows earthquake magnitude determine 01% of fatalities cause by the earthquakes. The significance F determine if the regression analysis predict the impact of earthquake magnitude on lives loss during earthquakes significantly or the result is reliable. The output of the analysis Significant F=0.613 which indicate the result is less reliable.

Figure 7 the regression analysis output of the research show (Multiple R=0.454) which demonstrate that a fair strong relationship exist between earthquake magnitude and lives loss at the occurrence of the earthquakes 2000-2009 in the study. The outcome of the study analysis shows (r2=0.21) which indicate earthquake magnitude determine 21% of the lives loss at 2000-2009 earthquakes. The significance F determine if the regression analysis predict the impact of earthquake magnitude on lives loss during earthquakes significantly or the result is reliable. And significant F=0.001 which indicate the result is reliable.

Figure 8 the regression analysis result reveal (Multiple R=0.452) which show fairly strong relationship exist between earthquake magnitude and lives loss at earthquakes that occur 2010-2019. While (r2=0.20) i.e. earthquake magnitude determine 20% of the lives lost during earthquakes occurred 2010-2019. The significance F determine if the regression analysis predict the impact of earthquake magnitude on lives loss during earthquakes significantly or the result is reliable. And significant F=0.0004 which indicate the result is reliable.

The findings of the research are as follows

1. The research revealed that there is fair strong relationship between earthquake magnitude and lives loss during earthquakes. Earthquake magnitude determine 01% of fatalities cause by earthquakes in Figure 6 Earthquake magnitude determine up to 21% of the lives loss during earthquakes in Figure 7 Earthquake magnitude determine 20% of the lives loss during earthquakes in Figure 8
2. The findings of the research shows 64.6% earthquakes that occurs between 1990 to 2019 with recorded loss of lives occur in Asia, North America 11.2%, South America 9.3%, Europe 8.1%, Oceania 5.6% Africa 1.2% and Australia 00%.
3. There are other factor that influence lives loss during an earthquake apart from earthquake magnitude such as; geological structure of an area where earthquake occur Tarasov and Randolph, 2011, time of earthquake occurrence Duma and Ruzhin, 2003, fluid or precipitation also trigger earthquakes Hainzl et al., 2006 and population density of the area where earthquake took place. These factors can influences the number of lives loss during an earthquake directly or indirectly. Time of earthquake occurrence and population density of the areas where earthquake took place,

Table 1. Table of Earthquakes Details Which Include Coordinate, Magnitude and Lives Lost

S/N	Earthquake location	Magnitude Mm	Death	Latitude	Longitude
1	Panay Island, Philippines Jun 14, 1990	7.1	8	11.34°N	122.10° E
2	Manjil–Rudbar, Iran Jun 21st, 1990	7.4	50000	37.07°N	49.28°E
3	Baguio City Philippines Jul 16, 1990	7.7	2621	15.679°N	121.172°E
4	Racha, Georgia Apr 29, 1991	7	270	42.453°N	43.673°E
5	India Oct 19, 1991	6.6	2000	30.75°N	78.82°E
6	Erzincan, Turkey Mar 13, 1992	6.7	652	39.71°N	39.6°E
7	Joshua Tree, U.S.A Apr 23rd, 1992	6.1		33.576°N	116.19°W
8	Cape Mendocino, U.S.A. Apr 26,1992	7.2	25	40.33°N	124.23°W
9	Landers, California, USA Jun 28, 1992	7.3	3	34.217°N	116.433°W
10	Nicaragua Sep 2nd, 1992	7.7	116	11.742°N	87.340°W
11	Flores, Indonesia Dec 12, 1992	7.8	2500	8.480°S	121.896°E
12	Japan (Hokkaido) Jul 12, 1993	7.7	230	42.851°N	139.197°E
13	India Sep 29, 1993	6.3	9748	18.07°N	76.62°E
14	Reseda, U.S.A Jan 17, 1994	6.7	57	34.213°N	118.537°W
15	Sumatra, Indonesia Feb 15, 1994	7	207	4.967°S	104.302°E
16	Java, Indonesia Jun 2nd, 1994	7.8	250	10.51°S	112.87°E
17	Paez, Cauca, Colombia Jun 6, 1994	6.8	1100	2.917°N	76.057°W
18	Bolivia Jun 9, 1994	8.2	5	13°7'S	67°3'W
19	Near Kuril Islands, Russia Oct 4, 1994	8.2	12	43.85°N	147.17°E
20	Calapan, Philippines Nov 15, 1994	7.1	78	13.525°N	121.067°E
21	Near Honshū, Japan Dec 28, 1994	7.7	3	40.451°N	143.491°E
22	Hyōgo Prefecture, Japan Jan 16, 1995	6.9	6434	34.59°N	135.07°E
23	Russia in Sakhalin Island May 27, 1995	7.5	1989	52.63°N	142.83°E
24	Antofagasta, Chile Jul 30, 1995	8	3	23.35°S	70.32°W
25	Guerrero, Mexico Sep 14, 1995	7.4	3	16.779°N	98.597°W
26	Dinar, Afyon, Turkey Oct 1st, 1995	6.2	90	38.063°N	30.134°E

