STATISTICAL ANALYSIS OF ROAD TRAFFIC FATALITIES IN NAMIBIA FROM 2007 TO 2009

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Chapter 1

INTRODUCTION

1.1 Introduction

In this study, much focus is on statistical analysis of road traffic fatalities in Namibia from 2007 to 2009. The first chapter of the study, which is *introduction* provides more information on the research background and discusses issues such as the statement of the problem, research questions, research objectives and hypothesis of the study. It then highlights the significance of the study. The chapter concludes with a general overview of the study and an outline of the chapters.

1.2 Background Information

"While the road safety situation in Namibia may not be the worst in the world, at least one person is killed and 16 others injured on our roads, every day", reads the first line of the second paragraph of the foreword by the Chief Executive Officer of the Motor Vehicle Accident Fund (MVA Fund) in the Annual report on Road Crashes and Claims of MVA Fund of 2010. A motor vehicle collision occurs when a road vehicle collides with another object, be it a vehicle, pedestrian, animal, or any other obstacle. These collisions can result in injury, property damage, and/or in fatality. ***Property damage*** refers to any harm or destruction of material goods such as vehicles, buildings and bridges, etc. Injury is classified as serious or as slight injury. ***Serious injury*** means injury sustained in an accident that require hospitalisation within 30 days after the occurrence of the accident while ***Slight injury*** means minor cuts and bruises, sprains and light shocks sustained in an accident which may be treated at the scene of the accident or at home without being hospitalised (NRSC Action Plan 2009-2014, 2009).

Fatality, as defined in the oxford dictionary is a death of persons. In United States, the definition used in the Fatality Analysis Reporting System (FARS) run by the National Highway Safety Administration (NHTSA) is "a person who dies within 30 days of a crash on a US public road involving a vehicle with an engine, the death being the result of the crash."

(en.wikipedia.org/wiki). In Namibia, the definition of road-traffic fatality that is used by the National Road Safety Council (NRSC), is "a road-traffic fatality is defined death as any person who dies outright or within 24 hours as a result of Road traffic Accident or Collision or Crash", (NRSC, 2007). They do not have mechanisms in place to follow up on the persons who were seriously injured, who could have died within 30 days after the accident, and become accustomed to the international definition of fatality. Largely, the entire definitions single out that fatality is death of persons as a result of road traffic accidents.

Road traffic fatalities have become a major concern in this world we are living in. Thousands of people are killed on the roads worldwide, every day, as reported in the media. Family members travelling to different destinations, either to work or setting out on a long trip, children playing in the streets and walking to schools, expected to come back home safely, never return home. They become victims of road traffic deaths. Those who survive the fatal accidents spend weeks, months and even years in hospitals in pains and life will never be the same to them anymore as it used to be.

Table 1.1: Number of fatalities for 2003 to 2006 in Namibia

Year	Fatalities
2003	278
2004	291
2005	252
2006	330

Source: NRSC statistical report of 2007

The trend of road traffic fatalities over the past four years presented in Table 1 above reflects the increase in the number of fatalities.

There have been several campaigns and plans that Namibia has done and is currently doing as a country in order to tackle the problem of road traffic accident and ensure the safety of the all the road users in the country. Among them is the Xupifa Eemwenyo (Save lives) road safety projects, which was established in 2005 with the aim of reducing fatalities, injuries and trauma on Namibian roads and to create road safety awareness amongst Namibian road users due to

distressing Road Traffic Accidents (RTAs) (www.mvafund.com.na). Others include; Namibia Road Safety Strategy (NRSS) and Khomas Region Transport Safety Plan, as well as, law enforcement of traffic fines and national drink-driving law.

The questionnaire submitted to the World Health Organization by the National Road Safety Council regarding the drink-driving law in Namibia entailed the following:

- The national drink-driving law was implemented in the country because alcohol consumption is not legally prohibited in Namibia. It is based on **Blood** Alcohol Concentration (BAC) or an equivalent **Breath** Alcohol Concentration level of which penalties can be applied is 0.079g/100ml blood and 0.37ml breath.
- The mechanisms used to enforce the drink-driving law include;1) the usage of breath testing at specific locations or times (e.g holiday periods, outside pubs or bars), 2) all year-round random (population) breath testing and 3) when involved in road crash.
- To penalize transgressors of drink-driving law, his/her driver's license is suspended or revoked, he/she is fined, sent to jail/prison/detained as well as given a penalty claim of MVA Fund Act 10 of 2007.

1.3 Statement of the Problem

Throughout the world, the growth of the transport system has been and continues to be a key element in economic development. An increase in gross national product (GDP) is accompanied by a greater movement of people and goods and greater investment in both vehicles and transport infrastructure. As a result, more vehicles are being manufactured to cater for the transportations of people and goods in order to enhance development. However, these vehicles are a major cause of traffic problems including fatality.

