RESEARCH PROJECT AND FIRLD STUDIES

University of Rajshahi
Department of Statistics
According to B. Sc. (Honours)

Research project on
Factors Associated With Road Accidents: A Case Study of Rajshahi City

A Report Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelors of Science in Statistics for the year 2022

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The Author

ABSTRACT

Nowadays road traffic accidents draw attention worldwide due to having the burning question in transportation systems which creates the increasing amount of injured persons, loss and destruction of valuable lives, wastage, and reduction of property. In Bangladesh, about 7,855 people have died and 13,330 persons were injured in 5,516 road accidents last year in 2019. Many countries are the victim of this great problem but Low and middle-income countries are the most in the world. Road accidents are taken place frequently in Rajshahi and it is a very crucial city for road accidents across the country. The detail of the accident data was collected from the pedestrian, drivers and traffic police. Some additional data was collected from the metropolitan police station. The analysis shows that not following traffic rules, increasing small vehicle, narrow road, not properly follow traffic rules, unawareness are leading reason for accident in this city. Among the respondents the number male respondent is 250 which is 83.3%, the number of female respondent is 50 which is 16.7%. Here we see that most of the respondents are in honors level. Among the respondents the number of pedestrian is 120 which is 40.0%, the number of driver is 120 which is 40.0% and the number of traffic police is 60 which is 20.0%. Among the drivers, 54 are under the age of 25, representing 45.0% of the population. There are also 55 respondents who are between the ages of 25 and 44 representing 45.8% and 9.2% of the population are old ages respectively. I observe that 41.7% are bus/truck drivers, 36.7% are bikers, and 10% and 11.7%, respectively, own auto rickshaws and private cars. From a total of 120 respondents, the frequency distribution chart reveals that 40.8% of drivers have more than 10 years of driving experience, 16.7% have five to ten years, 38.3% have one to five years, and 4.2% have less than one year experience. The frequency distribution chart also shows that 85% of drivers have a driving license and 15% do not. It also shows that 89.2% of drivers follow traffic rules and 10.8% do not. A total of 120 people responded, and the frequency distribution chart reveals that 51.7% of drivers have experienced one or more accidents on the road, while 48.3% have not. 120 people replied in all. Of the 62 drivers involved in accidents, bikers account for 38.7% of them, bus drivers for 27.4%, private automobile drivers for 19.4%, and others account for 12.9%. According to the table, 33.9% of accidents take place at night. Accidents occur in the morning 29.0% of the time, at dawn 25.8% of the time, and at midday 11.3% of the time. In our study we use statistical method for analysis such as frequency distribution and chi-square test. The chi-square test applied to examine the impact of involved vehicle, accident time, road condition and vehicle speeds on type of accident. From the observed result we see that type of accident associated with vehicle type, accident time, road condition and vehicle speed. At last we use logistic regression to test which factor more responsible for series accident. From the result we found vehicle and vehicle collision is the leading reason for series accident.

CONTENT

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Traffic accidents have been increasing rapidly in Bangladesh over the last two decades resulting in huge social and economic losses in terms of loss of life and property damage. In the last 21 years there were 84 thousand road accidents, 56 thousand people died and 63 thousand were injured. The number of accidents and fatalities increased steadily from 2020 to 2021. According to the Bangladesh Road Safety Foundation's (RSF) annual report, at least 6,284 people died and 7,468 were injured in road accidents between January and December 2021, while 5,431 people were killed and 7,379 were injured in road accidents in 2020.

Meanwhile, according to NSC-We Demand Safe Roads, 4,289 people died in 3,793 traffic accidents in 2021.

Motorcycles have generally been the most dangerous mode of transport in the country, with two-wheelers responsible for the majority of traffic incidents.

The RSF data details that motorbikes were involved in 38.68 percent of total accidents in 2021. At least 2,214 people were killed and 1,309 were injured. A total of 2,078 motorcycles were involved in the collision. This is a full increase from 2020, when 1,381 people were killed and 1,463 injured in motorbike accidents. Also, 927 women and 734 children died in traffic accidents in 2021 compared to 871 women and 649 children in 2020.

2003 motorcycle accidents occurred across the country in the 10 months from January to October this year. According to the Road Safety Foundation, 2097 people were killed and 1286 injured in these accidents.

Significant progress in reducing accidents can be achieved through a comprehensive accident information system. A general issue of central importance in road safety management is the collection and use of accurate and comprehensive data on road accidents. Interpretation of these data can lead to a better understanding of operational problems, a prerequisite for accurate diagnosis of accident problems, assist in the development of remedial measures, and allow us to evaluate the effectiveness of road safety programs. A comprehensive database is a basic prerequisite for undertaking any effective road safety initiative. Every organization, whether public or private, involved in road safety activities should have a clear understanding of the nature, scale and distribution pattern of the road accident problem they seek to address.

1.2 Importance of the study

Road safety is the safety of people from roadside injuries and accidents. It is the prevention and protection of road accidents by using all the road safety measures. Every person going on the road has a risk of injury or death. Such as pedestrians, motorists, cyclists, passengers, etc. It is said that a person's brain works in such a way that it tells the concerned person how safe he is at that time.

The most obvious reason why road safety is so important is that many lives are at risk when you are on the road. The possibility of death or serious injury is always a prominent risk if one is not paying attention while driving. It takes a few seconds to look away from the road. This is especially true when you consider the fact that other drivers aren't paying attention either.

1.3 Objectives of the study

The main objective is to study the factors associated with road accidents based on the opinions of drivers connecting to Rajshahi city.

In this regard, the specific objectives of the study are:

- To analyze the major causes of road traffic accident
- To study what can be done to prevent road traffic accidents.

1.4 Concept of Road Traffic Accidents

A road traffic accident occurs when a vehicle collides with another car, pedestrian, animal, and debris, or other stationary obstruction such as a tree or pole. Traffic accidents may result in injury, death, and poverty damage. In general, an unplanned and unexpected event that occurs suddenly and causes injury or loss, or a decrease in the value of the resources is called an accident. A road accident is any accident involving at least one road vehicle, occurring on the road open to public circulation, and at least one person is injured or killed. Injured persons are accident victims having suffered trauma requiring medical treatment with or without hospitalization. The falling down of a pedestrian is not a traffic accident, but that of a rider of a bicycle. Intentional acts (murder, suicide) and natural disasters are also excluded from road traffic accidents.

Road traffic accidents generally fall into one of four common types:

- Land departure crashes, which occur when a driver leaves the lane they are in and collide with another vehicle or a roadside object. These include head-on collisions and run-off-road collisions.
- Collisions at junctions include rear-ending collisions and angle or side impacts.
- Collisions involving pedestrians and cyclists.
- Collisions with animals.

1.5 Statistics of Road Traffic Accidents and Casualties in Bangladesh:

- The trend of road traffic accidents in Bangladesh in the fifteenth years from 1994 to 2008 is shown in table 1. The numbers of accidents and persons injured in 1994 are inexplicably higher than the previous years and this high rate has increased in every year after 1994. Such the numbers of deaths and injuries were 1597 and 2736 in 1994. This rate got increased about 3765 deaths and 3284 injuries in 2008.

