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RESEARCH ARTICLE

Disaster; an Inexplicable Canker to the Cape Coast Metropolitan Assembly in the Central Region of Ghana

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Abstract

The study was carried out to analyze data on recorded disaster cases in the Cape Coast Metropolitan Assembly which are assuming alarming proportions annually. The main objective of the study was to determine the quarterly trend of recorded cases of disaster made available for this research (2010 to 2012 inclusive). The findings of this research were to clear the uncertainty in the minds of the teeming populace within the metropolis regarding rate of change of disasters in their locality. It was to better inform the National Disaster Management Organisation (NADMO), the Motor Traffic and Transport Union (MTTU) of the Ghana Police Service, and the Ghana National Fire Service in the Central Region of Ghana, appropriate preventive measures and interventions during the peak zones of disasters. Testing the results with the Two-Way Analysis of Variance (Two-Way ANOVA) at 5% significance level, revealed that there were no statistical differences in the annual recorded cases of disasters. However, the quarterly differences were significant with the last quarter of every year recording the highest in the sub-region. The rate of increase of recorded cases of disasters stood at an average of 17% over the period with approximately 83 disaster cases recorded quarterly in the Cape Coast Metropolis. This number was largely influenced by motor accident. The cultural and religious practices of the people during certain periods of the year were possible contributory factors.

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Introduction

The International Federation of Red Cross and Red Crescent Societies (IFRC 2007) defines disaster as “a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community’s or society’s ability to cope using its own resources.” The United Nations International Strategies for Disaster Reduction (UNISDR 2004) views disaster as “a serious disruption of the functioning of a community or a society. Disasters involve widespread human, material, economic or environmental impacts, which exceed the ability of the affected community or society to cope using its own resources.” From the two definitions we may conclude on two main type types of disasters, namely; natural disasters and disasters caused by humans (fire, road accident, deforestation, overgrazing of cattle, uncontrolled housing construction, removal of wetlands,). A natural disaster is a disaster caused by nature, such as floods, volcanic eruptions, earthquakes, tsunamis, blizzards, drought, hailstorms, heat waves, hurricanes, tropical storms, typhoons, Ice Ages, tornadoes, and wildfires. Disaster causes damage to life and property and destroys the economic, social and cultural life of people. It can be caused by our inability to manage risk. One particular disaster (primary disaster) can lead to another (secondary disaster) which may eventually increase the impact. For example, earthquake may cause tsunami which may eventually lead to flooding.

There has also been growing concern about climate change and increasing disasters in some parts of the world in recent times for which flood, accident and fire disasters have been identified as the most common ones in the world. Ghana, like most parts of the world lose a lot of lives and property including government buildings through disaster in recent times and Cape Coast is not an exception. Fortunately for us in Ghana and particularly in the Cape Coast metropolis most disasters are caused by human activities which could have been avoided if we were aware of the peak seasons of disasters and human activities that led to their occurrences. The concerns being raised have increased our desire to learn more about disaster experiences in the past.

For the past 10 years, flooding has become a major enemy to the development of Ghana as governments and international bodies continue to pump huge sums of money into helping flood victims to get back on their feet through the provision of relief items like blankets, food items and in some cases temporary shelter. The trend and the impact of flood, fire and other forms of disasters continue to escalate, hence the need to reduce the trend. As the government presses on with efforts to reduce disaster through NADMO, one may ask, what is being done to reduce its occurrence? Hundreds of residents at Ankafu and Kwapro, all in the Cape Coast Metropolitan Area, were displaced after the Kakum River overflowed its banks following the opening of its spillways in September 2012. The quarterly official newsletter of NADMO (1, Volume 5, October – December, 2013) revealed that in the Northern Region of Ghana alone rains hit 21 districts including 222 communities with 8 deaths, 43 injured, 4354 houses and 49 schools ripped during the early rains of 2013. In 2011, flood affected 243,988 people across the length and breadth of Ghana. In the process 16,801 houses were seriously affected. In the same year, 6316 different fire incidents were recorded costing 1,291,347 US dollars.