The costs of fatalities and injuries due to road traffic accidents (RTAs) have a tremendous impact on societal well-being and socioeconomic development. Families are driven into poverty when bread-winners are killed in vehicle accidents. In Namibia, the Motor Vehicle Accident Fund organization, which is responsible for compensating affected people as the result of accidents, has to spend a lot of money paying for the funeral services, medical expenses, etc. for these

affected persons. According to World Health Organization (WHO) report of 2004, RTAs are among the leading causes of death and injury worldwide, causing an estimated 1.2 million deaths and50 million injuries each year. The World Bank Group report of 2002 also stated that road crashes are the second leading causes of death amongst the people aged between 30 and 44 years worldwide.

The MVA Fund report of 2010 underlined that the majority of the deceased are young people within the productive age-group of 21 to 40 years. It was also stated by Khomas Region Transport Safety Plan reports of 2010 that Road Traffic Accidents (RTAs) are third biggest cause of deaths in Namibia, outnumbered only by HIV/AIDS and Malaria. These people in the productive age-groups killed in vehicle accidents are the backbone of the labour force, whowould have made a meaningful contribution towards Namibia's economic growth. According to the World Medical Association of 2006 as cited in Lehohla (2009), serious injuries and mortality in road collisions are a public health problem with consequences similar to those of major diseases such as cancer and cardiovascular disease.

Despite of all the efforts being done to reduce fatalities in Namibia, as highlighted in the background information, fatalities are still alarming as indicated in the **Table 1,** in the background information and as reported in the local media almost every day. These road traffic accidents are a concern as they continue to threaten the lives of the Namibian nation. Also, considering the rate of fatalities per 10000 vehicles and per 10000 people which is 10.5 and 1.2 respectively, indicates that there are more than 10 fatalities per 10000 vehicles and at least one person being killed per 10000 people in Namibia (NRSC, 2007), this is a problem. This problem emphasizes an increased need for analysing the potential risk factors behind such fatal road traffic accidents.

In this research, the researcher will concentrate on the variables: Time of the day, Day of the Week, Weather condition, Road surface type, Light condition and Road signs condition to find out how they affect the odds of having a fatality in a vehicle collision in Namibia.

1.4 Objectives of the Study

The primary objective of the research is to analyze potential factors that affect the odds of having fatalities in a vehicle collision in Namibia.

Specifically, the research wants to address the following questions:

(i) What are the significant factors that affect the odds of having a fatality in a vehicle collision in Namibia?

(ii) Is there a significance difference in total mean number of fatalities between the three years 2007 to 2009?

1.5 Hypothesis

(i) There is no significant difference in average number of fatalities between the three years (2007 to 2009).

1.6 Significance Of The Study

Road traffic collisions have over the years claimed lives and time has come to redouble efforts in order to prevent or reduce its occurrence and associated health implications. The road and surrounding area is a significant element in traffic safety. As such, one cannot improve safety without successfully relating accident frequency and severity to the causative variables (Kononov op.cit Tibebe, 2009).

Firstly, the most published reports about road traffic accidents in Namibia contain descriptive information only. Therefore there is a high need for in-depth studies. Secondly, determining the Time of the day, Day of the week, Light condition, Weather condition, Road surface type, and Road signs condition and where most of the accident is most likely to result in fatalities is quite useful to Road users to decide when to travel. Lastly, identifying the best factors that affect the odds of having fatality in a vehicle collision, the selected final model might be a helpful tool in formulating cost-effective safety measures for legislation that will benefit all road users and the public at large. As such, this study can be regarded as highly significant in terms of road safety.

1.7 Limitations of the study

Looking at the body of this research, there were several things that are limited the researcher from obtaining all relevant information. First of all, there was unavailability of latest data in the database which limited the researcher to only use 2007 to 2009 because they were the latest captured road traffic data. The research was primarily aimed at analyzing road traffic fatalities for 2009 to 2011.

Another limitation is that the National Road Accidents Forms (NRAFs) were partially completed, leading to a lot of missing cases and errors. The assumption is that many police officers are very busy throughout the day and do not get to finish their paperwork until their shift is over; sometimes not even until the end of the week. Because of this, some details may become fuzzier or the officer may have completely forgotten where the accident occurred or other details such as the person's age, if the person used a seatbelt or not, etc.

Lastly, there was a limitation imposed by time. The researcher did not get enough time to follow up on the missing cases which appeared to be more than 50% of the total number of accident cases recorded for the three calendar years to find out whether the blame lies on the police officers or on Data capturers.

1.8 Organizations of Sections

The following is a brief outline of the sections involved in the research project.

CHAPTER 1: The first chapter is giving the introductory part of the research which includes: background information, statement of the research problem, objectives, research questions, research hypotheses and significance of the study.

CHAPTER 2: The second chapter is giving the literature review, which is the idea of what other researchers and book authors have done on topics similar to the current study.

CHAPTER 3 : The third chapter consist of methodology in which a clear explanations on how the study was carried out is stated. Relevant procedures used, population of the study and Statistical tests used are also found in chapter 3.

CHAPTER 4: The fourth chapter consists of data analysis and results presentation, analysis results from the questionnaire, and the test of hypotheses were dealt with in this part of the study.

