

# Environmental Factors of Road Accidents Involving Public Service Vehicles in Nairobi County, Kenya

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**Abstract:** ***Purpose:** The study aimed at identifying the environmental factors that causes road accidents in Nairobi County, Kenya. **Materials and methods:** This study adopted a descriptive survey design. The area of study was the County of Nairobi. The study population was 25,276 PSV drivers within Nairobi County. The study used simple random sampling. The sample size was 384 cases. Primary data was gathered by use of structured questionnaires. The archival method was used to collect secondary data regarding road accidents involving PSVs in Nairobi County from 2011 to 2015. Data was analyzed quantitatively using statistical package for social sciences (SPSS) computer software. **Results:** The study concluded that the greatest environmental factors that lead to road accidents involving PSVs were roads with no sidewalks and unmarked roads. Finally, the study concludes that there is a positive and significant relationship between causes of road accidents (environmental causes) and the road accidents among PSVs. **Recommendations:** The study recommends that in order to curb environmental factors that lead to road accidents involving PSVs in Nairobi County, the government through the ministry of Transport should ensure that all the roads are well marked and that all the roads should be built with sidewalks and proper signage.*

**Keywords:** Road traffic accidents, public service vehicles, environmental factors

## 1. Introduction

### 1.1 Background to the Study

Road traffic accidents have become the leading cause of death and disability in many countries across the world, human behavior, vehicles and environmental conditions are the defined major key risk factors in road traffic injuries, influencing both the risk of road crash as well as the severity of the injuries that result from the crashes (WHO Report, 2012). They reduce driver's ability to steer safely around curves or objects in the roadway, they extend the distance necessary to stop a vehicle and increase the distance the vehicle travels while a driver reacts to a dangerous situation. (World Health Organization, 2008).

#### 1.1.1 The Global Perspective of Road Accidents.

Over 1.25 million people die each year worldwide on the roads; with 20 million to 50 million more sustaining serious injuries that take long healing periods, while others remain with lifelong health complications. Globally road traffic crashes are a leading cause of death among young people aged 15 – 29 years and cost governments approximately 3% of gross domestic product (GDP), (WHO, 2013).

In 2010, concerned about the very high and increasing burden of road traffic crashes around the world, the United Nations General Assembly adopted Resolution 64/255, which proclaimed 2011-2020 the Decade of Action for Road Safety. The goal of the Decade is to reduce the increasing trend in road traffic deaths, and to save an estimated 5 million lives over the period. (UN; 2010, Global status report on road safety)

Low and middle income countries account for 90% of road traffic deaths globally. Vulnerable road users; pedestrians, cyclists and motor cyclists make up half of these deaths. African region has the highest road fatality rates with an

estimated economic loss of up to 5% (GDP), yet it remains the least motorized of the six world regions (Paden et al., 2014; Peltzer and Renner, 2012).

While the African Region possesses only 2% of the world's vehicles it contributes 16% to the global deaths. Nigeria and South Africa have the highest fatality rates (33.7, 31.9 deaths per 100 000 population per year, respectively) in the region. More than one in four deaths in the African region occur on Nigeria's roads and Nigeria with six other countries; South Africa, Kenya, Ethiopia, Democratic Republic of Congo (DRC), Tanzania and Uganda are responsible for 64% of all the deaths in the Region. These seven countries must reduce their deaths considerably if the region is to realize a significant reduction in deaths. (WHO, 2013; Odero et al., 2013; Nantulya & Reich, 2014).

#### 1.1.2 Kenyan Perspective of Road Accidents

Kenya has consistently been experiencing rising road crashes. From 1981 to 1990, road fatalities rose at an average of 0.9% per annum (p.a), 1720 to 1856 people. The fatal crashes rose phenomenally to 17% in 1991 and 21% in 1993. These have continued to rise with over 13000 accidents annually with an average of 3000 fatalities (Odero, et al, 2013, GOK, 2003).

In an effort to reduce the escalating road crashes, the Government of Kenya introduced Legal notice number 161 of 23<sup>rd</sup> August 2003 on mandatory requirements to be complied with by PSV and commercial vehicles operators. The initial six months of the implementation, were highly successful and there was a massive reduction of road accidents and fatalities by up to 60%, compared to a similar period of time in the previous year. Soon thereafter a rise in crashes re-emerged on the roads despite the continuous enforcement of the rules set in the Legal notice (GOK, 2004).