27	Jalisco, Mexico Oct 9, 1995	8	58	19.08°N	104.18°W
28	Chiapas, Mexico Oct 21st, 1995	7.1		16.840°N	93.469°W
29	Wuding, Yunnan, China Oct 23rd, 1995	6.2	53	26.003°N	102.227°E
30	Lijiang, Yunnan, China Feb 3rd, 1996	6.6	322	27.30°N	100.29°E
31	Biak Island, Indonesia Feb 17, 1996	8.2	166	5°S	136.94°E
32	Near Baotou, China May 3rd, 1996	6.4	26	40.774°N	109.661°E
33	Near Nazca, Peru Nov 12, 1996	7.5	14	14.993°S	75.675°W
34	Ardabil, Iran Feb 28, 1997	6.1	1100	38.08°N	48.05°E
35	South Khorasan, Iran May 10, 1997	7.3	1567	33.844°N	59.810°E
36	Cariaco, Venezuela Jul 9, 1997	6.9	81	10.45°N	63.58°W
37	Umbria–Marche, Italy Sep 26, 1997	6	11	43.084°N	12.812°E
38	Punitaqui, Chile Oct 15, 1997	7.1	8	30.93°S	71.22°W
39	China Tibet Nov 8, 1997	7.4		35.069°N	87.325°E
40	Aiquile, Bolivia May 22nd, 1998	6.6	105	17.91°S	65.47°W
41	Takhar, Afghanistan May 30, 1998	6.5	4500	37.17°N	70.09°E
42	Ceyhan, Adana, Turkey Jun 27 1998	6.3	145	36.94°N	35.26°E
43	Papua New Guinea Jul 17, 1998	7.1	2700	3.11°S	142.44°E
44	Yunnan-Sichuan border Nov 19, 1998	6.2	5	27.27°N	101.03°E
45	Colombia, Armenia Jan 25, 1999	6.2	1900	4.5°N	75.7°W
46	India, Chamoli Mar 28, 1999	6.6	103	30.408°N	79.416°E
47	Mexico, Puebla Jun 15, 1999	7	14	18.386°N	97.436°W
48	Turkey Kocaeli Aug 17, 1999	7.6	17118	40.81°N	29.98°E
49	Greece, Athens Sep 7, 1999	6	143	38.06°N	23.51°E
50	Taiwan Sep 20, 1999	7.7	2444	23.772°N	120.982°E
51	Mexico, Oaxaca Sep 30, 1999	7.5	35	16.059°N	96.931°W
52	Turkey Nov 12, 1999	7.2	894	40.82°N	31.2°E
53	Indonesia 4 Jun 2000	7.9	103	4.61°S	102.06°E
54	Azerbaijan Nov 25, 2000	6.8	26	40.25°N	49.9°E
55	El Salvador, La Libertad Jan 13, 2001	7.7	944	13.04°N	88.66°W
56	India Jan 26, 2001	7.7	20085	23.419°N	70.232°E
57	El Salvador, San Salvador Feb 13, 2001	6.6	315	13.67°N	88.93°W
58	Peru, Arequipa 23rd, Jun 2001	8.4	145	16.36°S	73.48°W
59	Turkey, Afyon Feb 3rd, 2002	6.5	44	38.573°N	31.271°E
60	Afghanistan, Hindu Kush Mar 3rd, 2002	7.4	166	36.5°N	70.48°E
61	Philippines, Mindanao Mar 5, 2002	7.5	15	6.033°N	124.249°E
62	Afghanistan Mar 25, 2002	6.1	1,000	36.5°N	70.48°E
63	Iran, Qazvin Jun 22nd, 2002	6.5	261	35.63°N	49.05°E
64	Indonesia, Sulawesi Aug 15, 2002	6.2	48	02°S	121°E
65	Pakistan, Balochistan Nov 20, 2002	6.3	19	27°25'N	64°30'E
66	Mexico, Colima Jan 22nd 2003	7.6	29	18.69°N	104.15°W
67	China, Xinjiang Feb 24, 2003	6.3	261	39.610°N	77.230°E
68	Turkey, Bingöl May 1st, 2003	6.4	177	38.95°N	40.4°E
69	Algeria, Boumerdès May 21st, 2003	6.8	2266	36.91°N	3.71°E
70	China Yunnan July 21st, 2003	6	16	25°03'N	101°52'E
71	China Xinjiang Dec 1st, 2003	6	11	42.905°N	80.515°E