CHAPTER 5: The last chapter consist of conclusion and recommendations as well as suggestions of the future research are focused upon.

Chapter 2

REVIEW OF RELAVANT LITERATURE

Fatalities and human trauma caused by road traffic accidents are a worldwide problem. The Global Road Safety Partnership (GRSP), a United Nation initiative, estimated that in 1999 alone, the cost of road crashes globally was in excess of US$500 billion, of which US$60 billion was contributed by developing countries – Namibia included (NEPRU, 2006). Namibia, as a young country which recently gained its independence, is burdened with many social problems, and this situation is aggravated by road accidents which not only cause human suffering, but also carry a very high price tag. In an attempt to address this situation, the Namibian government appointed the National Road Safety Council (NRSC) in 1996 to spearhead efforts to curb the increasing dangers of today's road traffic system (NEPRU, 2006).

It has been observed over the past years that in Namibia, the highest number of fatalities were recorded during the April, August and December months, yearly as reported in the NRSC report of 2004. This could be because of public holidays or festive seasons in Namibia i.e., 'Easter holiday' in April, 'Heroes day' in August and the 'Christmas break' in December, leading to higher traffic volumes in these periods in Namibia, putting road users at increased risk of road crashes. Out of all the 13 regions, Khomas region and Otjozondjupa region are alleged to constitute higher number of fatalities each year as reported in the same NRSC report of 2004. The chances of an accident occurring are higher where there are more vehicles i.e. in industrialized towns. Otjozondjupa region is situated in the centre of the country where many of the vehicles leading to major towns such as Oshakati, Walvis Bay, Rundu, Luderitz, etc., pass through. Consequently leading to heavy traffic during "peak days" of festive seasons when everyone is travelling.The NRSC of 2004 reports also highlighted that head-on, head-to-rear, sideswipe collisions and collisions with pedestrians are mostly major causes of accidents which result in fatalities in towns.

There are several types of issues to look at when relating fatalities to vehicle collisions. These could include weather, road condition, lighting, time of day, day of week, and season or quarter

of the year of the accident (Mathis, 2011). When describing weather, it could include heavy rain, hail, snowstorms, high winds, blowing sand, fog, and other atmospheric effects. Weather effects often influence the driver in multiple ways; visibility, the ability to control the vehicle, and even the ability to hear. Thus, there is a higher possibility of an accident during these times, which means a higher chance for a fatality to occur. In a study, it was found that about 34% of serious crashes had contributing factors related to the roadway or its environment (Lum & Reagan, 1995 op.cit Mathis, 2011). Road conditions like construction, ice, potholes and wetness can also cause more accidents to occur because it is harder to steer the vehicle if the driver is not familiar with the situation, or is not driving safely (Mathis, 2011).

However, Road Traffic Fatalities and serious injuries are to a great extend preventable, since the risk of incurring injury in a crash is largely predictable and many countermeasures, proven to be effective, exist, (World Health Organization, 2004, p. 109). The report further highlighted that exposure to road injury risk can be decreased by strategies that include:

- Reducing the volume of motor vehicle traffic by means of better land use.
- Providing efficient networks where the shortest or quickest routes coincide with the safest routes.
- Encouraging people to switch from higher-risk to lower-risk modes of transport
- Placing restrictions on motor vehicle users, on vehicles, or on the road infrastructure.

Wedagama (2010) did a study to investigate the influence of accident related factors on motorcycle fatal accidents in the city of Denpasar during period 2006-2008 using a logistic regression model. The study found that the fatality of collision with pedestrians and right angle accidents were respectively about 0.44 and 0.40 times lower than collision with other vehicles and accidents due to other factors. In contrast, the odds that a motorcycle accident will be fatal due to collision with heavy and light vehicles were 1.67 times more likely than with other motorcycles. Collision with pedestrians, right angle accidents, and heavy and light vehicles were respectively accounted for 31%, 29%, and 63% of motorcycle fatal accidents.

Bener et.al (2010) used **Smeed's equation** to model for prediction of traffic fatalities which has been found inadequate for use in developing countries. They applied regression analysis to time-

series data on vehicles, population and traffic fatalities in the United Arab Emirates (UAE), Jordan and Qatar. The data were fitted to exponential models for fatality prediction, producing an average absolute error of 20.9% for Qatar, 10.9% for Jordan and 5.5% for the UAE. They found a strong linear relationship between gross domestic product and fatality rate.

Goswami and Sonowal (2011) did a statistical analysis of road traffic accident data for the year 2009 in Dibrugarh city, Assam, India. Data interpretation was done using Degree of freedom, Chi–square test for goodness of fit, $\chi 2$ – test for independence of attributes and Kruskal-Wallis test. They found that human characteristics (rush and negligence) make 95.38% of the total RTAs. 60% of the accidents were recorded during day time (6 AM to 6 PM). The peak time was between 12 PM to 6 PM (38.46%). The highest numbers of accidents (32.30%) were observed in the heavy rainy season during the months of July – September.