The National Transport and Safety Authority (NTSA), was established in 2012 through the NTSA Act (2012) to effectively implement and enforce compliance to the requirements of traffic rules. One of its mandates was to put in place strategies that will contribute to a reduction in the dramatic rise in road traffic crashes which were being experienced in Kenya. (NTSA Act, 2012); (Traffic Act cap 403); (GOK, 2012).

Despite all the above measures, over 13000 road crashes are experienced each year and have maintained a constant average of 3000 lives lost. Emotionally; these leaves behind a trail of pain, anguish, suffering and families that are thrown into extreme poverty due to loss of sole bread winners. Economically; the country incurs heavy budgetary expenditure, to procure medical supplies and emergency equipment required for the accident victims.

In 2015 the economic cost of road crashes was at 5.6% of the GDP ~ 300 billion Kenya shillings. Interestingly, road transport is the most widely used mode of transport in Kenya, handling over 93% of both passenger and cargo transportation. It creates direct and indirect employment, provides income to the government and to the road transport service provider, and facilitates linkages within the economy. From the surface road transport looks meticulous, however, when one considers the fact that road transport accidents costs Kenya 5.6% of her GDP ~ 300 billion Kenya shillings, it becomes clear that road transport accidents is a net robber of the national economy (Ikiara, 2005; GOK, 2015; NTSA, 2015).

## 1.2 Statement of the Problem

Public transport systems are generally poorly developed in most countries of Africa. Both conventional buses and other vehicle types (e.g. minibuses, taxis and converted pick-up trucks etc), known by different names (such as *matatusin* Kenya, *donfoin* Nigeria, *trotroin* Ghana) are used widely for passenger transport. These vehicles are often poorly maintained, overloaded, and driven recklessly at high speeds resulting in high accident rates. Unconventional vehicles are often the main means of transport for low-income people both in the cities and rural areas, because of their lower fares, availability and convenient routes (Simon, 2010).

Many scholars have investigated the factors influencing the traffic accidents worldwide (For example, Baguley, 2010; Clarke, et al., 2015). Recently, Baruah and Chaliha, (2015) have analyzed the incidence of alcohol consumption among the victims of road traffic incidents brought for autopsy to the Department of Forensic Medicine, GMCH, Guwahati. Murimi, (2013) investigated the determinants of Severity of Road Accidents involving buses along Kenyan Roads: A Case of Nairobi - Kisumu Highway, Kenya.

Ogutu, (2012) did a study on the Road Traffic Accidents (RTA) characteristics along the A109 roads while Pukose, (2009) evaluated the outcome of the effects of the new road traffic rules and regulations on the incidence and severity of passenger service vehicle related injuries presented at Kenyatta National Hospital. From the above studies none focused on the environmental factors leading to road

accidents involving public service vehicles in Nairobi County, Kenya. It is against this background that this study was conducted to fill in the gap in knowledge which exists by identifying the environmental factors that lead to road accidents involving public service vehicles in Nairobi County Kenya.

## 1.3 Specific Objective

To investigate the environmental factors that causes road accidents in Nairobi County, Kenya.

## 2. Literature Review

### 2.1 Theoretical principles

#### 2.1.1 Risk theory

A common agreed upon definition of risk is yet to be articulated. Risk can for instance be defined as subjective assessment of probability for a specific occurrence of a negative event, and how concerned individual is with the consequences of this event (Sjorberg 2013, Rundmo 2014 & Moen 2005), thus the combination of perceived probability and severity of consequences, relate to how the individual perceive risk.

According to Dejoy (2009), in the road traffic, risk is the function of four elements. The first is the exposure-the amount of movement or travel, within the system by different users or a given population density. The second is the underlying probability of crash, given a particular exposure. The third is the probability of injury, given a crash. The fourth element is the outcome of injury. Risk can be explained by human error, kinetic energy, tolerance of the human body and post-crash care Bastide (2011).