Table 1: Road Accident Rates in Bangladesh (Years 1994-2008)

Year	Total Number of accidents	Deaths	Injuries	Total casualties
1994	3013	1597	2736	4333
1995	3346	1653	2864	4517
1996	3730	2041	3301	5342
1997	5448	3162	5076	8238
1998	4769	3085	3997	7082
1999	4916	3314	3453	6767
2000	4357	3430	1911	5341
2001	4091	3109	3172	6281
2002	4918	3398	3770	7168
2003	4749	3289	3818	7107
2004	3917	2968	2752	5720
2005	3955	3187	2755	5942
2006	3794	3193	2409	5602
2007	4869	3749	3273	7022
2008	4427	3765	3284	7049

Source: Police Headquarters (FIR) Report

- Table 2- also provides the accident statistics for Bangladesh from 2009 to 2016 (July). All data have been collected from Bangladesh Police Headquarters. The table shows that the numbers of accidents, deaths and injuries were higher in 2009 than 2010 to 2015.

Table-2: Road Accident Rates in Bangladesh (Years 2009-2016)

Year	Total Number of accidents	Deaths	Injuries
2009	3381	2958	2686
2010	2827	2646	1803
2011	2667	2546	1641
2012	2636	2538	2134
2013	2029	1957	1396
2014	2027	2067	1535
2015	2394	2376	1958
2016(Up to July)	1489	1422	1289

Source: Police Headquarters (FIR) Report

1.6 Causes/Factors of Road Traffic Accidents in Bangladesh:

A prompt review of literature reveals the following major factors that affect the number of fatal accidents and fatality rates:

- Human Factors
- Road Related Factors
- Vehicle Related Factors
- Socio-economic and Demographic Factors

Within each factor, several variables can be identified as being the most influential (Journal of Bangladesh Institute of Planners, vol.: 4, December 2011)

Table: Influential variables are presented for each factor:

Factors	Influential Variables
Human Factor	Age, Alcohol, Fatigue, Seat belt usage, Speed, Aggressiveness, Violation history.
Road Factor	Posted speed limit, Roadside safety device, Geometric characteristics, Existence of Median and Barriers
Socio-economic and Demographical Factor	Income, Employment Levels, Poverty, Residential Density, Vehicle Ownership, Highway Network Density.

CHAPTER TWO

LITERATURE REVIEW

2. Literature Review

2.1 Factors affecting injury severity in developing countries

Literature on traffic crashes is relatively fewer in the context of developing country. Amongst these,only few studies investigated factors influencing injury severity. Rather most of these studies identified factors contributing to crashes. As a result, both types of studies are reviewed intertwiningly in this section in order to have a better knowledge about the crashes in developing country.

Stephan et al. (2011) found that a majority of transport injuries are associated with the use of motorcycles amongst adults in Thailand. Conard et al. (1996) showed that around 50% motorcycle users do not maintain the helmet wearing law while using motorcycle in Yogyakarta, Indonesia. Oginni et al. (2009) used data from 221 motorcycle injured patients who received treatment in four Nigerian teaching hospitals and identified the risk factors associated with the crashes. This study found that male aged 21-30 years are more likely to be involved in crashes. Factors contributing to motorcycle crashes include alcohol use (31.2%), bad roads (17.6%), and fatigue (13.5%). Similarly, Adesunkanmi et al. (2000) identified injury patterns and severity of 324 children who were injured in road traffic accident between 1992 and 1995 in Nigeria. Using hospital data, this study found that head injuries were the most common injury, followed closely by limb trauma. Injury severity scores (ISS) ranges between 1 and 25 for 306 children (no mortality but significant morbidity) whereas 18 patients had a score between 26 and 54 with a 61% mortality rate (11 patients). The highest scores were found in the group of patients who were passengers in a motor vehicle. Using an ordered probit model, Quddus et al (2002) identified factors contributing to injury severity associated with motorcycle accidents in Singapore. This study found that the motorcyclist having non-Singaporean nationality, increased engine capacity, headlight not turned on during daytime, collisions with pedestrians and stationary objects, driving during early morning hours, having a pillion passenger, and when the motorcyclist is determined to be at fault for the accident are associated with higher level of injury severity. Schmucker et al. (2011) studied the crash characteristics and injury patterns for auto rickshaw occupants (n=139) and the road users hit-by-motorised rickshaw (n=114) in Hyderabad, India. This study reported that single vehicle collisions are the most common form of crashes. In another study in the same context, Dandona et al. (2011) assessed road use pattern and incidence; and risk factors of non-fatal road traffic injuries (RTI) among children aged 5–14 years using data from 2809 children aged 5–14 years. This study reported that boys and girls had similar RTI rates as pedestrians but boys had a three times higher rate as cyclists. A similar finding has also been reported by Zargar et al. (2003) in Iran by analysing patterns of transport related injuries amongst children aged 19 years or less. This study found that boys were affected 3.5 times as often as girls. Further classification in this study shows that younger children were more prone to pedestrian-related injuries while teenagers were more prone to motorcycle related injuries.

Huda et al. (2010) assessed the impact of the characteristics of car drivers (e.g. professional vs. nonprofessional) on injury severity in Moradabad, India. This research found that the former group is involved with more accidents, and victims associated with this group faced more severe injuries than the latter group. In contrast, AlEassa et al. (2013) investigated the impacts of different types of vehicles (e.g. sport utility vehicles vs. small passenger cars) on injury severity using data collected from 101 patients who were admitted into two trauma centres of Al-Ain city, UAE. The study found no significant difference between the two groups in terms of anatomical distribution of injuries and severity level.

The above review shows that little has been done so far in identifying the factors contributing to traffic injury severity level in developing countries. Within the studies, most of them again identified factors associated with traffic accidents but not the severity level of these accidents. More importantly, a majority of these studies have focused on the motorcycle crashes which have little implication in case of Rajshahi because this mode of transport is almost absent in this context. Barua and Tay (2010) have recently modelled injury severity of transit based crashes in urban Bangladesh using 19This study reported that injury severity level increases if collision occurs on weekends, off-peak periods, two-way street, and involving only one vehicle whereas severity level reduces at locations where some form of police control mechanism exist. However, transit based crashes account only about 33% of all crashes in the country (UNESCAP, 2007), and presumably the figure is much lower in case of Rajshahi, and therefore, further investigations are deemed necessary on the validity of the factors for other modes in the country as well as in Rajshahi city.

2.2 Factors affecting injury severity in the developed world

A large body of safety literature focuses on the identification of factors associated with the occurrence of crashes whereas another large group of studies identified factors related to severity of crashes in the developed world. Given the abundance of literature, this section focuses on the reviews of literature related to the latter category. Factors that affect injury severity level in the developed countries can broadly be classified into: a) environmental characteristics (e.g. day/night), b) roadway characteristics (e.g. road class), c) crash characteristics (e.g. head on crashes), d) non-motorist characteristics (e.g. socio-demographics of the non-motorist being involved in a crash), e) motorized vehicle driver characteristics (e.g. socio-demographic of drivers, alcohol use while driving), and f) motorized vehicle characteristics (e.g. age/weight of vehicles) (Eluru et al., 2008). The following subsections discuss the impact of these factors on injury severity level. However, the discussion is limited to the first three categories of factors for comparison because factors related to the remaining three categories are not considered in this research due to data unavailability.