A study was done by Fujita and Shibata (2006) to clarify the relation between alcohol use and traffic fatalities in accidents involving motor vehicles in Japan between 1987 and 1996. Multiple logistic regression models were used to assess the effect of alcohol use on the risk of traffic-accident death. The data showed that 58,421 male drivers were involved in traffic accidents during the 10-year study period, and that 271 of these were killed as a result of the accident. Alcohol use was significantly associated with speed, seat belt use, time, and road form. Among male motorcar drivers, the odds ratio of alcohol use before driving, after adjusting for age, calendar year, time, and road form, was 4.08 (95% confidence interval, 3.08–5.40), which means that about 75% of fatalities (attributable risk percent among exposed) might have been prevented if drivers had not drunk before driving.

A descriptive analysis of road traffic accident (RTA) and injury data in Kenya was done using routine accident reports, official statistical abstracts, published and unpublished surveys. The characteristics of injury-producing accidents examined included trends, distribution patterns, risk factors, types of vehicles involved, and road-users injured or killed between 1962 and 1992. It was found that fatality rate per 10,000 vehicles increased from 50.7 to 64.2, while fatality per 100,000 populations ranged between 7.3 and 8.6. 66% of the accidents occurred during daytime. 60% of the reported RTAs occurred on rural roads and had a higher case fatality rate (CFR) of

16% compared to those occurring in urban areas (11%). Human factors were responsible for 85% of all causes. Vehicle-pedestrian collisions were most severe and had the highest CFR of 24%, while only 12% of injuries resulting from vehicle-vehicle accidents were fatal. Utility vehicles and buses were involved in 62% of the injury producing accidents. Of all traffic fatalities reported, pedestrians comprised 42%, passengers 38%, drivers 12%, and cyclists 8%.

Mohammad S (2009) conducted a statistical analysis for road traffic accidents and associated casualties in Bangladesh. An exploration was undertaken using the averages (per annum) of rates of fatal casualty, accident and involved vehicles applying Bar-charts. Annual time series data were also investigated using trend lines. Time series, Mann-Whitney, Kruskal-Wallis tests were used as well as modeling of two/ three-way data was conducted using the frequencies of fatal casualty, fatal accident and involved vehicles applying Poisson regression. The research found out that pedestrians are highly involved in the casualty figures. Fatal hit pedestrian is the main collision type accident. Maximum fatal accidents occur at out of junction. Cities have higher accident and casualty rates than that for non-cities (divisions/ districts, excluding cities). National highways are the main venues of accidents and casualties. Heavy vehicles including buses and trucks are predominantly involved in casualty accident.

Concluding Remarks

It is more evident from the literature review that logistic regression is a powerful method to model categorical data. Hence this research will employ binary logistic regression to model factors that affect the odds of having a fatality in a vehicle collision.

Chapter 3

METHODOLOGY

3.1 Research Design

This is a quantitative research. No questionnaires were designed for this project. The study depended on the secondary data that were collected from National Road Safety Council, for the time period of 2007 to 2009.

3.2 Population and Sampling

The researcher used 2007 to 2009 accident data of all road users in Namibia as the population of the study. Complete enumeration of accident data for the three calendar years (January 2007 to December 2009) was done of which, up to 15 685 cases were eligible for analysis out of 36 132 accident cases for the three years as confirmed by in the Table 3.1 below.

Table 3.1: Number of Valid and Missing Cases

	Number of cases	**Percent**
Valid	15685	43.4
Missing	20447	56.6
Total	36132	100

3.3 Instruments of Data collection and Data management

Namibia Road Accident Form (NRAF) is used to collect the data. The forms are administered by the police officer on duty who records the particulars of the person(s) involved in the accident within 24hours of the accident occurrence. The NRAFs are then submitted to the National Road Safety Council offices for capturing and analysis. The information are captured in the Road Safety Information and Management System (RSIMM) database. They are then imported to Microsoft Excel and SPSS for analysis. The researcher got the data in Microsoft Excel format.

3.4 Data Analysis and Methods

A Statistical Package for Social Scientists (SPSS) version 20.0 for windows and Microsoft Excel 2010 were be used to analyze the data. The analysis was be done based on the significance level of 5% and rejection region of p-values less than $\alpha = 0.05$. The variables of interest are summarized in the **table 2** below. The dependent variable of the study is **Fatalities** while all others are independent variables.

Table 3.2: Variables of interest and their categories

Variable	**Categories**
1. Time of the Day	12am-4am, 4am-8am, 8am-12pm, 12pm-4pm, 4pm-8pm and 8pm-12am.
2. Day of the Week	Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday
3. Weather Condition	Clear, Hail, Mist/Fog, Overcast, Rain and Unknown
4. Road Surface Type	Concrete, Dirt/Sand, Gravel, Salt, Tarmac and Other
5. Light Condition	Dawn/dusk, Daylight, Night: Street lights, Night: Unlit
6. Road signs condition	Good, Damaged/Missing, Poor and Not Applicable
7. Year of Accident	2007, 2008 and 2009

To model the potential factors that affect the odds of having fatalities in a vehicle, the dependent variable, **Fatality** in this study is a dichotomous variable with two categories, Fatal or Not fatal. Therefore, each of the subjects sampled is classified as a Fatal or not. Due to the binary nature of this dependent variable a **Binary Logistic Regression** approach is suitable. While to determine if Fatalities depends on the potential factors selected for the study, the Pearson's Chi-square test is suitable to discover if there is a relationship between each Factor and Fatality categorical variables, whereby Fatalities have two categories Fatal or not. Furthermore, the One-way

Analysis of Variance test is suitable to to find out whether there is significant difference in average number of fatalities between the three years since it compares the mean between three or more groups of the Independent categorical variable which in this case is **Year of Accident**.