Available statistics at the Ghana Road Safety Commission showed that Ghana lost 1.74 million cedis on fire in the first quarter of 2012 as compared to 1.62 million cedis in the first quarter of 2011. Furthermore, In Ghana, fire gutted parts of the Kumasi Central Market destroying property worth several thousands of Ghana cedis on February 26, 2014; ravaged settlements and shops around the Tamale Polytechnic destroying property running into thousands of Ghana Cedis on the 25th of December, 2013; And also destroyed the old Parliament House near the Arts Centre in Accra on the 19th of December, 2013.

In Ghana, road crashes were responsible for at least six deaths a day and over 2,000 deaths in a year with its accompanying thousands of injuries and incapacitation with majority of the victims between the ages of 15 and 55 years. In general disaster is a great concern that needs to be addressed because it negatively affects economic development in every nation especially the developing Countries. For example, a former Minister of State (E. T. Mensah), in November, 2013, reading a speech on behalf of the President of the Republic of Ghana in Tamale, expressed worry over the loss of 1,539 lives between January and September 2013 as a result of traffic road accidents in the country. According to him, the “government observes with grave concern the statistics from the National Road Safety Commission (NRSC) of the Motor Traffic and Transport Unit (MTTU) of the Ghana Police Service which indicated that more than 1,539 people lost their lives, while 9,741 got injured during the period”. He added that between January 2000 and December 2010, 20,503 people died on the roads in the country while 63,384 were reported injured, which according to him, is far more than deaths occasioned by HIV and violent crimes.

A research conducted by Asumadu (2012) showed that, accidents increased every year and the number of people who were killed by road accidents in Ghana seems to be increasing as years go by. In 2001, there were 1660 people who were killed in road accidents, this was increased to 1666 deaths in 2002 and in the year 2003 the number rose to 1734. In 2010, the number had risen to 1986. This observation was supported by Odoom (2010) that as years go by, the number of vehicles in Ghana will increase and the number of traffic accidents will increase accordingly and as such the number of people who are likely to be killed in road accidents was expected to increase. Sunkwa (2013) also reported that Road Accidents increase every year and there was no significant difference in yearly recorded cases of road accident in the Central Region of Ghana.

We are therefore interested in determining the peak periods of disasters in the Cape Coast Metropolis and whether the cultural activities/festivals celebrated by the people at certain periods of the year, have influenced the former. For example both the people of Cape Coast and Elmina celebrate their festivals ‘Oguaa Fetu Afahye’ and the ‘Bakatue’ in the third quarter of every year. Furthermore, quarterly trend and rate of increase of recorded disaster

cases are of interest. Another interesting area is whether significant differences in the yearly/quarterly cases of disaster exist in the metropolis.

Materials/Methods

The only one but largest metropolitan area in the Central Region of Ghana (Cape Coast Metropolis) which houses the Regional staff responsible for gathering data on disaster was selected. All recorded cases of disaster from 2010 to 2012 were considered for the study. The data used for the research was very reliable since it was collected from the only authorized bodies mandated by law to collect and manage such sectors. Secondary data were obtained from the regional head offices of NADMO, MTTU of the Ghana Police Service and Ghana National Fire Service. The analysis of data was done using descriptive statistics, trend analysis and Two-Way Analysis of Variance. (Refer: Webster,1998;. For the trend analysis, the following computational formulae were useful;

For the trend analysis

The general form of linear trend equation is given as:

$$Y' = \alpha + \beta(t) \quad 1$$

Two equations may be solved simultaneously to arrive at the least squares trend equations. They are:

Equations for the trend line

$$\sum Y = na + \beta \sum t \quad 2$$

$$\sum tY = a \sum t + \beta \sum t^2 \quad 3$$

$$\text{The slope } \beta = \frac{n \sum tY - (\sum Y)(\sum t)}{n \sum t^2 - (\sum t)^2} \quad 4$$

$$\text{The intercept } \alpha = \frac{\sum Y}{n} - \beta \left[\frac{\sum t}{n} \right] \quad 5$$

Where; Y' is the projected value of the response variable (total quarterly disaster cases) for a selected value of the predictor variable (t = quarter period). α is the Y- intercept. It is the estimated value of response variable Y , when the predictor variable $t = 0$. β is the slope of the line, or the average change in response variable Y' for each change in t quarters, t is any value of time that is selected.