2.2.1 Environmental characteristics

Environmental factors are commonly used to refer to the specific condition of the environment at the time of an accident such as the time of a day, rural or urban context etc. Some commonly identified significant environmental factors are weather condition, lighting condition, road surface condition, and regional context. Generally adverse weather such as fog and rain increases the injury severity propensity (Kim et al., 2007; Klop and Khattak, 1999; Lee and Abdel-Aty, 2005; Zajac and Ivan, 2003).This is probably due to visibility impairment caused by fog and rain.

Darker lighting condition is another important environmental factor that significantly impacts injury severity level (Kim et al., 2007; Lee and Abdel-Aty, 2005; Zajac and Ivan, 2003). For instance, Quddus et al. (2002) found that more severe injuries occur in the early morning (midnight to 3:59 a.m) periods and less severe injuries occur during the day in Singapore. Similar findings have been reported in studies conducted in Florida (Miles-Doan, 1996), and in North Carolina (Klop and Khattak, 1999). A more specific 'darker period' is reported by Sze and Wong (2007) who found that the odds of a fatality are higher for crashes occurring between 7 p.m.–7 a.m. Despite crashes in day time are reported to be less severe, variations, however, exist. Pitt et al. (1990), for example, reported that the most severe injuries occurred between 6 and 9 a.m. and the least severe injuries occurred between 12 and 3 p.m. Consistent with this, Kim et al. (2007) found that crashes occurring during the AM peak (6–10 am) and weekends increase the likelihood of fatality in North Carolina. Although rain is associated with increased accident severity as discussed above, wet road surface does not increase the severity level. This supports the visibility impairment issue associated with rain as discussed earlier. Zhu and Srinivasan (2011) found that crashes on wet surfaces are less severe as drivers are inherently more cautious during such rainy conditions. Similarly, Kaplan and Prato (2012) have shown that dry road surface is significantly associated with an increase in fatalities. However, this can vary according to gender and age. As Morgan and Mannering (2011) reported, the likelihood of severe injuries increased for females and older males if crashes occur on road Traffic crashes occurring in rural areas are more severe and more likely to be fatal than those occurring in urban areas for drivers of all age groups (Lee and Abdel-Aty, 2005; Miles-Doan, 1996). However, variations also exist between different parts in an urban area. For instance, Zajac and Ivan (2003) found that crashes occurring in downtown and compact residential areas result in lower injury severity compared to the crashes in low-density residential areas in Connecticut. This study also reported that crashes that occur in low and medium density commercial areas result in less severe injuries compared to the crashes occurring in village and downtown fringe areas.

2.2.2 Roadway characteristics

Commonly identified roadway factors included road hierarchy (e.g. highway, local road), geometry of road network (e.g. curve), the type of intersections, and traffic control mechanism. Generally, crashes in highways are more sever than other road classes (e.g. arterial road, feeder roads) for two reasons. First, highways have higher speed limit. Research has shown that an increase in speed limit increases severity level (Renski et al., 1998). This is particularly true when speed limit exceeds 40 mph (Miles-Doan, 1996; Sze and Wong, 2007). Second, highways are generally wider than other road classes. Zajac and Ivan (2003) found that an increase in roadway width increased injury severity propensity in Connecticut. Zhu and Srinivasan (2011) used a two class road hierarchy (e.g. interstate and other highway) and four classes of road location (e.g. segment, intersection, interchange, and other). By combining these two types of roadway characteristics together, they developed a eight category factor (e.g. interstate highway segment, interstate highway interchange etc.). This work found that crashes in interstate other segments are least severe. Quddus et al. (2002) have used a 12 class road geometry in their analysis of motorcycle injury severity level in Singapore (e.g. bend, T-junction, cross-junction, straight, merging, narrow, sharp turn, blind corner, one way, two way, dual carriageway, expressway). Using an ordered probit model of their 3-point injury severity scale, this work reported that bends result in more severe injuries while T-junctions, cross-junctions, and straight roads increases fatality. Crashes on road-ways with more lanes were identified to be less severe because of better separation of vehicles in multi-lane highways (Zhu and Srinivasan, 2011). However, multi-dual carriageway roads are more riskier compared to one-way roadways (Sze and Wong, 2007). The situation would be more severe if a two way street does not have a road divider (Quddus et al., 2002). The effect of road geometry on accident severity is complicated and varies between contexts, and modes. For example, Zhu and Srinivasan (2011) did not find any statistically significant effect of horizontal (straight versus curved) and vertical (flat versus uphill/downhill) alignment of the roadway for large truck crashes in the USA. However, Kim et al. (2007) found that road curvature is positively associated with severity level for bicycle related injuries in North Carolina. In contrast, Shankar et al. (1996) reported that the number of horizontal curves per mile in the roadway segment significantly reduced the likelihood of injury severity for all types of roadways in WashingtonEngineering design of intersections also impacts injury severity level. For example, crashes occurring on intersections with traffic signals are severe than intersections with other traffic signs (Sze and Wong, 2007). However, for signalized intersections, having a pedestrian crossing signal decreases the probability of sustaining severe injuries in crashes because they make drivers of turning vehicles slow down(Lu et al., 2004). The impact of traffic control mechanism is mixed in the literature. Pitt et al. (1990) did not find any impact of the presence of traffic control on injury severity.

CHAPTER THREE

DATA AND METHODOLOGY

3.1 Introduction

The purpose of this chapter is to provide a brief summary of the data and the chosen population. This is the information on the data source, sample design, questionnaire development, fieldwork, data processing, background characteristics, analytical methodology, and all other study-related difficulties.

3.2 Area selection of the Study

We have chosen the Rajshahi City area as the location for data collection. There are 17 traffic police posts in this area, but we've selected 10 at random. And from Kazla, Zero Point, CNB Mor, Court Station, Rail Gate, Laxmipur, Dhaka Bus Stand, Talaimari, Binodpur, and Bornali Mor, we collected data.

Once more, we discover that there are 200 buses in all, operated by several companies, which travel from Rajshahi to various locations across the nation. We randomly selected 49 buses. After that, we obtained data from them.

3.3 Sampling Technique and Sample Size

Sample size determination is the act of choosing the number of observations or replicates to include in a statistical sample. The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample

For a sufficiently large population, the formula for estimating the sample size is

$$n = \frac{z^2 pq}{d^2} \; ; \qquad p+q=1$$

here,

n = desired sample size

z = standard normal deviate usually set at 1.96, which corresponds to the 95% confidence level

p = assumed proportion in the target population estimated to have a particular characteristic

d = degree of accuracy desired in the estimated proportion

The purpose of this study was to evaluate the current level of traffic accidents in the Rajshahi City area. 300 respondents from the research region were chosen as samples using the two stage simple random sampling method.