A variety of factors have been suggested to predict risk perception. Rundmo (2014) identified that poverty and poor countries exhibit a higher risk tolerance culture are the relevant approach in understanding why people neglects risk because of being influenced by other existing risks, in a high risk society people are experiencing several severe risks. Furthermore, risk is associated with personality traits and attitudes. Some people prefer a higher risk level, so called sensation-seekers, most likely in all types of society or cultures. Zuckerman (2009). Existing literature on traffic accidents points to the fact that while rates of accidents have fallen in industrialized countries, it is rather on the increase in developing countries. As the developing countries are characterized by poverty, majority of the people living in these countries are exposed to various risk situations every day. Risk can be assessed as an "objective" phenomenon or a social cultural or subjective "phenomenon" which could be socially construction. (Lupton 2013, Green 2015).

Several variables are thought to influence risk perceptions among the public. Information about risk from various social relations and the media are for example thought to shape how individuals and societies approach potential risks (Slovic 2009). A consequence is that the public do not always associate objectively more dangerous activities (Olterdal, Moen, Klempe & Rundmo, 2012). For instance,

during a vacation in Egypt the statistical probability of being injured in traffic is larger than being struck by a terrorist attack. Still many western tourists tend to worry more about terrorism than traffic accident. During their stay in this country, this example indicates that risk should be regarded as the multidimensional concept, which is not always congruent with objective statistical calculations.

### 2.1.2 The Epidemiological Theory of Accident Causation

This theoretical framework in very general terms explains causal association between diseases or other biologic processes (accidents) and specific environmental experiences. In medicine and epidemiology, concepts corresponding to Heinrich's first three dominoes would be Host (human), Agent (hazard), and Environment. All kinds of illness including injury are considered as results of interactions between these three categories. The science of epidemiology was developed from the perspective of infectious diseases, which is also reflected in its vocabulary. Diseases were generally seen as results of impacts from external 'agents', such as bacteria or virus, affecting the 'host' and environmental conditions could either convey or restrain this process (Anderson, 2009). From the perspective of epidemiological model an accident is defined as 'the unexpected, unavoidable unintentional act resulting from the interaction of host, agent, and environmental factors within situations which involve risk taking and perception of danger' (Heinrich et al., 2015).

In this model two important components namely, predisposition characteristics and situational characteristics, are instrumental in the accident conditions and accident effects. Accident effects are the injuries and damages inflicted upon the people or the property. These effects are the measurable indices of the accident. Conditions under which accident takes place are unexpected, unavoidable and unintentional act resulting from the predisposition characteristics and situational characteristics. Predisposition characteristics include the susceptibility of the people (host), hazardous environment, injury producing agent etc. Situational characteristics are risk assessment by individual, peer pressure, priorities of the supervisor and prevailing attitude. For example, if an employee who is particularly susceptible to pressure from the people in the position of power (predisposition characteristic) were pressured by his supervisor (situational characteristic) to speed up his operation, the result would be increased probability of an accident.

### 2.1.3 The Systems Theory of Accident Causation

The very concept of 'systems' provide a general framework for modeling mutual and complex interactions in virtually all types of applications, from technology and biology, to economy, psychology, and sociology. By means of systems theory, it is possible to describe the dynamics of such circumstances in more detail and to understand under which circumstances a given system transform into new, and perhaps unwanted, stages or modes of operation. In the late 2000s, Surry explored the nature of man-environment interactions from a behavioral and systems-oriented view, in order to better understanding why such interactions give rise to accident risks, and why latent risks are transformed into accidents and injuries. Surry's model consists of two

sequences. The first one analyses the risk build-up from normal man-machine environment interaction, and the second one describes the dynamics of accidents and what makes some result in injury and some not (Surry, 1969).

In the mid-1970s, a Swedish research group, concurrently active with a project on occupational accidents in the city of Malmö, performed an evaluation of Surry's model based on the authentic material collected through the project. In spite of its clear merits the model was found to include some important limitations, mainly biases towards the behavior of the individual. The model was found to pay no attention to the technical and environmental circumstances and their origin. Many accidents occur in disturbed and deviated situations, which demand corrective and improvising actions from the individual. In such situations, it is important to analyze the background of these deviations, rather than focus on why the individual did not manage the upcoming situation properly (Anderson et al., 1978).