Binary Logistic Regression

Logistic regression is a multiple regression but with an outcome variable that is a categorical variable and predictor variables that are continuous or categorical (Field, 2009 p.265). Categorical data is a form of discrete data that describes some characteristic or attribute. Binary logistic regression is a special analysis of the logistic regression applied when predicting the membership of only two categorical outcomes, meaning zero or one, with one being a success. It is useful to recode continuous explanatory variables into binary because it makes it easier to use and interpret when we use fixed group as the **reference.** The goal of an analysis using logistic regression is the same as that of any model-building technique used in statistics which is to find the best fit and most parsimonious. In logistic regression, we predict the *probability* of *Y* occurring given known values of X_i. In other words, Logistic regression models the relationship between a binary or ordinal response variable and one or more explanatory variables.

The specific form of the logistic regression model is:

$$\pi(x) = \frac{e^{(\beta_0+\beta_1 x)}}{e^{(\beta_0+\beta_1 x)}+1} = \frac{1}{e^{-(\beta_0+\beta_1 x)}+1},$$

where, for simplifying notations, we let $\pi(x) = E(Y \setminus x)$. The transformation of $\pi(x)$ logistic function is known as the Logit transformation:

$$g(x) = \ln \frac{\pi(x)}{1-\pi(x)} = \beta_0 + \beta_1 x,$$

The importance of this transformation is that *g(x)* has many of the desirable properties of a linear regression model. The logit, *g(x)* is linear in its parameters, may be continuous, may range from *–infinity* to *+infinity*, dependent on the range of *x*.

Generally, the odds are the ratio of the probability of occurrence of an event to that of nonoccurrence. In particular,

Odds = P(event)/ P(no event)

P(event Y) = $1/(1+ \exp(-b_0-b_1X_1)$

P(no event Y) = 1-P(event Y)

One-Way Analysis of Variance (ANOVA)

The one-way analysis of variance (ANOVA) is used to determine whether there are any significant differences between the means of three or more independent groups. Specifically, it tests the null hypothesis:

H_0: $\mu_{1=}\ \mu_{2=}\ \mu_{3=...=}\ \mu_k$, where μ = group mean and k = number of groups.

Assumptions of one-way ANOVA

To be able to perform a one-way ANOVA the following assumptions must hold;

1. Independent variable must consists of two or more categorical independent groups.
2. Dependent variable is either interval or ratio (continuous).
3. Dependent variable is approximately normally distributed for each category of the independent variable.

4. Variances between the independent groups must be equal (homogeneity of variance)

Chapter 4

RESULTS AND ANALYSIS

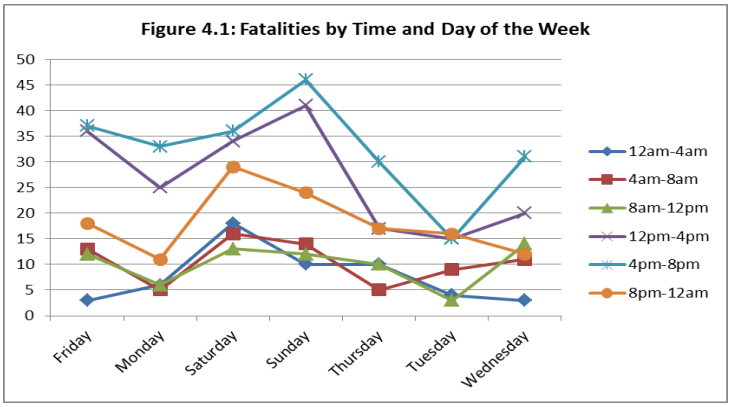
4.1 Introduction

The dependent variable is fatalities, which is binary in nature. In order to represent categorical variables, dummy variables are created following the coding system in SPSS software used in this study. The categorical variables have several levels, so that they require the use of dummy variables defined as 0, 1, 2, 3, and so forth. This coding system is applied for the rest of categorical variables as shown in Table 1. It should be noticed that the SPSS is able to carry out this coding automatically once the end user has set the levels of the categorical variables.