3.4 Population and Respondents

In this study, the all People, Traffic Police and Drivers of Rajshahi City region were selected as population Respondent means from which the data were collected.

3.5 Sources and Types of Data

The sources of data are from where data is obtained. Data sources can be of two different categories, such as primary source and secondary source, depending on their nature. A primary source is used when information is gathered from the actual circumstances of a particular person. While in other studies different kinds of materials are employed as secondary sources, the primary source in the current study is.

According to the source, there are two types of data such as

i) Primary data,
ii) Secondary data.

The data collected from primary source is called primary data. The data are obtained from secondary source is called secondary data. In this present study, Primary type of data is used.

3.6 Data Collection Methods

Data collecting methods refer to the means and procedures used to collect data from respondents. The following actions are necessary for this situation:

a) Preparation of Questionnaire

According to the goal of this research problem, a questionnaire was made. Data has been collected through individual questionnaires. The questionnaire was designed considering the following characteristics:

- Number of questions in the questionnaire should be limited.
- A respondent should adequately be assumed that his identity will not be against his interest.
- Avoid long and confusing questions and formulate simple and short question.
- Start with easy questions then slowly put the difficult ones.

Pre-testing of the schedule was conducted in order to minimize needless bother and potentially dangerous circumstances, and the contents of the schedule were modified in light of the results. First, a draft questionnaire was created, and it underwent pre-testing. The draft questionnaire's anomalies and inconsistencies were then removed in preparation for the field survey. All questions pertaining to one aspect are gathered under one sub-head and are placed in a logical order. The majority of the questions are closed-ended, and the respondents' selections were denoted with a tick mark. There are several open-ended questions included to elicit the respondent's ideas, and there is space available for writing responses. We limited the number of open-ended questions because it can be challenging to analyze them. The questionnaire's phrasing was carefully considered during design in order to make it straightforward and easy for the respondent to understand. Some terminology is occasionally used in their regional dialect.

b) Data Collection

The goals of the study should be taken into consideration when collecting the data. Editing the completed surveys made it possible to correct and record errors or to remove data that was manifestly incorrect and inconsistent. In questionnaires, all errors have been fixed when they were discovered, and all responses have been carefully scrutinized. There is no unrelated information as a consequence. Not only should there not be a temptation to gather excessive amounts of data, but also some of the crucial data should never be further investigated and evaluated. The direct interview method was employed in this survey. The primary responsibility for gathering data and accurately documenting it fell to the enumerators. The accuracy and truthfulness of the respondents' statements were carefully recorded.

The most important part of every survey in terms of coverage and the accuracy of data collection is the enumerator. The efficiency, capability, and responsibility of the enumerators determine whether they are successful or unsuccessful in obtaining pertinent responses. There are 2 groups of 4 enumerations in this study. With the enumerators, a thorough discussion about the scope and substance was held. The information actually to be collected was vividly demonstrated to the enumerators by means of clear examples and direct interviews. All concepts and definitions employed were also thoroughly explained. The enumerators were instructed to get in touch with me if they needed ready solutions to issues that had arisen throughout the enumeration so that I could work through them with the support of my supervisor.

c) Instruments Used in Data Collection

We have used some instruments in this study such as Pen and Pencil etc.

d) Data Processing and Analysis

The easiest method is to analyze the data using a computer program. At this point, no one is considering data analysis without a suitable comparing program. There is no other quick, easy, and accurate way to evaluate the data. Therefore, for data entry and analysis, we have selected an appropriate computer program.

e) Editing

The data are extensively adjusted to remove any inconsistencies and reduce non-sampling mistakes, which are frequently seen in studies. The questions were prepared for coding after modification.

f) Coding

The data were coded in accordance with the code plan once the questionnaire was edited. The data are prepared for computer processing once the coding is complete.

g) Computerization

The computer then processes the data that has been edited and coded. A computer program called SPSS (Statistical Package for Social Science) for Windows version 25.0 has handled the whole computerization of the data. The practical social science data analysis program The research is finished using Microsoft Word and Microsoft Excel. All of the qualitative characteristics were entered in order to examine the data.

3.7 Variable

A characteristic that varies over time, place, and individual is called a variable.

a) Variable Selection

In this study, we have selected the following quantitative and qualitative variables

- Follow traffic rule
- Experience
- Driving license
- Regular Speeds
- Overtaking Habit
- Facing Accidents
- Vehicle Type
- Accident Time

b) Measurement of Variables

In this present study for quantitative and qualitative variables we have used the interval and nominal scale respectively. Thus the measurement procedures for quantitative and qualitative variables which have been measured by interval and nominal scale are discussed as following.

- **Vehicle Type:** Vehicle Type was necessary to specify the kind of vehicle the respondent was driving. The data was obtained by direct individual question from the respondents.

- **Experience:** Experience measures the driving experience of the responders which is defined by the time period of driving. The data was obtained by direct individual question from the respondent.

- **Driving license:** A driving license indicates whether respondents have a license to drive or not. The data was obtained by direct individual questions from the respondent.

- **Regular Speeds:** Regular speeds refer what is the average speed a driver drives his or her vehicle during regular driving time. The data was obtained by direct individual questions from the respondent.

- **Overtaking Habit:** Whether a motorist overtakes other vehicles during routine driving is referred to as an overtaking habit. Direct questions from the respondent to them individually were used to collect the data.

- **Facing Accidents:** A responder is said to be facing accidents whether or not they occur while they are on the road. Direct questions from the respondent to them individually were used to collect the data.

- **Accident Time:** Accident time describes the situation a responder is in at the moment of an accident. Direct questions from the respondent to them individually were used to collect the data.

3.8 Technique of Analysis

A multivariate analysis such as linear regression analysis was performed to assess main effects of the independent variables. We also do chi-square test with cross table to associates the dependents and independents variable.

3.9 Limitations of the Study

There is some limitation in conducting the study. Some of these are as following:

- The time and the cost were insufficient for this study.
- Many respondents did not know their exact age and given an inappropriate age on which we had to depend. As a result age of the respondent may be subject to error,
- In many cases they did not understand about the aim of the study and they did not give interview before clearance about it. For this reason, we needed huge time to get desirable information,
- Data on age recording and digit preference are as existing without smoothing.

CHAPTER FOUR

BACKGROUND CHARACTERISTICS OF THE STUDY

4.1 Introduction:

Knowing the background features of the study, the target population, or the type of data is crucial for any research project. This evaluation paves the way for the interpretation of the findings and the investigation of the causal connections between the variables under inquiry. It is crucial to concentrate on the frequency distribution of the variables being studied in order to examine the background features of various variables. The pattern of the distribution and observations in various groups is displayed by the frequency distribution. Studying the frequency distribution of some of the variables under consideration is a crucial first step. The following table lists some significant demographic details.