## 2.2 Legal Framework

Currently the National Transport and Safety Authority (NTSA) is the umbrella body through the NTSA Act (2012), in which several institutions functions on road transport policies are regulated and coordinated. These include the Transport Licensing Board (TLB), the Motor Vehicle inspection Unit, the Registrar of Motor Vehicles, the Driving Test Centre, the Traffic Police and the County Authorities.

The Government of Kenya (GoK) has also drawn up policy guidelines that are in form of legislation, directives and decrees on road safety. Penalties for various types of road traffic offences are spelled out in the laws of Kenya under Traffic Act (Laws of Kenya, Cap.403, 404, 405 and 406)

The Kenyan Traffic Cap.403 commencement was on 1<sup>st</sup> January, 1954. As An Act of Parliament to consolidate the law relating to the traffic on the roads. It has subsequently been revised severally according to the traffic changes on the roads and the current edition is (Rev.2012). The Act has many amendments necessitated by changes in transport trends.

To be able to create meaningful reforms that will transform the transport industry, the 10<sup>th</sup> Parliament passed the Integrated National Transport Policy (INTP), as stipulated in the Sessional Paper Number 2 of 2012. In this Paper, written in 2012 after serious consultations with stakeholders nationally and internationally, one finds the bed rock of transforming transportation in Kenya since the policy encompasses both local and international best practice.

A good policy will always create a good legislative framework. Good legislations will in turn create good institutions that will regulate and manage transport at National and County level as well.

In Kenya's public transport, the most significant transformation was the introduction of Government reforms in 2003. Key changes included; fitting of speed governors in all PSV's and commercial vehicles whose tare weight exceeds 3,048 kilograms, speed limit of 80 kilometers per

hour, fitting of seat belts on all vehicles, employment of drivers and conductors on permanent basis, indication of route details and painting of a yellow band on Matatus for purposes of easy identification, Re-testing of drivers after every two years, and approval of all driver's identification by the police. (Ministry of Transport and Communication [MOTC], 2004)

Legal Notice No. 161 of August 2003, sought to regulate the (PSV) sub-sector. The objectives of the Legal Notice were; reduce accidents caused by over speeding, enhance the safety of commuters, ensure responsibility, accountability and competency of drivers, conductors, eliminate illegal drivers, and criminals that had infiltrated the industry, facilitate identification of vehicles and restrict operation to authorized routes (MOTC, Transformation of Road Transport Report, 2004).

## 2.3 Empirical Literature

### 2.3.1 Environmental Factors that causes road accidents

Road accidents appear to occur regularly at some flash points such as where there are sharp bends, potholes and at bad sections of the highways. At such points over speeding drivers usually find it difficult to control their vehicles, which then result to fatal traffic accidents, especially at night (Atubi, 2009).

According to Howe, (2013) the weather is an important influence on the crash rates of all drivers, although these factors have been found to have a disproportionate impact on inexperienced drivers. For example, Canadian research suggested that young drivers who drove above the speed limit in intemperate weather crashed more frequently. In addition, inexperienced drivers were also more likely to be involved in crashes when fog and smoke were present.

The level of urbanization is another factor that impacts crash rates. One Australian study considered the various crash risks amongst inexperienced drivers who lived in urban, regional and rural settings. The study found that those who lived in urban areas had a higher crash risk, although no significant difference was found in terms of being involved in crashes that resulted in an injury. Inexperienced drivers who lived in regional or rural areas were more likely to be involved in only a single vehicle crash (Green, 2015).

Michael and Nicholas (2013) investigated risk factors for fatal motor vehicle crashes on slippery roads in the Northeastern United States, 2008–2012. Their study found out that the rates of crashes on slippery roads, and ratios of crashes on slippery roads to crashes on dry roads, were greatest among the youngest drivers. Among those aged 16 to 19 years, logistic regression analysis showed significant, independent risks associated with excessive speed for conditions (odds ratio [OR]=1.38), time of day (OR=1.80 for 5:00 to 9:00 am. 10:00 am to 2:00 pm), time of year (OR=6.17 for January vs. July), type of road (OR=1.27 for rural vs. urban roads), and age (OR=1.19 for those aged 16 to 17 years vs. those aged 18 to 19 years). Licensure from states with graduated licensing programs was protective against crashes attributed to swerving on slippery roads (adjusted OR = 0.63). Risk factors among drivers older than

19 years were similar but peaked at different times of day and included increased risks for women compared with men.