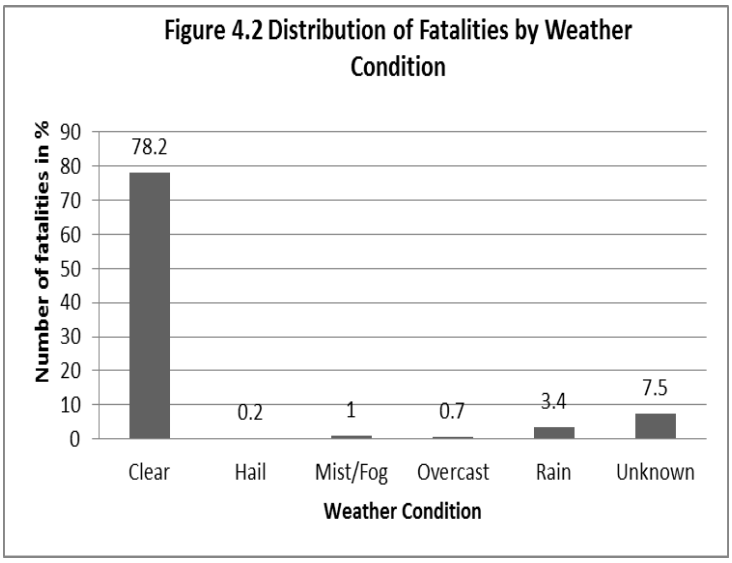
4.2 Descriptive Statistics

Looking at the Fatalities by Time and Day of the Week might give road users the option to decide which day and time the road is safest. The Figure 4.1 above illustrates that the safest time to be on the road every day of the week is from 12am to12pm, during this period the total number of Fatalities was in the range of 3 to 14. The total number of Fatalities for the whole week increased from 12pm to 8pm, with the highest fatalities recorded from 4pm to 8pm every day. This could be because there is a high tendency of road users using the road during this time. Sunday recorded the highest number of Fatalities , followed by Saturday with 147 and 146, respectively.

Fatalities versus Time and Day of the Week

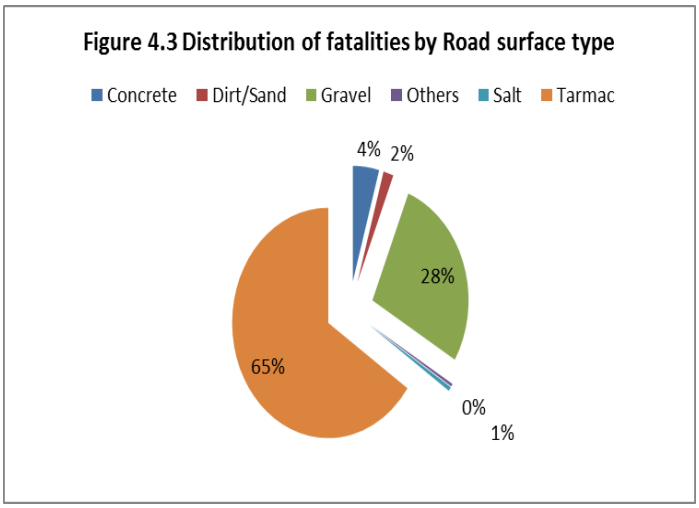


Fatalities versus Weather Condition



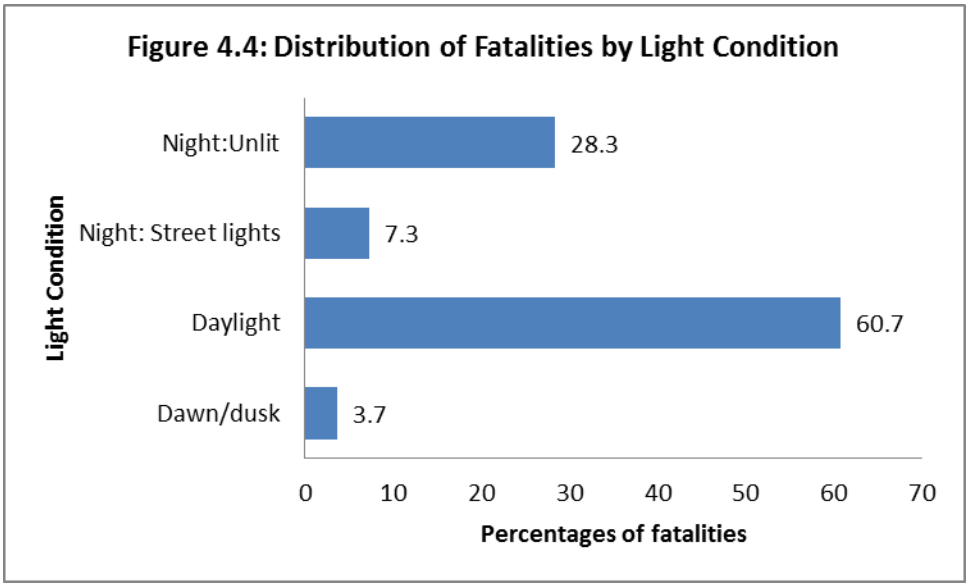
During the years under review, more fatalities were recorded when the Weather condition was Clear constituting of 78.2%, followed by Weather condition Unknown with 7.5%, while the lowest percentages of fatalities were recorded when the Weather condition was Hail with only 0.2% of all the valid cases analyzed. However, Weather condition such as of Severe wind did not form part of these categories under Weather condition and so it could be that it is also included in the Clear category.