72	Iran Dec 26, 2003	6.7	26271	28.85°N	58.25°E
73	Morocco Al Hoceima Feb 24, 2004	6.4	631	35.23°N	4.02°W
74	Iran, Baladeh May 28, 2004	6.3	35	36.34°N	51.6°E
75	Japan, Chūbu Oct 23rd, 2004	6.6	68	37.3°N	138.8°E
76	Indonesia, Alor Nov 11 2004	7.5	23	8.15°S	124.45°E
77	Indonesia Dec 26, 2004	9.2	227898	3.30°N	95.98°E
78	Iran Feb 22, 2005	6.4	612	30.72°N	56.81°E
79	Indonesia Mar 28, 2005	8.6	1314	2.09°N	97.11°E
80	Chile, Tarapacá Jun 13, 2005	7.8	11	19.5913°S	69.1149°W
81	Pakistan Oct 8, 2005	7.6	87351	33.50.36°N	73. 51.05°E
82	Iran, Qeshm Nov 27, 2005	6	13	26.84°N	55.93°E
83	Iran, Lorestan Mar 31st, 2006	6.1	70	33.56°N	48.73°E
84	Indonesia May 26, 2006	6.4	5778	8.07°S	110.35°E
85	Indonesia West Java Jul 17, 2006	7.7	733	9.33°S	107.32°E
86	Indonesia, Sumatra Mar 6, 2007	6.4	68	0.49°N	100.5°E
87	Solomon Islands Apr 2nd, 2007	8.1	52	8.29°S	156.58°E
88	Chile, Aysén Apr 21st, 2007	6.2	10	45.27°S	72.66°W
89	Japan, Niigata Jul 16, 2007	6.6	11	37.57°N	138.44°E
90	Peru Arequipa Aug 15, 2007	8	519	13.354°S	76.509°W
91	Indonesia, Sumatra Sep 12, 2007	8.5	23	4.438°S	101.367°E
92	China May 12, 2008	8	87587	31.021°N	103.367°E
93	Japan, Honshu Jun 13, 2008	6.9	23	39.017°N	140.528°E
94	China, Sichuan Aug 30, 2008	6.1	41	26.0°N	101.9°E
95	Kyrgyzstan, Osh Oct 5, 2008	6.6	75	39.5054°N	73.4648°E
96	China, Tibet Oct 6, 2008	6.4	10	29.45324°N	90.1872°E
97	Pakistan Oct 29, 2008	6.4	215	30.569°N	67.484°E
98	Costa Rica, Alajuela Jan 8, 2009	6.1	98	10.23°N	84.22°W
99	Italy Aquila Apr 6, 2009	6.3	308	42.3476°N	13.3800°E
100	Indonesia, Java Sep 2nd ,2009	7	79	7.778°S	107.328°E
101	Bhutan Sep 21, 2009	6.1	11	27.346°N	91.412°E
102	Samoa Sep 29, 2009	8.1	192	15.53°S	171.87°W
103	Indonesia Sep 30, 2009	7.6	1,115	0.71°N	99.97°E
104	Haiti Jan 12, 2010	7	316000	18.28°N	72.32°W
105	Chile Feb 27, 2010	8.8	550	36.12°S	72.90°W
106	China Apr 14, 2010	6.9	2968	33.165°N	96.629°E
107	Turkey. Elazig Mar 8, 2010	6.1	58	38.79°N	40.03°E
108	Indonesia, Papua Jun 16, 2010	7	17	2.22°S	136.58°E
109	Indonesia, Sumatra Oct 25, 2010	7.7	711	3.464°S	100.084°E
110	New Zealand Feb 22, 2011	6.3	185	43.583°S	172.680°E
111	Japan Mar 11, 2011	9.1	20896	38.30°N	142.37°E
112	Myanmar, Shan Mar 24, 2011	6.9	151	20.705°N	99.949°E
113	Uzbekistan, Sughd Jul 19, 2011	6.2	14	40.05°N	71.44°E
114	Indonesia, Aceh Sep 5, 2011	6.7	10	2.81°N	97.85°E
115	India, Sikkim Sep 18, 2011	6.9	423	27.723°N	88.064°E
116	Turkey Oct 23, 2011	7.2	604	38.628°N	43.486°E