Danieland Kenneth (2010) conducted a study on Effects of Snowfalls on Motor Vehicle Collisions, Injuries, and Fatalities. They linked all recorded fatal crashes (1.4 million) for the 48 contiguous states from 2000 through 2009 to daily state weather data. For a subsample including 17 states, they also linked all recorded property-damage-only crashes (22.9 million) and nonfatal-injury crashes (13.5 million) to daily weather data. Employing negative binomial regressions, they investigated the effects of snowfall on crash counts. Fixed effects and other controls were included to address potential confounders. They found out that Snow days had fewer fatal crashes than dry days (incidence rate ratio [IRR] = 0.93; 95% confidence interval [CI] = 0.90, 0.97), but more nonfatal-injury crashes (IRR = 1.23; 95% CI = 1.18, 1.29) and property-damage-only crashes (IRR=1.45; 95% CI=1.38, 1.52). The first snowy day of the year was substantially more dangerous than other snow days in terms of fatalities (IRR = 1.14; 95% CI=1.08, 1.21), particularly for elderly drivers (IRR=1.34; 95% CI=1.23, 1.50). They concluded that the toll of snow-related crashes is substantial. Their results may help estimate the potential benefits of safety innovations currently proposed by meteorology and traffic safety experts.

Higher temperatures appear to have a decreasing effect on accident frequencies and severity both at daily, weekly and monthly bases (Scott, 2009). The hours of sunlight appear to increase road accidents (Hermans *et al.* 2006; Brijs, *et al.* 2007), while deviations from mean daily or monthly temperatures were found to increase road accidents (Brijs, *et al.* 2007; Stipdonk 2008). Malyshkina, *et al.* (2008) found that extreme temperatures (both low during winter and high during summer) are positively correlated with road accidents; on the other hand, when the monthly number of days with temperature below zero increases, road accidents are reduced possibly due to reduced exposure (Hermans, *et al.* 2006; Stipdonk 2008).

Key and Simmonds (2006) showed that increased rainfall in centimeters results in decreased daily traffic volume, both at daytime and nighttime, winter and spring. Bergel-Hayat and Depire, (2013) decomposed the global effect of monthly rainfall in two components: a direct effect on the number of injury accidents and fatalities, and an indirect effect on traffic volume. In Stipdonk, (2008), the indirect effect was confirmed, leading to a recommendation for estimating weather effects on road accidents under constant traffic conditions. Further, they also suggest that reduced traffic may lead to increased travel speeds that result in increased accident risk. The effects of traffic congestion on traffic safety, however, are less obvious. Rietveld & Shefer, (2013) suggest that congestion might have a positive effect on safety by decreasing the number of fatalities as speeds decrease. Although this statement seems logical, when looking at the traffic conditions in more detail the effects of congestion on safety are less apparent. As traffic flow increases and density approaches its critical value, traffic flow is said to be unstable. Under these conditions, any small disturbance may lead to crashes. Once the traffic jam is formed, rear-end crashes may occur at the tail of the queue due to large differences in speed. Furthermore, motorways

giving evidence of structural congestion (i.e. there where demand is almost always higher than capacity) cause road users to seek alternative routes - often perceived as faster routes - which are almost inevitably roads with a higher accident risk. Roadway design is one of the most significant factors that affect driving behavior and perceived safety.

Bassat and Shinar (2011) studied combined effect of roadway design element such as shoulder width, guardrail and roadway geometry (curvature) by taking objective driving measures (speed and lane position) and subjective measure (perceived safe driving speed and estimated road safety) into account. They found the shoulder width had a significant effect on actual speed and lane position but when a guard rail had a significant effect on perceived safe driving.

Chen et al., (2011) developed traffic safety model using regression in New York City. The result shows that signal related countermeasure that are designed to reduce conflict are split phase, timing, signal installation, all pedestrian phase and increasing pedestrian crossing reduces crashes. Traffic calming measures including road diets are also found to be significant in safety benefits. Countermeasures that are designed to alert driver cognitive attention such as high visibility crosswalks and posted speed limit reduction signs appear to have lesser effect.