4.2 Frequency Analysis:

The term "frequency distribution" refers to a type of tabulation that, from a statistical perspective, is arguably the most significant. This is a method of highlighting and summarizing a lengthy and intricate list of quantitative data. In this method, the numbers of observations that belong to each class are counted after the raw data have been divided into classes or groups of the proper sizes. A class's width is referred to as its class interval, and the quantity of observations that make up a class is referred to as its frequency or simple frequency. This type of arrangement of data is known as a frequency distribution. This form of layout emphasizes how the frequencies are distributed over the class intervals, hence the name frequency distribution. This distribution is very significant in statistics, and it is vital to be well-versed in its numerous facets.

4.3 Frequency distribution and Graphical representation of respondent Age:

Age Group	Frequency	Percent
Young Age	54	45.0%
Middle Age	55	45.8%
Old Age	11	9.2%
Total	120	100%

The frequency distribution chart shows that there are three groups of ages. Out of a total of 120 respondents, 54 are under the age of 25, representing 45.0% of the population. There are also 55 respondents who are between the ages of 25 and 44 representing 45.8% and 9.2% of the population are old ages respectively. Below is a pie chart showing the different age groups:

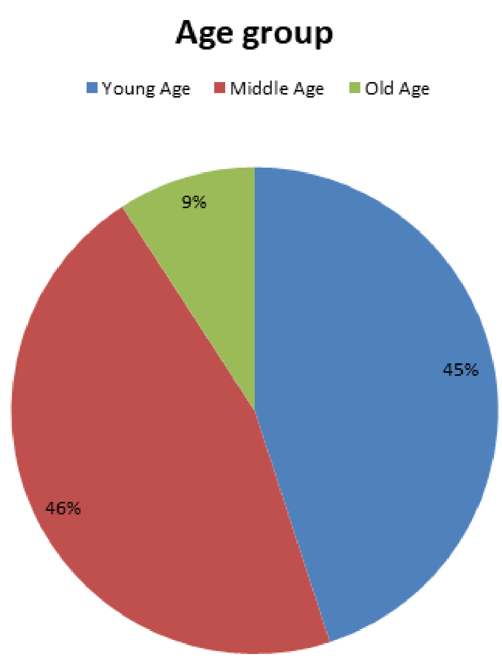


Fig 01: Pie chart of the Respondents Age group

4.4 Frequency distribution and Graphical representation of Vehicle Type driven by the respondent:

Vehicle type	**Frequency**	**Percent**
Auto rickshaw	14	11.7%
Motor cycle	44	36.7%
Private car	12	10.0%
Bus/Truck	50	41.7%
Total	120	100.0%

From a total of 120 responders, we can observe that 41.7% are bus/truck drivers, 36.7% are bikers, and 10% and 11.7%, respectively, own auto rickshaws and private cars. Below is a pie chart showing the vehicle type:

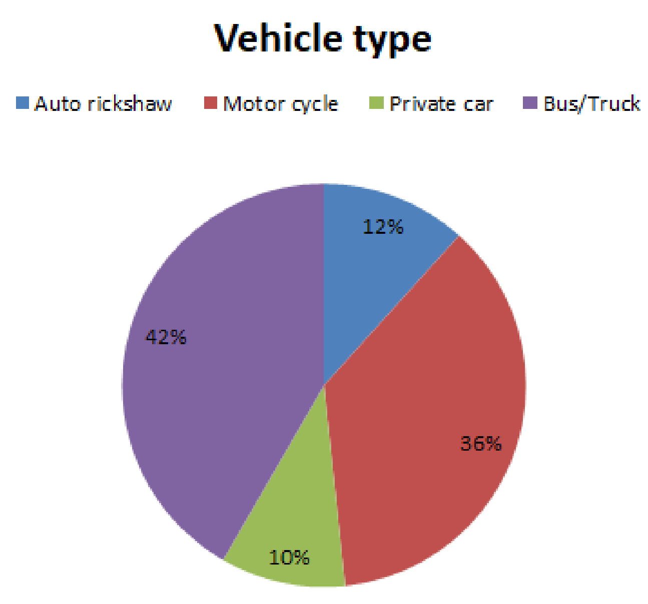


Fig 02: Pie chart of the Respondents Vehicle Type.

4.5 Frequency distribution and Graphical representation of respondent Driving Experience:

Experience Year	Frequency	Percent
Less than 1 year	5	4.2%
1 to 5 years	46	38.3%
5 to 10 years	20	16.7%
More than 10 years	49	40.8%
Total	120	100%

From a total of 120 respondents, the frequency distribution chart reveals that 40.8% of drivers have more than 10 years of driving experience, 16.7% have five to ten years, 38.3% have one to five years, and 4.2% have less than one year. Experience of drivers is depicted in the pie chart below:

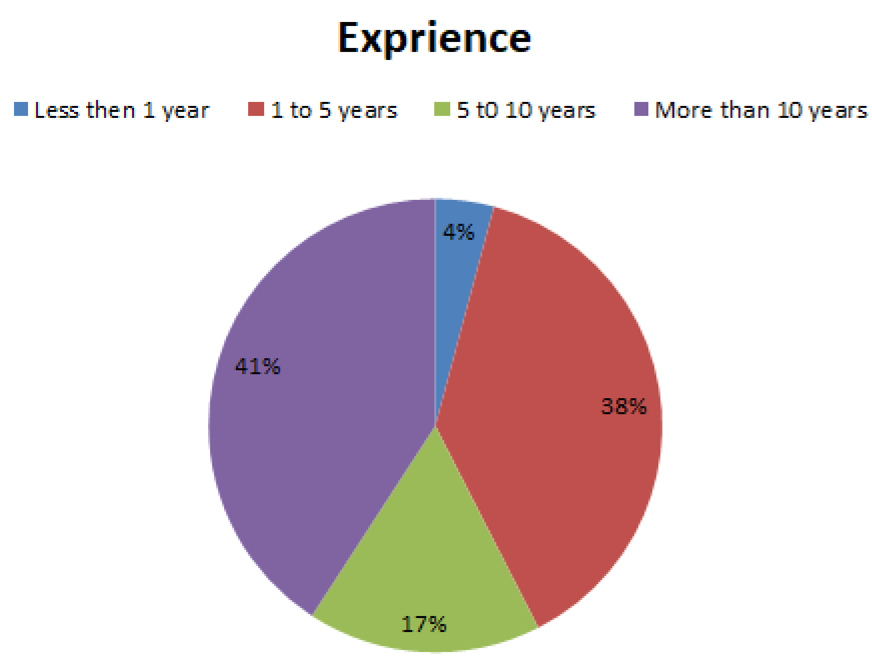


Fig 03: Pie chart of the Respondents Driving Experience.