117	Philippines Feb 6, 2012	6.9		113	9.58°N	123.08°E
118	Indonesia Apr 11, 2012	8.6		10	2.311°N	93.063°E
119	Iran Aug 11, 2012	6.4		306	38.359°N	46.786°E
120	Guatemala Nov 7, 2012	7.4		39	13.987°N	91.965°W
121	Myanmar Nov 11, 2012	6.8		38	23.014°N	95.883°E
122	Solomon Islands Feb 6, 2013	8		13	10.799°S	165.114°E
123	Iran, Bushehr April 9, 2013	6.3		40	28.48°N	51.58°E
124	Iran, Sistan & Baluchestan Apr 16, 2013	7.7		35	28.107°N	62.053°E
125	China Apr 20, 2013	6.6		216	30.17.02°N	102.57.22°E
126	Indonesia, Sumatra 2013	6.1		43	4.698°N	96.687°E
127	Pakistan Sep 24, 2013	7.7		825	26.951°N	65.501°E
128	Pakistan Sep 28, 2013	6.8		22	26.951°N	65.501°E
129	Philippines, Central Visayas Oct 15, 2013		7.2	230	9.880°N	124.117°E
130	China Aug 3, 2014	6.1		617	27.245°N	103.427°E
131	Nepal Gorkha Apr 25, 2015	7.8		8964	28.230°N	84.731°E
132	Nepal, Dolakha May 12, 2015	7.3		218	27.837°N	86.077°E
133	Malaysia, Sabah Jun 4, 2015	6		18	5.980°N	116.525°E
134	Chile, Coquimbo Sep 16, 2015	8.3		21	31.570°S	71.654°W
135	Afghanistan Badakhshan Oct 26, 2015	7.5		399	36.524°N	70.368°E
136	India, Imphal Jan 3rd 2016	6.7		11	24.834°N	93.656°E
137	Japan, Kyushu 2016	7		50	32.46.55.2°N	130.43.33.6°E
138	Ecuador Esmeraldas Apr 16, 2016	7.8		676	0.371°N	79.940°W
139	Italy Umbria Aug 24, 2016	6.2		299	42.706°N	13.223°E
140	Indonesia Aceh Dec 7, 2016	6.4		104	5.283°N	96.168°E
141	China, Sichuan Aug 8, 2017	6.5		25	33.193°N	103.855°E
142	Mexico Chiapas Sep 7, 2017	8.1		98	15.068°N	93.715°W
143	Mexico Puebla Sep 19, 2017	7.1		370	18.584°N	98.399°W
144	Iraq-Iran border Nov 12, 2017	7.3		630	34.905°N	45.956°E
145	Taiwan, Hualien Feb 6, 2018	6.4		17	24.132°N	121.659°E
146	Mexico, Oaxaca Feb 16,2018	7.2		14	16.646°N	97.653°W
147	Papua New Guinea Feb 25, 2018	7.5		160	6.070°S	142.754°E
148	Papua New Guinea Mar 4, 2018	6		11	6.070°S	142.754°E
149	Papua New Guinea Mar 6, 2019	6.7		25	6.070°S	142.754°E
150	Indonesia, Lombok Jul 28, 2018	6.4		20	8.274°S	116.491°E
151	Indonesia Lombok Aug 5, 2018	6.9		513	8.287°S	116.452°E
152	Indonesia, Lombok Aug 19, 2018	6.9		140	8.287°S	116.452°E
153	Japan, Hokkaido Sep 6, 2018	6.6		41	42.671°N	141.933°E
154	Indonesia, Sulawes Sep 26, 2018	7.5		4340	0.178°S	119.840°E
155	Philippine San Marcelino Apr 22, 2019	6.1		18	14.59°N	120.21°E
156	Indonesia North Maluku Jul 14, 2019	7.2		14	0.566°S	128.056°E
157	Indonesia Maluku offshore Sep 25, 2019	6.5		41	3.450°S	128.347°E
158	Philippines, Soccsksargen Oct 29, 2019	6.6		10	6.45°N	125.00°E
159	Philippines, Soccsksargen Oct 31, 2019	6.5		14	6.45°N	125.00°E
160	Albania, Durrës Nov 26, 2019	6.4		51	41.511°N	19.522°E
161	Philippines, Davao Dec 15, 2019	6.8		13	6.708°N	125.188°E