Mohmed, (2013) studied on crash related to visibility obstruction due to fog and smoke in Florida. It was found that fog smoke related crashes are more likely to occur at night without street lighting leading to more severe injuries. Head-on and Rear-end are common crashes in terms of crash risk and severity. These crashes are more prevalent on high speed road, undivided roads, roads with no sidewalks and two lane rural roads.

### 3. Research Methodology

This study adopted a descriptive survey design. The area of study was the County of Nairobi. The County lies at altitude of 1670M above sea level, and longitude 36° 50' East and latitude of 1° 17', just 140 kilometers South of the Equator. Nairobi County lies on the Athi plains. The plain is wedged between Nairobi hills on the West bank of Nairobi River. It also lies on the brink of Rift Valley marked by Ngong hills.

Specifically, this research study was carried out at bus stops in the Nairobi CBD. These venues receive high populations of drivers of public service vehicles that were able to produce adequately the required representative study sample.

Burns and Grove (2003) describe a target population as the entire aggregation of respondents that meet the designated set of criteria. According to the Kenya Matatu Owners Association, there are 25, 276 PSV drivers within Nairobi County. These formed the study population from which a study sample was found.

The Central Bus Station, situated on Temple Road between Mfangano Street and Uyoma Street, was for a long time

reserved for the exclusive use of Kenya Bus Service (KBS), the oldest public transport company in Nairobi which at one time had a monopoly on intra-city mass transport services in Nairobi and Mombasa. In the mid 1980's, Nyayo Bus Service was introduced, and the smaller 14-seater Matatus started appearing on the scene, bringing to an end the long running KBS monopoly. While the Nyayo Bus Service has since collapsed, other bus companies have emerged to take its place.

Simple random sampling was used to identify the drivers of the PSVs in the bus stations. Based on the formula below the minimum target sample for a large population were 384 cases.

The sample for a large population is determined using the Cochran's, (1997) formula given as;

$$n = \frac{t^2 * (p)(q)}{d^2}$$

Where:

**n** = Sample size for large population

**t** = Normal distribution t value score, e.g. 1.96 for (0.25 in each tail) a 95% confidence.

**p** = Proportion of units in the sample size possessing the variables under study, where for this study it is set at 50% = (0.5)

**q** = (1-p). = (1-0.5) = (0.5)

**pq** = estimate of variance = 0.25.

**d** = Acceptable Precision margin of error desired or the significance level which is 5% (0.05) for the study

Hence substituting the values in order to determine the required sample size for this study population as follows we obtain:

$$n = \frac{(1.96)^2 * (0.5)(0.5)}{(0.05)^2} = 384$$

The sample size for this population, **n**= 384.

**Table 1: Sample Size for Quantitative Data**

Stage	Population	%	Sample
Central Bus Station	3000	30	115
Muthurwa	1000	10	38
Odeon	1000	10	38
Railways	2500	25	96
Koja Round About	800	8	30
Kamkunji	300	3	12
Kencom	300	3	12
Tuskys Bebabeba Supermarket	500	5	20
Ronald Ngala Avenue.	600	6	23
<b>Total</b>	<b>10,000</b>	<b>100%</b>	<b>384</b>

Primary data was gathered by use of structured questionnaires and captured through a 5-point type Likert scale with close-ended questions to key informants distributed to respondents. The data was sorted, coded, edited, and entered in Microsoft Excel. Data gathered from the questionnaires was analyzed quantitatively using statistical package for social sciences (SPSS) computer software. SPSS generated descriptive and inferential statistics.

## 4. Results

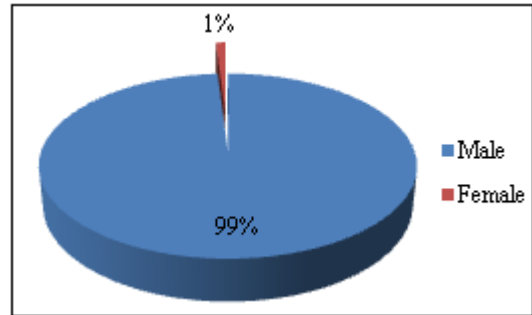
### 4.1 Response Rate

The number of questionnaires that were administered was 384. A total of 384 questionnaires were properly filled and returned. This represented an overall successful response rate of 100% as shown on Table 2

**Table 2: Response Rate**

Response	Frequency	Percent
Returned	384	100%
Unreturned	0	0%
<b>Total</b>	<b>384</b>	<b>100%</b>

population of the PSV industry in Nairobi County is male dominated.