4.6 Frequency distribution and Graphical representation of respondent having Driving License:

Having License	Frequency	Percent
Yes	102	85%
No	18	15%
Total	120	100%

The frequency distribution chart from a total of 120 respondents shows that 85% of drivers have a driving license and 15% do not. The pie chart below shows the drivers having driving license:

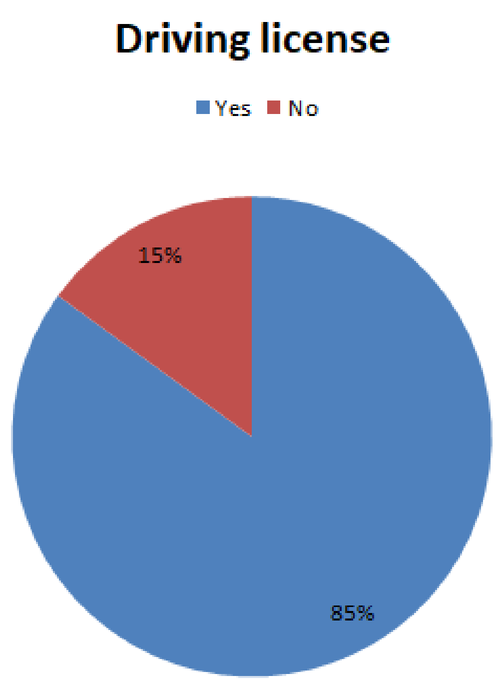


Fig 04: Pie chart of the Respondents having Driving License.

4.7 Frequency distribution and Graphical representation of respondent following Traffic Rules:

Follow Traffic Rules	Frequency	Percent
Yes	107	89.2%
No	13	10.8%
Total	120	100%

The frequency distribution chart from a total of 120 respondents shows that 89.2% of drivers follow traffic rules and 10.8% do not. The pie chart below shows the respondent's traffic rules following habits:

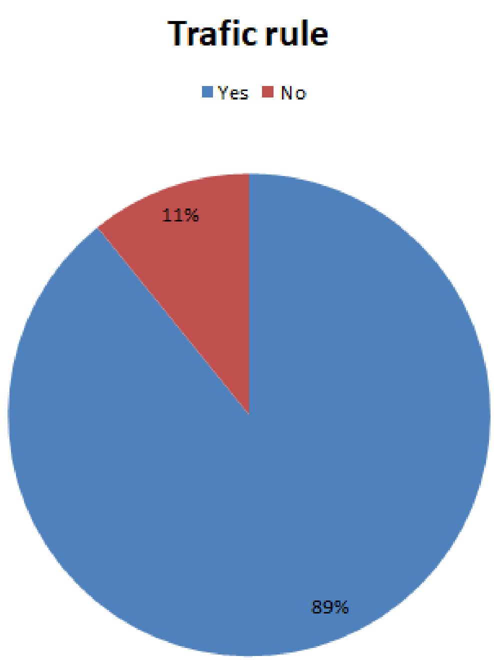


Fig 05: Pie chart of the Respondents following Traffic Rules.

4.8 Frequency distribution and Graphical representation of respondent facing an accident:

Facing Accident	Frequency	Percent
Yes	62	51.7%
No	58	48.3%
Total	120	100%

A total of 120 people responded, and the frequency distribution chart reveals that 51.7% of drivers have experienced one or more accidents on the road, while 48.3% have not. Responders facing an accident or not are depicted in the pie chart below:

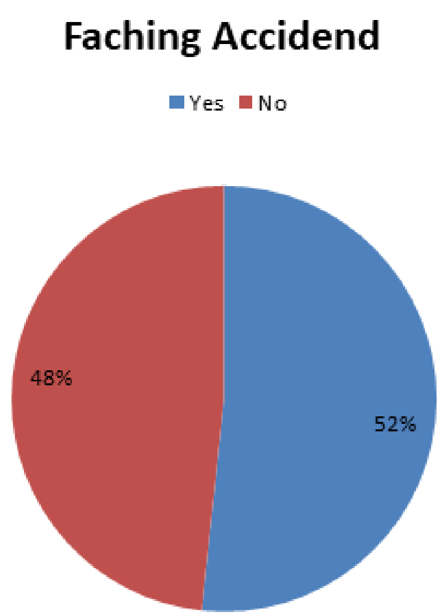


Fig 06: Pie chart of the Respondents facing an accident.

4.9 Frequency distribution and Graphical representation of vehicle involving in accidents:

Vehicle Type	Frequency	Percent
Bus	17	27.4%
Private Car	12	19.4%
Bike	25	38.7%
Auto Rickshaw	6	9.7%
Others	2	3.2%
Total	62	100%

120 people replied in all. Of the 62 drivers involved in accidents, bikers account for 38.7% of them, bus drivers for 27.4%, private automobile drivers for 19.4%, and others account for 12.9%. The type of vehicle involved in the accidents is depicted in the pie chart below:

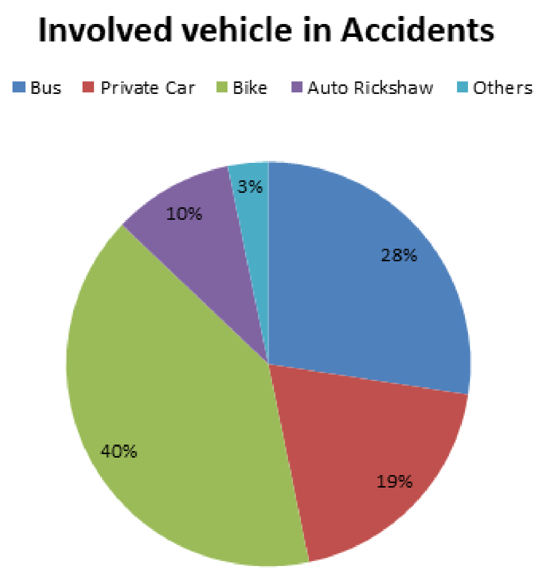


Fig 07: Pie chart of the vehicle type involving in the accident.

4.10 Frequency distribution and Graphical representation of accident occurring time:

Time	Frequency	Percent
Dawn	16	25.8%
Morning	18	29.0%
Noon	7	11.3%
Night	21	33.9%
Total	62	100.0%

According to the table, 33.9% of accidents take place at night. Accidents occur in the morning 29.0% of the time, at dawn 25.8% of the time, and at midday 11.3% of the time. The frequency of accidents is depicted in the following pie charts:

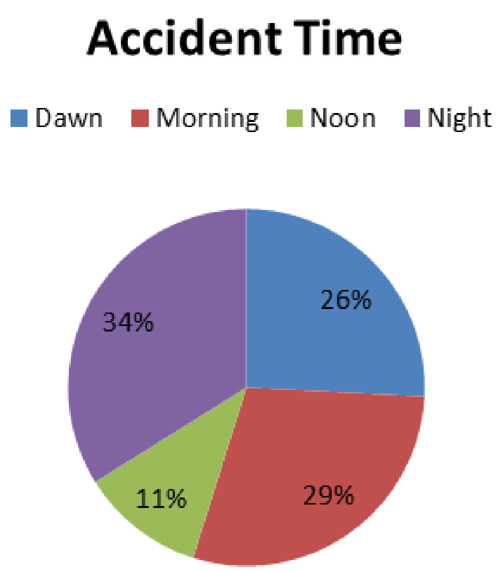


Fig 08: Pie chart of frequency of accidents is depicted.