Table 2. Table of Earthquake Occurrence 1990-2019 Base on Continent and There Percentage

S/N	Continents	No. Earthquakes	Percentage
1	Asia	99	61.50%
2	Africa	2	1.20%
3	Australia	0	0%
4	Europe	18	11.20%
5	North America	18	11.20%
6	South America	1 5	9.30%
7	Oceania	9	5.60%
Total		161	100%

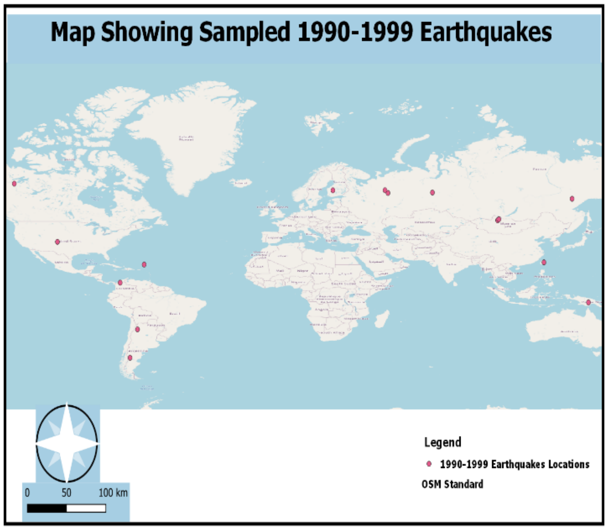

Figure 1. Map Showing Sampled Earthquakes 1990-1999

influence lives loss during earthquake directly. While geological structure of the area where earthquake occur and present of fluid or precipitation in an area where earthquake occur, influence lives loss during an earthquake indirectly through influencing the intensity of vibration or waves release from earthquake epicenter.

4. CONCLUSIONS

The paper examine the impact of earthquake magnitude on lives loss during earthquakes from 1990-2019. The result of the research indicate a fair strong relation among studied variables. Fig.1.6 Multiple R=0.073, fig. multiple=0.454 and fig. multiple R=0.452. Multiple R determine the nature of relation between study variables, the close the value of multiple R is to 1 the stronger the relationship. Which means fair strong relationship exist between earthquake magnitudes and live loss during 1990-2019 earthquakes. And R2 result Figure 6, 1% of the lives lost during earthquakes 1990-1999 are determine by earthquake magnitude, R2 result in Figure 7 indicated 21% of the lives lost during earthquakes 2000-