Fatalities versus Road Surface Type



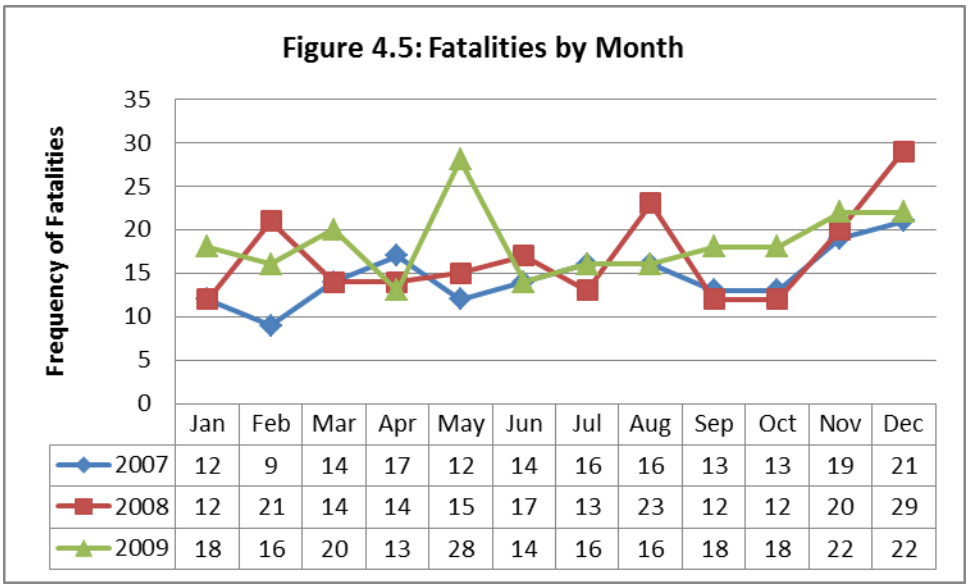
The distribution of Fatalities by Road Surface Type as illustrated by the Figure4.3 above indicates that most of the Fatalities occurred on Tarmac and Gravel roads with 65% and 28%, respectively while the lowest was number of fatalities are recorded on Salt Road Surface type with only 1% of the total number of valid cases of fatalities recorded during the 2007 to 2009.

Fatalities versus Light Condition



It is evident from figure 4.4 above that most Fatal accidents happen during Daylight. This is because many people drive during the day than any other time. It does not really mean that the safest time to be on the road is during Dawn/dusk which has low percentages of Fatalities.

Fatalities by Month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007	12	9	14	17	12	14	16	16	13	13	19	21
2008	12	21	14	14	15	17	13	23	12	12	20	29
2009	18	16	20	13	28	14	16	16	18	18	22	22

Figure 4.5 above illustrates the distribution of fatalities over the three years (2007 to 2009) period. Fatalities were observed to increase with time such that as the years goes up, the total number of Fatalities also increases. i.e. The number of Fatalities in 2007 were observed to be less than that of 2008 and the 2008 were less than 2009.

4.3 Inferential Statistics

Before deciding on which test to use, the data were tested for normality and homogeneity of variances using Kolmogorov-Smirnov test and Levene's test for equality of variance based on the frequencies of Fatalities per month of each year. The Kolmogorov-Smirnov test produced a p-value of 0.073 which is greater than 0.05 and hence implying that fatalities are approximately normally distributed. The test for homogeneity of variances on the other hand produced a p-value of 0.280 which is greater than 0.05 also implying that variances are approximately equal. Hence parametric tests are applicable.

What are the significant factors that affect the odds of having a fatality in a vehicle collision in Namibia?

The backward method of logistic regression was followed using SPSS version 20.0. The Omnibus Test of model coefficients was analysed in order to assess whether the data fit the

model as shown in the Table 4.1 below. In the table, the specified model is significant (Sig. =0.000 < 0.05) so it is concluded that the independent variables improve on the predictive power of the null model.

Table 4.1: Omnibus Tests of Model Coefficients

		χ^2	**df**	**Sig.**
Step 1	Step	144.144	27	.000
	Block	144.144	27	.000
	Model	144.144	27	.000
Step 2[a]	Step	-3.539	5	.618
	Block	140.605	22	.000
	Model	140.605	24	.000
Step 3[a]	Step	-4.682	3	.197
	Block	135.924	19	.000
	Model	135.924	19	.000

Table 4.2: Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	12.639	8	.125
2	20.699	8	.008
3	14.749	8	.064

In Table 4.2 above, the Hosmer-Lemeshow (H-L) test shows the significance of the developed logistic regression models (Sig. = 0.064 > 0.05).