CHAPTER FIVE

CONTINGENCY AND REGRESSION ANALYSIS

5.1 Introduction:

The goal of the chapter is to show an examination of the impact of various variables on the independent variable and their statistical significance. The study's purpose was to analyze the interrelationships of the variables considered in the analysis. Making a contingency analysis of the chosen variables follows this chapter as well. With the use of the dependence criterion, the contingency analysis examines the degree of relationship between the chosen variables. The direction and enlarged interrelationship of the variable under study are examined by the correlation analysis. A contingency table was used to examine the relationship.

5.2 Statistical Analysis

The analysis of data is an important part of any research project work. To meet the objectives of the study, some statistical techniques were used. To investigate the patterns of different variables, percentage (frequency) distribution of the selected explanatory variables were computed.

The **chi-square ($\chi2$)** test was employed to find the significant association between entrepreneurship independent variables and facing accident by a drivers (outcome variable).

Software: The statistical analysis was carried out using SPSS software (version 25). The operating system of the computer was Windows 10 and text and table prepared by using MS word. A value of $p<0.05$ was considered as statistically significant in this analysis.

5.3 Cross Table analysis:

We represent contingency analysis, which is intended to investigate any potential relationships between various phenomena. If "O" stands for observation frequency and "E" for expected frequency of a contingency table in contingency analysis, then the expected frequency under any hypothesis is

$$E_{ij} = \frac{R_i \times C_j}{N}$$

Where,

$\mathrm{E_{ij}}$ = Expected frequency of i^{th} row and j^{th} columns

$\mathrm{R_i}$ = No. of observation at the i^{th} row the respectively contingency table

$\mathrm{C_j}$ = No. of observation at the j^{th} row the respectively contingency table

N = Total number of frequencies

And we have to test the following statistical hypothesis:

H_0= There is no significant association between our selected variable

Vs.

H_1: H_0 Is not true.

The test statistic is, $$\chi^2 = \sum_{i}\sum_{j}\frac{O_{ij}^2}{E_{ij}} - N \sim \chi^2_{(r-1)(c-1)}$$

Where,

O_{ij} = The observation number of data in $(ij)^{th}$ cell

E_{ij} = The expected number of data in $(ij)^{th}$ cell

Finally comparing the calculated value of χ^2 and tabulated value of χ^2 and we present the comment.

5.4 Chi-square test:

By the **chi-square test**, I have shown the association between the dependent and independent variables by the cross tables.

- **Table 1:** Presents the association between Driving License and Facing Accident of our respondent. The Chi-square test demonstrated that their association between Driving License and Facing Accident was significant ($P<0.05$) that means there is association between Driving License and Facing Accident.

Variable	Group	Driving license/ Outcome variable		Total	Chi-square value	p-value
		Yes	No			
Facing Accident	Yes	48 (77.4%)	14 (22.6%)	62	5.782	0.016
	No	54 (93.1%)	4 (6.9%)	58		
	Total	102 (85%)	18 (15%)	120		

Table-1: Association between Driving License and Facing Accident.

- **Table 2:** Presents the association between Responder overtaking habit at the time of driving and Facing Accident of our respondent. The Chi-square test demonstrated that their association between Responder overtaking habit at the time of driving and Facing Accident was significant ($P<0.05$) that means there is association between Overtaking habit and Facing Accident.

Variable	Group	Responder overtaking habit at the time of driving		Total	Chi-square value	p-value
		Yes	No			
Facing Accident	Yes	50 (80.6%)	12 (19.4%)	62	4.268	0.039
	No	37 (63.8%)	21 (36.2%)	58		
	Total	87 (72.5%)	33 (27.5%)	120		

Table-2: Association between Overtaking habit and Facing Accident.

- **Table 3:** Presents the association between following traffic rules habit of our respondent at the time of driving and Facing Accident of our respondent. The Chi-square test demonstrated that their association between following traffic rules habit at the time of driving and Facing Accident was significant (P<0.05) that means there is association between Following traffic rules and Facing Accident.

Variable	Group	Traffic rule		Total	Chi-square value	p-value
		Yes	No			
Facing Accident	Yes	52 (83.9%)	10 (16.1%)	62	3.724	0.045
	No	55 (94.8%)	3 (5.2%)	58		
	Total	107 (89.2%)	13 (10.8%)	120		

Table-3: Association between Following traffic rules and Facing Accident.

- **Table 4:** Presents the association between driving experience of our respondent and Facing Accident of our respondent. The Chi-square test demonstrated that their association between driving experience of our respondent and Facing Accident was significant (P<0.05) that means there is association between driving experience and Facing Accident.

Variables	Group	**Experience**				Total	**Chi-Square value**	**P-value**
		Less than 1 year	**1 to 5 years**	**5 t0 10 years**	**More than 10 years**			
Facing Accident	**Yes**	2 (3.2%)	25 (40.3%)	17 (27.4%)	18 (29%)	62	14.724	.002
	No	3 (5.2%)	21 (36.2%)	3 (5.2%)	31 (53.4%)	58		
	Total	5 (4.2%)	46 (38.3%)	20 (16.7%)	49 (40%)	120		

Table-4: Association between Experience and Facing Accident.

- **Table 5:** Presents the association between average vehicle speeds of our respondent at the time of driving and Facing Accident of our respondent. The Chi-square test demonstrated that their association between average vehicle speeds and Facing Accident was significant ($P<0.05$) that means there is association between Speeds and Facing Accident.

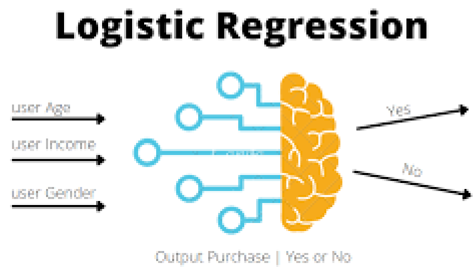
Variables	Group	Speeds Category		Total	Chi-Square value	P-value
		General	**High**			
Facing Accident	**Yes**	5 (8.1%)	57 (91.9%)	62	4.839[a]	0.028
	No	13 (22.4%)	45 (77.6%)	58		
	Total	18 (15%)	102 (85%)	120		

Table-5: Association between Speeds and Facing Accident.

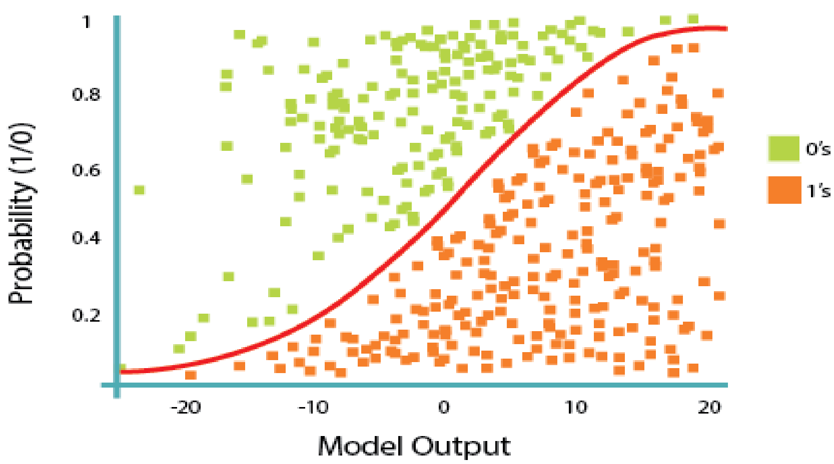
5.5 Binary Logistic Regression Analysis

Regression analysis is a set of statistical methods used for the estimation of relationships between a dependent variable and one or more independent variables.