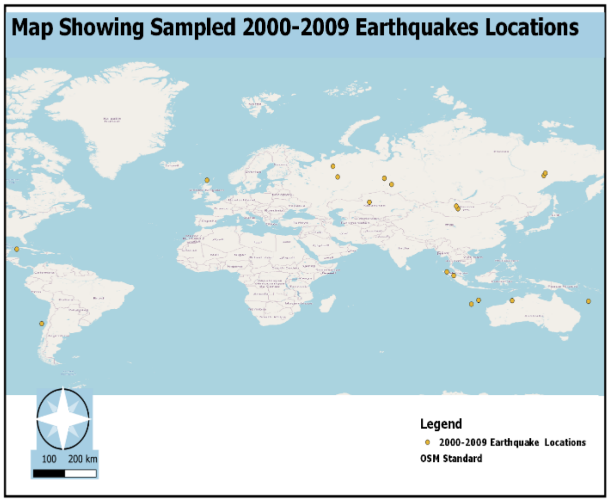

Figure 2. Map Showing Sampled Earthquakes 2000-2009

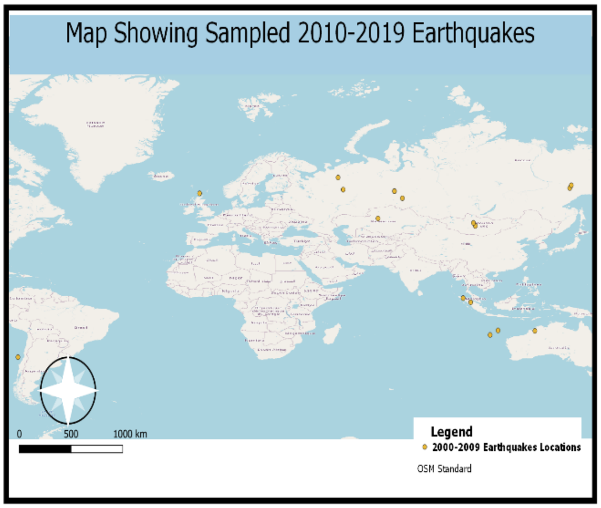

Figure 3. Map Showing Sampled Earthquakes 2010-2019

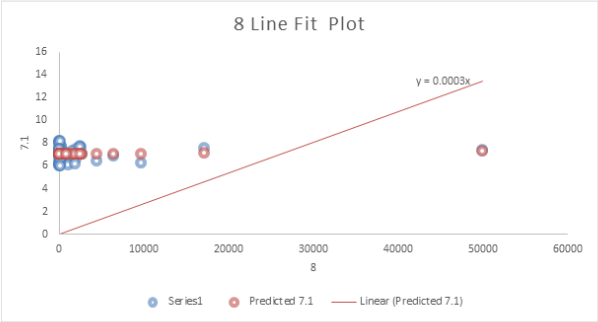

Figure 4. Line Fit Plot of 1990-1999 Sampled Earthquakes

Table 3. Summary Output of Regression Analysis for 1990-1999 Sampled Earthquakes and Lives Lost During Earthquake

Regression Statistics	
Multiple R	0.073
R Square	0.005
Adjusted R Square	-0.015
Standard Error	0.643
Observations	51

ANOVA

	df	SS	MS	F	Significance F				
Regression	1	0.107	0.107	0.26	0.613				
Residual	49	20.269	0.414						
Total	50	20.376							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.00%	Upper 95.00%	
Intercept	7.051	0.094	75.013	3.11E-52	6.862	7.24	6.862	7.24	
8	6.25E-06	1.23E-05	0.51	0.613	-1.84E-05	3.09E-05	-1.84E-05	3.09E-05	

Table 4. Summary Output of Regression Analysis for 2000-2009 Sampled Earthquakes and Lives Lost During Earthquake

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.454
R Square	0.206
Adjusted R Square	0.19
Standard Error	0.748
Observations	50

ANOVA

	df	SS	MS	F	Significance F				
Regression	1	6.993	6.993	12.482	0.001				
Residual	48	26.892	0.56						
Total	49	33.885							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.00%	Upper 95.00%	
Intercept	6.852	0.109	62.635	1.00E-47	6.632	7.072	6.632	7.072	
103	1.05E-05	2.96E-06	3.533	0.001	4.50E-06	1.60E-05	4.50E-06	1.64E-05	

Table 5. Summary Output of Regression Analysis for 2010-2019 Sampled Earthquakes and Lives Lost During Earthquake