For the two-way analysis of variance, the total sum of squares can be partitioned into three separate sources of variability: one due to variability among treatments (quarterly differences); and the other, variability due to blocks (yearly differences); and one due to random fluctuations (i.e. the variability among the x_{ij} that is not accounted for by either treatment or block). In mathematical terms, the total sum of squares,

$$SS_T = \sum_{i=1}^b \sum_{j=1}^k (x_{ij} - \bar{x}_{..})^2 \quad \text{can be partitioned into}$$

$$SS_{Tr} = b \sum_{j=1}^k (\bar{x}_{.j} - \bar{x}_{..})^2 \quad (\text{Quarterly sum of squares})$$

$$SS_B = k \sum_{i=1}^b (\bar{x}_{i.} - \bar{x}_{..})^2 \quad (\text{Yearly sum of squares})$$

$$SS_E = \sum_{i=1}^b \sum_{j=1}^k (x_{ij} - \bar{x}_{.j} - \bar{x}_{i.} + \bar{x}_{..})^2 \quad (\text{Error sum of squares})$$

Thus,

$$SS_T = SS_{Tr} + SS_B + SS_E$$

The decision to reject the claim of the null hypotheses were based on the F – test statistic which is given by

$$F = \frac{SS_{Tr} / (k - 1)}{SS_E / (k - 1)(b - 1)} \quad \text{compared with the F-critical.}$$

Results

Table 1: Annual and Quarterly (Q) Distribution of Reported Disaster Cases

YEAR	Q1	Q2	Q3	Q4	Total	Percentage
2010	81(7.45)	80(7.35)	88(8.09)	104(9.56)	353	(32.45)
2011	86(7.90)	93(8.55)	85(7.81)	96(8.82)	360	(33.09)
2012	88(8.09)	88(8.09)	92(8.46)	107(9.83)	375	(34.46)
Total	255	261	265	307	1088	(100)
Percentage	(23.44)	(23.99)	(24.36)	(28.21)	(100)	(100)

Percentages in brackets

From Table 1; 2012 recorded the highest yearly percentage (34.48%) of disaster cases. On the quarterly cases, it appears the fourth quarter of every year registered the highest disaster cases with the fourth quarter of 2012 registering the highest (9.83%) among them. Not only did we witness a gradual increase in the annual cases but also the quarterly increases were prevalent. For example, 2010 experienced an increase from 81(7.45%) in the first quarter to 104(9.56%) in the last quarter of the same year, and also from 88 (8.09%) to 107 (9.83%) in 2012. The year on year increase in the recorded disaster cases stood at 33.33% whilst the average quarterly increase was 25%. It was also noted during the three years that the second quarter of 2010 recorded the lowest number of disasters 80(7.35%). It may not be very clear considering the general behavioural pattern at this preliminary stage and hence, a pictorial view was useful. (Refer: Figure 1).