**Figure 3: Gender of Respondents**

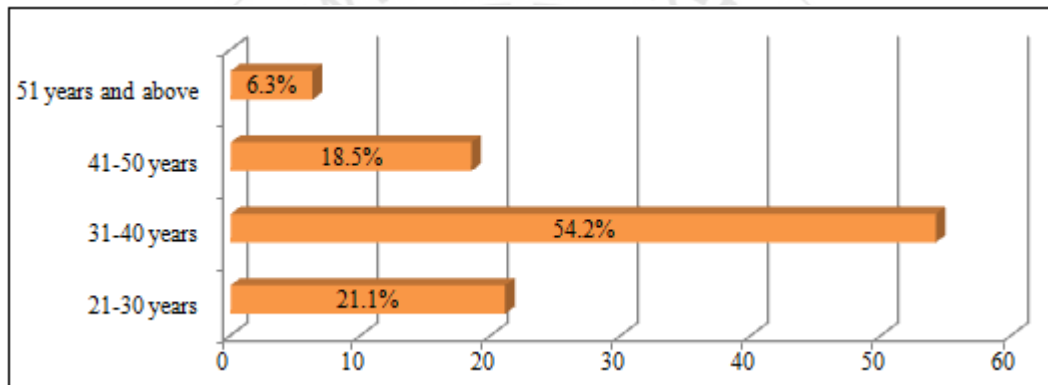
### 4.2 Demographic Characteristics

#### 4.2.1 Gender

The respondents were asked to indicate their gender. Majority of the respondents were male who represented 99% of the sample while 1% was female. These results imply the

#### 4.2.2 Age

The respondents were asked to indicate their age. Majority of the respondents were between 31-40 years as represented by 54.2%, 21.1%, were between 21-30 years, 18.5% were between 41-50 years, while 6.3% were above 51 years. This implies that the majority of the PSV drivers in Nairobi County are in their middle age.

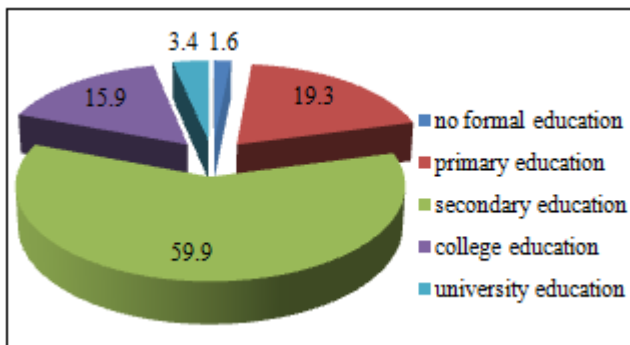


**Figure 4: Age**

#### 4.2.3 Level of Education

The respondents were asked to indicate their level of education. Majority of the respondents had acquired up to secondary level education as represented by 59.9%, 19.3% had primary level education, 15.9% had college level education, 3.4% had university level education, while only 1.6% had no formal education. This implies that PSV drivers in Nairobi County are fairly educated.

years of PSV driving experience as represented by 41.9%, 37% had had 6 years to 10 years of PSV driving experience, 18.8% had 2 years to 5 years of PSV driving experience, while only 2.3% had less than 1 year of PSV driving experience. This implies that PSV drivers in Nairobi County are experienced.



**Figure 5: Level of Education**

#### 4.2.4 Years of PSV Driving Experience

The respondents were asked to indicate their years of PSV driving experience. Majority of the respondents had over 10