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.452
R Square	0.204
Adjusted R Square	0.19
Standard Error	0.649
Observations	57

ANOVA

	df	SS	MS	F	Significance F
Regression	1	5.94	5.94	14.108	0.0004
Residual	55	23.157	0.421		
Total	56	29.097			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.00%	Upper 95.00%
Intercept	6.905	0.089	77.522	7.00E-58	6.727	7.084	6.727	7.084
316000	1.00E-04	2.90E-05	3.756	0.0004	5.03E-05	2.00E-04	5.03E-05	2.00E-04

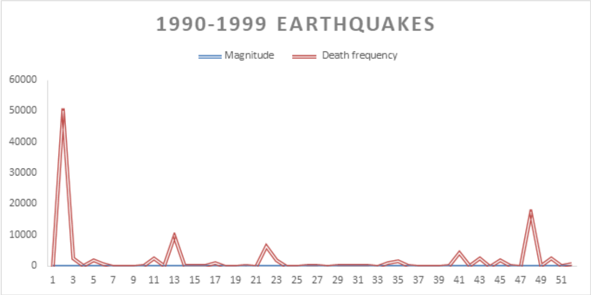

Figure 5. Line Graph Demonstrating 1990-1999 Earthquakes Magnitude and Lives Lost During Earthquake

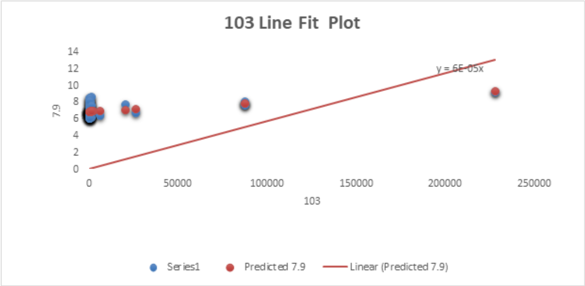

Figure 6. Line Fit Plot of 2000-2009 Sampled Earthquakes

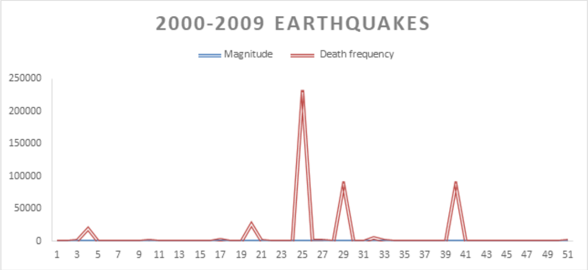

Figure 7. Line Graph Presenting 2000-2009 Earthquakes Magnitude and Lives Lost During Earthquake

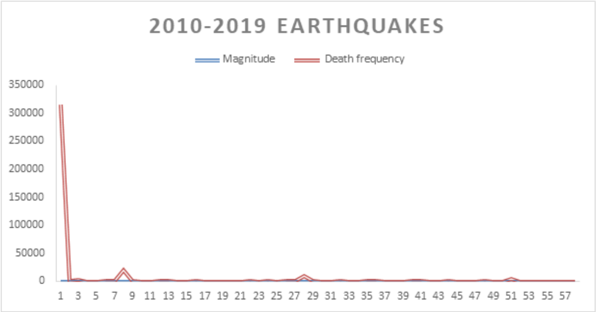

Figure 8. Line Graph Presenting 2010-2019 Earthquakes Magnitude and Lives Lost During Earthquake

2009 are determine by earthquake magnitude and R2 result in Figure 8 demonstrate 20% of the lives lost during earthquakes 2010-2019 are determine by earthquake magnitudes. Significant F result is Figure 6 significant F =0.613, Figure 7 significant F=0.001 and Figure 8 significant F=0.0004. Two out of the three significant F result indicated that the result of the research is reliable while one result indicated that the result is not reliable. However, the result of the research signifies that even though earthquake magnitude influence lives lost during an earthquakes, other factors such as population density of the area where the earthquakes occur, the geological structure of the areas where the earthquake take place, the time at which the earthquake occur i.e. night or during daylight and earthquakes are trigger by present of fluid or precipitation in an area where it occur, also influence figures of lives lost during earthquake.

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