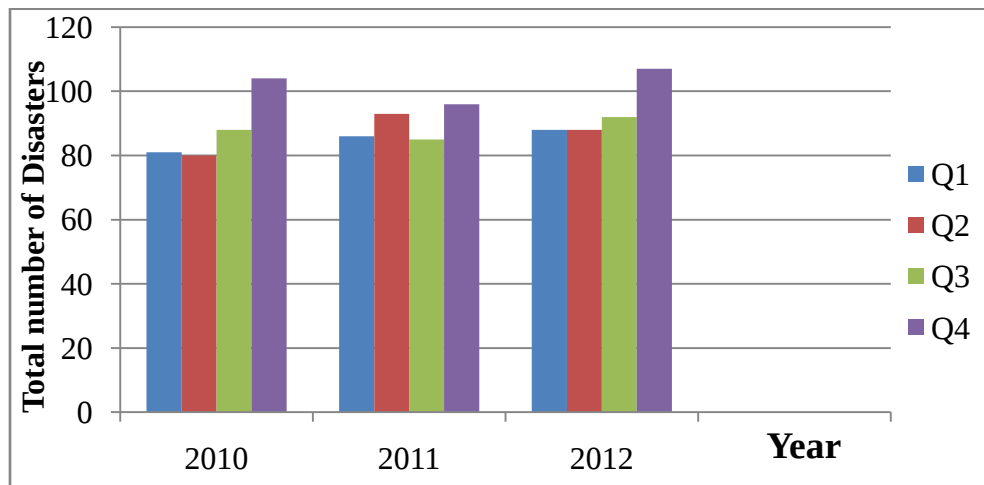


Fig.1: Distribution of Disaster Reported Cases over the Three Years

Clearly from Figure 1, disaster cases were generally high during the fourth quarter (that is, October to December) of every year in the Cape Coast Metropolis followed by the third quarter (July to September). However, the first quarter (January to March) each year has recorded the lowest though, not too different from the second quarter (April to June).

Table 2: Distribution of the Three Main Factors Determining Disaster in the Cape Coast Metropolis

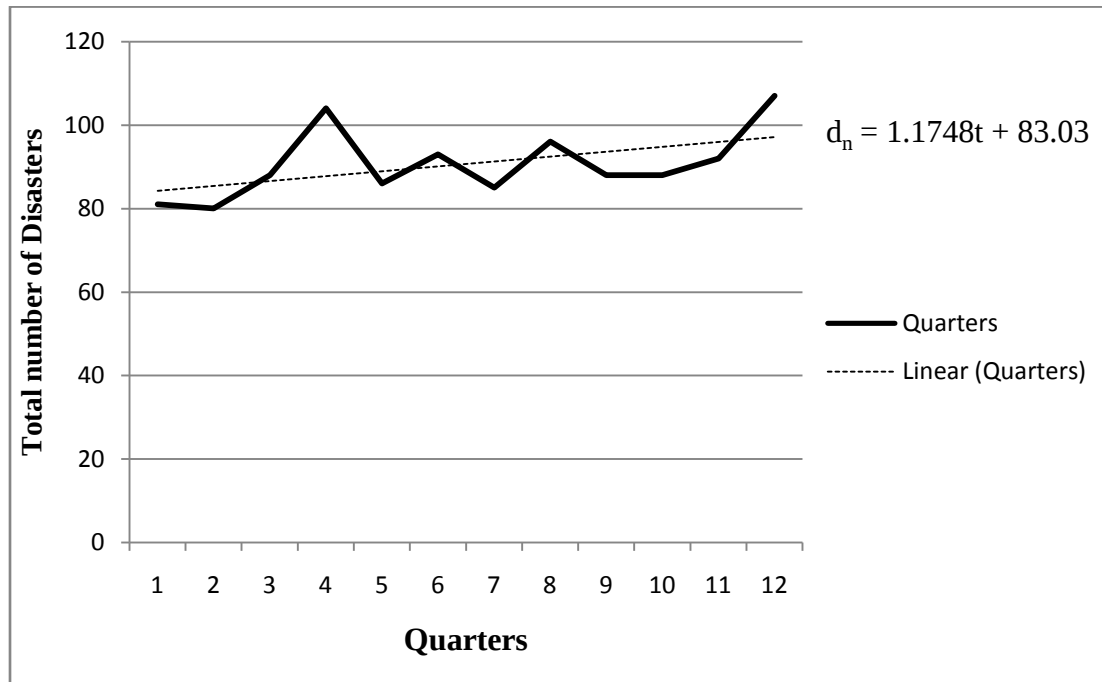
Year	Fire	Flood	Moto Accident	Total	Ov.%
2010	12(1.10)	0(0)	341(31.34)	353	32.44
2011	7(0.64)	1(0.09)	352(32.35)	360	33.09
2012	5(0.46)	8(0.74)	362(33.27)	375	34.47
Total	24	9	1055	1088	100
Ov. %	2.2059	0.827206	96.96691	100	100

Ov. % represents overall percentage; Values in brackets represent percentages

With reference to Table 2, motor accident assumed an alarming proportion (1055 out of 1088) representing 97% of the overall disaster cases in the Metropolis. On the annual contributions, accident recorded the highest of 31.34% in 2010; 32.35% in 2011; and 33.27% in 2012 (increasing every year). It was only fire disaster that recorded decreasing number of cases during the period of this research.