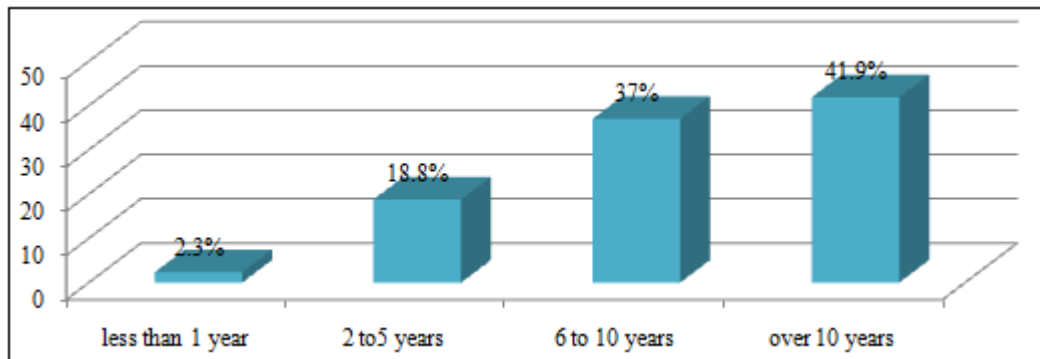


Figure 6: Years of PSV driving experience

#### 4.4.3 Environmental Factors That Lead To Road Accidents Involving PSVs

In order to investigate environmental factors that lead to road accidents involving PSVs in Nairobi County, respondents were asked to rate the factors on a scale of 1 to 5; (1; strongly disagree, 2; disagree, 3; neutral, 4; agree, 5; strongly agree). The means of the environmental factors that lead to road accidents involving PSVs in Nairobi County were ranked in order to establish their order. The highest rank (for instance Rank 5) in the table 3 below implies that respondents were in disagreement with the assertion that the road accidents in Nairobi County were

caused by environmental factors while the lowest of the ranks (for instance Rank 1) implied that the respondents agreed that the road accidents in Nairobi County were caused by environmental factors. Specifically, the results indicate that the greatest environmental factors to causation of road accidents in Nairobi County were; roads with no sidewalks (mean = 4.13) and unmarked roads (mean = 4.11) while the least environmental factors that lead to causation of road accidents in Nairobi County were Slippery roads (mean = 3.83) and Fog reducing visibility (mean = 1.42) as indicated by the rank results in table 3.

Table 3: Environmental Factors That Lead To Road Accidents Involving PSVs

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Deviation	Rank
Road accidents involving PSVs are more prevalent on roads with no sidewalks	0.3	7.2	4.8	54.7	33.1	4.13	0.822	1
Road accidents involving PSVs are more prevalent on unmarked roads	1.3	8.8	6.7	43.6	39.6	4.11	0.962	2
Traffic calming measures including road bumps are important safety measures	3.8	14.2	4.6	47.7	29.8	3.86	1.11	3
Slippery roads increases the risk of motor vehicle crashes involving PSVs	12	8.3	64	15.7	3.83	0.833	4	
Fog reduces visibility and is a major factor in road traffic accidents involving PSVs	72.9	5.1	9.1	5.8	7.1	1.42	1.062	5

## 5. Conclusions and Recommendations

### 5.1 Conclusions

The study concluded that there are environmental factors that lead to road accidents involving PSVs. More specifically, it was concluded that among the environmental factors that lead to road accidents involving PSVs were roads with no sidewalks and unmarked roads.

Finally, the study concludes that there is a positive and significant relationship between causes of road accidents (environmental causes) and the road accidents among PSVs.

### 5.2 Recommendations of the Study

#### 5.2.1 Recommendations for theory and knowledge

This study results validate the accident causation theories. The systems theory of accident causation proved useful in identifying the critical factors. In particular, it was through the systems theory of accident causation that the study was able to identify the following; environmental factors of accidents causation. The study also validated the several

theories by showing their usefulness. For instance, the study applied the risk theory and the epidemiological theory of accident causation.

#### 5.2.2 Recommendations for managerial policy and practice

The study recommends that in order to curb environmental factors that lead to road accidents involving PSVs in Nairobi County, the concerned authorities should ensure that all roads are well marked, built with sidewalks and proper signage.

### 5.3 Suggestions for Further Study

Future studies should address the potential relationships of causes of road accidents and the road accidents involving PSVs in Nairobi County, as well as strategic solutions to the causes of the road accidents in Nairobi County.

Studies on vehicle body building industries should be conducted. It is important for such a study in order to establish compliance to the set standards for the construction of vehicle bodies used by the PSVs.

A replica of this study can be carried out with a further scope to include more Counties in Kenya other than Nairobi County. A similar study can be done on other classes of vehicles for comparison purposes.

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