Table 4.3: Model if Term Removed

	Variable	Model Log Likelihood	Change in -2 Log Likelihood	df	Sig. of the Change
Step 1	Time of the Day	-1249.388	3.539	5	.618
	Day of Week	-1262.449	29.661	6	.000
	Weather Condition	-1257.070	18.903	5	.002
	Light Condition	-1263.033	30.830	3	.000
	Road Surface Type	-1268.259	41.282	5	.000
	Road Signs condition	-1249.965	4.694	3	.196
Step 2	Day of Week	-1264.188	29.601	6	.000
	Weather Condition	-1258.873	18.971	5	.002
	Light Condition	-1266.182	33.588	3	.000
	Road Surface Type	-1270.531	42.286	5	.000
	Road Signs condition	-1251.729	4.682	3	.197
Step 3	Day of Week	-1266.474	29.491	6	.000
	Weather Condition	-1261.044	18.630	5	.002
	Light Condition	-1267.608	31.758	3	.000
	Road Surface Type	-1270.819	38.180	5	.000

Table 4.3 above shows the significant variables in step3. It indicates that at 95% confidence level, the variables: Day of the Week, Weather Condition, Light Condition and Road Surface Type are significant and so it this would be a bad model if we remove them.

Table 4.4: Variables in the Equation

Variables	B	Sig.	Exp(B)
Ref: Friday (Day of the Week)		.000	
Monday	-.387	.120	.679
Saturday	-.018	.935	.982
Sunday	**.604**	**.003**	**1.830**
Thursday	-.136	.562	.873
Tuesday	**-.547**	**.040**	**.579**
Wednesday	-.043	.849	.958
Ref: Clear (Weather condition)		.018	
Hail	-17.194	.998	.000
Mist/Fog	-.452	.446	.636
Overcast	-1.962	.051	.141
Rain	-.478	.190	.620
Unknown	**.670**	**.010**	**1.955**
Ref: Dawn/dusk (Light Condition)		.000	
Daylight	-.392	.266	.676
Night: street lights	**-.874**	**.038**	**.417**
Night: Unlit	.371	.305	1.449
Ref: Concrete (Road Surface Type)		.000	
Dirt/Sand	-1.114	.153	.328
Gravel	**.937**	**.006**	**2.552**
Other	.631	.555	1.879

Salt	.217	.838	1.243
Tarmac	.126	.702	1.134
Constant	-4.040	.000	.018
Bold figures are significant at 95%			

From Table 4.4 above, the model results indicate that at 95% confidence level, the Day of the week: Tuesday and Light condition: Nights with street lights were negatively related to Fatalities, while Day of the week: Sunday, Weather condition: Unknown and Road surface type: Gravel were positively related to Fatalities.

Road users are 0.58 times less likely to die on Tuesday 1.83 times more likely to die on Sundays than on Fridays. Also, they are 1.96 times more likely to die when the Weather is Unknown than when the Weather is condition is Clear. When it comes to Light Condition, those who are using the road at night with street lights are 0.42 times less likely to result in fatality than when it is Dawn/dusk. Finally, the probability of an accident resulting in fatalities on Gravel roads is 2.55 times more than on Concrete road surface.

Is there a significance difference in total mean number of fatalities between the three years 2007 to 2009?

I) H_0 : There is no significant difference in average number of fatalities between the three years (2007 to 2009).

H_1 : At least one year has an average number of fatalities which is significantly different from the other two years.

Significance Level: 5%

II) Decision rule: Reject H_0 (the null hypothesis) if p-value < 0.05

III) Test Statistics: From the One-way ANOVA table below, F= 2.245 and

p-value =0.122

Table 4.5: ANOVA

Fatalities

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	85.056	2	42.528	2.245	.122
Within Groups	625.250	33	18.947		
Total	710.306	35			

IV) Conclusion: Since the p-value =0.122 is greater than 0.05, we fail to reject the null hypothesis and hence there is insufficient evidence at 95% confidence level to conclude that at least one year has an average number of fatalities which is significantly different from the other two years. In particular, on average, there is no difference in the number of Fatalities recorded for the three years.

Chapter 5
RECOMMENDATIONS AND CONCLUSION

5.1 Conclusion

The main objective of this research is to analyze potential factors that affect the odds of having fatalities in a vehicle collision in Namibia. Therefore, from the results of the study one can make the following conclusions. The analysis of logistic regression revealed that Road users are 0.58 times less likely to die on Tuesday 1.83 times more likely to die on Sundays than on Fridays. Also, they are 1.96 times more likely to die when the Weather is Unknown than when the Weather is condition is Clear. When it comes to Light Condition, those who are using the road at night with street lights are 0.42 times less likely to result in fatality than when it is Dawn/dusk. Finally, the probability of an accident resulting in fatalities on Gravel roads is 2.55 times more than on Concrete road surface . While the one-way ANOVA disclosed that on average, there is no difference in the number of Fatalities recorded for the three years. What does this mean to the Namibia country?

5.2 Recommendations

More still needs to be done to address the issue of traffic safety in the country as there is no sign of reduction in the number of Fatalities recorded for the three years. Observing high number of missing cases implies that most of the NRAFs are partially completed. As such, there is a high need to educate police officers on the importance of recording accident information so that they complete the forms fully. Always, unless otherwise beyond your control, when travelling long distances drive during the safest time and day. Safety starts with yourself.

“It is better to be 100 times cautious than to die at once.’’

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