With regards to the quarterly reports, motor accident again contributed the highest to the overall disaster cases. For example, from the first quarter to the last quarter, motor accident recorded about 23%, 22%, 24% and 28% respectively against 0.74%, 1.01%, 0.28% and 0.84% for fire disasters; and less than 1% in every quarter for floods. Motor accident was therefore leading in every 4th quarter followed by the 3rd quarter. The second quarter recorded the least. (Refer: Table 3).

Although from the preliminary analysis a lot of results were obtained and critical observations made, it appeared the summary statistics are not sufficient to confirm the results. This therefore called for further statistical investigations and testing such as time series trend analysis and two-way analysis of variance.

**Figure 2: Trend Distribution of Quarterly Disasters**

From Figure 2, the time series plotted above indicates the disaster cases reported in the Cape Coast Metropolitan Assembly. The explanatory variable (t) is the number of quarters within the period whiles the response variable (d_n)

is the total number of disaster cases reported in each quarter over the period. The graph showed a linear trend over twelve quarters within the three years. The linear trend model, $d_n = 1.1748t + 83.03$ was used to formulate the trend line in the above time series, where 1.1748 is the slop indicating an average of 17.5% change in the quarterly reported disaster cases over each quarter of the period. Thus, a unit change in 't' quarters will bring about 17.5% change in the total number of disaster cases in the Metropolis. Also, at $t = 0$ (t is less than a quarter, since the quarters are discrete), there was an average of 83 recorded cases of disasters over the period. Using the ' q_n ' model, granted all things being equal, the expected number of disaster cases in the Cape Coast Metropolis, by the end of the first and second quarters of 2014 are 103 and 104 respectively at $t = 17$ or 18.

Table 3: Two-Way ANOVA Classification for Yearly and Quarterly Effect

Source of Variation	SS	df	MS	F	P-value	F crit
Yearly Effect	63.16667	2	31.58333	1.371532	0.323194	5.14325285
Quarterly Effect	561.3333	3	187.1111	8.125452	0.015555	4.757062663
Error	138.1667	6	23.02778			
Total	762.6667	11				

From Table 3, since $F = 1.371532 < F\text{-critical} = 5.14325285$, we do not have enough evidence to suggest that yearly differences were significant. This has been supported by the $P\text{-value} = 0.323194 > 0.05$. We therefore concluded that though yearly differences in disaster cases were slightly visible in the preliminary analysis (Refer: Table 1, & Fig. 1), they were not significant. On the other hand, for quarterly effects, $F\text{-test statistic} = 8.125452 > F\text{-critical} = 4.757062663$, with $P\text{-value} = 0.015555 < 0.05$, we could not but confirm that the quarterly differences in the recorded cases of disaster in the Cape Coast Metropolis were highly significant. This difference was greatly influenced by motor accident. The test has supported the wide quarterly differences identified in the earlier analyses. (Refer: Table 1, & Fig. 1).