Binary logistic regression is a regression model where the target (dependent) variable is binary (two categories), that is, it can take only two values, 0 or 1.



Not only does binary logistic regression allow us to assess how well our set of variables predicts our categorical dependent variable and determine the "**goodness of fit**" of our model as does regular linear regression, but also it provides a summary of the accuracy of the classification of cases, which helps us determine the percent of predictions made from this model / equation that will be correct.



Logistic Regression Model Visualization

5.6 Variable Selection of the Logistic Regression Model:

We have already observed that not all the variables have significant association with our dependent variable attitudes Facing Accident. So, to fit the logistic regression model I used the variables that are associated with the dependent variable. The variables I used to fit logistic regression model are**:**

Dependent Variable:

- Facing Accident**.**

Independent Variables:

- Follow traffic rule
- Experience
- Driving license
- Regular Speeds
- Overtaking Habit

5.7 Fitting and Testing Logistic Regression Model

The model was

$$\mathbf{Y(Yes = 1; No = 0) = \log\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon_j}$$

Where, Y = Facing Accident (Yes = 1, No = 0), X_1= Driving Experience, X_2= Having Driving License, X_3 = Following Traffic Rules, X_4 = Drivers Overtaking Habits, X_5 = Regular Vehicle speeds, $\beta_0 = \text{intercept term}$, $\beta_j's$ (j=1,2,3) are the regression coefficients and ε_j= random error.

We have to test the following hypothesis:
H_0: β_j=0 or OR=1, where, j = 1, 2, 3.
H_1: H_0 is not true.
Where, OR (odds ratio) $= e^{\beta j} = e^0 = 1$

If the regression coefficient is positive, non-reference case (group) is more likely to get Yes for outcome variable; on the other hand if regression coefficient is negative, non-reference case (group) is less likely to get Yes for outcome variable.

The OR is useful for comparing non-reference group to reference getting time (how many time) more or less to get Yes case.

- **Table 6:** Shows that the effects of Facing Accidents course or Follow traffic rule by the respondents, Experience of drivers, Having driving License, Drivers Regular Average Speeds on the road and Overtaking Habits of a drivers. Binary logistic regression model showed that Drivers Regular Average Speeds on the road were more likely to Facing an Accident compared to others variables [OR = 4.47 ; 95% CI: 1.203 to 16.641; p-value (0.025)<0.05]. Hosmer and Lemeshow Test showed that our selected model is good fitted, but Nagelkerke R^2 value (0.302) exhibited that our model can able to explain the variation of outcome variable by only 30.2%.

Variable	Group	B	S.E.	Wald	df	P-value	OR	95% CI for OR	
								Lower	Upper
	Experience			11.063	3	.011			
Experience (3)	Experience (1)	.982	1.240	.628	1	.428	2.671	.235	30.347
	Experience (2)	-.505	.468	1.168	1	.280	.603	.241	1.509
	Experience (3)	-2.345	.771	9.247	1	.002	.096	.021	.434
Driving license(1)	Driving license(1)	1.030	.653	2.489	1	.115	2.802	.779	10.081
Traffic rule(1)	Traffic rule(1)	1.046	.870	1.443	1	.230	2.846	.517	15.672
Speeds Category (1)	Speeds Category(1)	1.498	.670	4.998	1	.025	4.474	1.203	16.641
overtaking habit (1)	Responder overtaking habit at the time of driving(1)	-.693	.471	2.164	1	.141	.500	.199	1.259
	Constant	-1.126	1.133	.988	1	.320	.324		
Hosmer and Lemeshow Test	Chi-square value = 4.855			P-value = 0.678					
Nagelkerke R Square	0.302								

Table – 6: Binary Logistic Regression Analysis

CHAPTER FIVE

CONCLUSION

6.1 Conclusion

In this study I have collected 300 data about the road traffic accident of Rajshshi city Region. Here we consider the living arrangement of the general people, Drivers and Traffic police respectively. Here, I have compute the frequency distribution of personal details of the respondent such as gender, age, kind of road users, driver type, driving experience, following traffic riles habit, driving regular speeds, overtaking habits of drivers, drivers facing accident or not, vehicles type involve in accident and accident time such as dawn, morning, noon and night.

The frequency distribution chart shows that from 300 responders 83.3% are male and 16.7% are female where 40% are pedestrians there 40% are drivers and 20% are traffic police. Now I consider 40% driver's data it’s about 120 respondents. Out of a total of 120 respondents, 54 are under the age of 25, representing 45.0% of the population. There are also 55 respondents who are between the ages of 25 and 44 representing 45.8% and 9.2% of the population are old ages respectively. I observe that 41.7% are bus/truck drivers, 36.7% are bikers, and 10% and 11.7%, respectively, own auto rickshaws and private cars. From a total of 120 respondents, the frequency distribution chart reveals that 40.8% of drivers have more than 10 years of driving experience, 16.7% have five to ten years, 38.3% have one to five years, and 4.2% have less than one year experience. The frequency distribution chart also shows that 85% of drivers have a driving license and 15% do not. It also shows that 89.2% of drivers follow traffic rules and 10.8% do not. A total of 120 people responded, and the frequency distribution chart reveals that 51.7% of drivers have experienced one or more accidents on the road, while 48.3% have not. 120 people replied in all. Of the 62 drivers involved in accidents, bikers account for 38.7% of them, bus drivers for 27.4%, private automobile drivers for 19.4%, and others account for 12.9%. According to the table, 33.9% of accidents take place at night. Accidents occur in the morning 29.0% of the time, at dawn 25.8% of the time, and at midday 11.3% of the time.

Next, I performed a chi-square test and find the association between one dependent variable as Facing an Accident and several independent variables, considered as all variables of personal details. I found there is a significant association between facing accidents and Drivers' experience, Drivers' traffic rule following habits, Having a driving license or not, Drivers overtaking habits, and Drivers' regular driving speeds. And all variable relations are insignificant.

Finally, binary logistic regression analysis was performed. Binary logistic regression model showed that Drivers' regular driving speeds mother were more likely to get Facing an Accident to others variables.

Hosmer and Lemeshow test showed that our selected model is good fitted, And Nagelkerke R2 value (0.302) exhibited that our model can able to explain the variation of outcome variable by only 30.2%.

Therefore, it is hoped that this study would contribute to a greater understanding of the driving behaviors that contribute to traffic accidents.

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