Table 4: Distribution of recorded disaster cases in the Cape Coast Metropolis

YEAR		2010	2011	2012	TOTAL	%
1 st Quarter	Fire	1	4	3	8	0.735
	Accident	80	82	84	246	22.610
	Flood	0	0	1	1	0.092
	Total	81	86	88	255	23.438
2 nd Quarter	Fire	7	2	2	11	1.011
	Accident	73	91	79	243	22.335
	Flood	0	0	7	7	0.643
	Total	80	93	88	261	23.989
3 rd Quarter	Fire	2	1	0	3	0.276
	Accident	86	84	92	262	24.081
	Flood	0	0	0	0	0
	Total	88	85	92	265	24.357
4 th Quarter	Fire	2	0	0	2	0.184
	Accident	102	95	107	304	27.941
	Flood	0	1	0	1	0.092
	Total	104	96	107	307	28.217

Discussion

The primary objective of the study was not only to determine the quarterly trend of disaster cases from 2010 to 2012, but also to determine the peak period(s) of disasters in the Cape Coast Metropolis and whether the cultural activities/festivals celebrated by the people at certain periods of the year, have influenced it. Preliminary analysis was done and the results tested for significant differences.

It was observed from the results that the highest (34.46%) and lowest (32.45) annual disaster cases were recorded in 2012 and 2011 respectively. On the quarterly cases, it appears the fourth quarter of every year registered the highest disaster cases with the fourth quarter of 2012 registering the highest (9.83%) among them. The year 2010 experienced an increase from 81(7.45%) in the first quarter to 104(9.56%) in the last quarter of the same year, and also from 88 (8.09%) to 107 (9.83%) in 2012. The year on year increase in the recorded disaster cases stood at 33.33% whilst the average quarterly increase was 25%. It was also noted during the three years that the second quarter of 2010 recorded the lowest number of disasters 80(7.35%).

Generally, disaster cases were high during the fourth quarter (that is, October to December) of every year in the Cape Coast Metropolis followed by the third quarter (July to September). However, the first quarter (January to March) each year has recorded the lowest though, not too different from the second quarter (April to June). These differences in disaster cases were predominantly influenced by motor accident as it registered about 97% of disaster cases.

The trend analysis to determine the general linear pattern of the quarterly disaster cases in the Cape Coast Metropolis revealed a general increasing linear behaviour of the observed data. It was evident that a unit change in 't' quarters will bring about 17.5% change in the total number of disaster cases in the Metropolis.

The research supported the findings put out by the National Road Safety Commission, Asumadu (2012) and Odoom (2010) that road accidents increased annually. It also supported that of Sunkwa (2013) that though road accident increased over the years, there was no significant difference between the yearly recorded cases.

Conclusions

From the findings, we concluded that disaster cases were high during the fourth quarter (October to December), followed by the third quarter, first and second quarters respectively in the Cape Coast Metropolis. Also, there was no significant difference between the yearly records of disasters. However, there was significant difference among the quarterly records of disaster cases within the Cape Coast Metropolis. These differences were influenced by motor accident. The research also noted with great concern the importance the people of Cape Coast attach to the celebrations of Christmas in the fourth quarter of each year; the great cultural festivals ('Oguaa Fetu Afahye' and 'Edina Bakatue' at Elmina near Cape Coast) which attract people from around the world in the third quarter. The first quarter also met the 'New Year, valentine and Independence day celebrations. These events could possibly account for the high incidence of motor accident – a leading determinant of disaster in the Metropolis.

Recommendations

Following the findings from this research we recommend that the Ghana Road safety Commission embarks on serious road safety educational campaign, whilst collaborating with the Driver vehicle and licensing Authority for proper skills training and acquisition of certified, license and also to ensure that the vehicles are truly fit to be on road. The MTTU of the Ghana Police service should relentlessly enforce the road safety laws without fear or favour in order to bring sanity on our roads. Drivers as well as auto mechanics should ensure regular maintenance of vehicles and that only qualified and experienced mechanics perform maintenance work on the vehicles. With regards to fire and flood disasters, though the numbers were relatively small in the area, property and human lives lost are irreversible and as such, NADMO, Ghana National Fire Service and all the agencies that matter should intensify campaign on zero tolerance for fire and flood disasters. People who build on water ways and unauthorized places should be made to stop and those already constructed be pulled down and the debris cleared by the assemblies in collaboration with the Town and Country Planning. Particular attention must be given during the fourth, third and first quarters of every year to reduce or possibly eradicate disaster completely from the area since most of them are avoidable. We recommend for future researchers to extend this research to cover the entire country.

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