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Risk Factors for Road Crashes in Nairobi County, Kenya

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Abstract:
Road crash in the Transport Industry are a threat to public health and national development in many developing countries. They contribute to poverty by causing deaths, injuries, disabilities, grief, lost of productivity and material damages. The study was undertaken at Nairobi County, with specific focus on Nairobi Hospital, Nairobi County, Hospitals, (BCH), Nairobi police station, Nairobi Police station, County's department of Transport / accidents and some road terminus in Nairobi County. This study seeks to identify risk factors for road crashes in transport industry in Nairobi County. To find the relationship between speed of a vehicle and road crashes by applying power model to estimate the effects of road crashes. This study seeks to answer the following questions; do the speed of vehicle and risk factors are adequate reasons for perpetual road crashes in Kenya especially in Nairobi County? The results obtained in this study, can be used by the road safety authorities for planning and evaluating road safety measures. The methodology and procedure for data collection was based on both qualitative and quantitative approach. Interviews, focus group discussions, observations and review of secondary data, were collected accordingly; some data were subjected to power model to estimate the road crashes effects. The data will be used by the stake holders to develop interventions to mitigate road crashes in the Transport Industry. The data obtained in this study can be used by the road safety authorities for planning and evaluating road safety measures. Statistical analyses of data were done by descriptive statistics employing the measures of central tendencies, frequency distributions, difference between a set of observed frequencies and a corresponding expected frequency.

Keywords: *Risk, road crashes, disability adjusted life years; vehicle factors, factors influencing exposure to risk, the circadian rhythm , driver fatigue*

1. Introduction

Street crashes in transport industry are one of the main sources of death and handicap around the world. They represent more than 1.2 million passing—3.6% percent of the worldwide mortality load (WHO 2009). It is likewise assessed that in 2004, Road crashes in transport industry wounds (RATIs) added to 2.7% percent of the all-out handicap balanced life years (DALYs) lost all inclusive, an extent that is relied upon to ascend to 4.9 percent constantly 2030 and position RCTI s as the third driving supporter of the worldwide weight of ailment (WHO2008). Hazard is the likelihood of destructive outcomes or anticipated misfortunes (passings, wounds, property, employments, monetary movement disturbed or condition harmed) coming about because of associations between normal or human-instigated dangers and defenseless conditions. Networks require data both on perils and their vulnerabilities to decide needs to decrease their hazard (Peden et al., 2004). As per the World Report on mishaps in the Transport Industry Prevention, mishaps in the Transport Industry represent around 3000 day by day fatalities around the world (Peden et al., 2004). Kenya being a nearly creating nation has high populace thickness and moderately troublesome territory. Accordingly, huge roading use has been constrained and the nation keeps on depending to a great extent on two-path streets of shifting standard to interface the major urban territories. A large number of these streets have "advanced" from the first muram streets, instead of being appropriately intended for present day engine vehicles. Along these lines, they frequently contain many sub-standard bends bizarre with the encompassing condition, just as an absence of passing chances. Both the motoring open and street experts have recognized these as real worries that should be distinguished and eventually cured (MoT, 2006a)

1.1. Statement of the Problem

The street crashes in Nairobi County are disturbing. The significant clinics like Kenyatta Hospital and Nairobi region doctor's facility have put aside exceptional wards to deal with instances of street crashes. This street crashes has made numerous populace who are in their defensive stage to be a weight to the general public. Kenya, has seen a sharp

increment in the quantity of enlisted engine vehicles in the course of recent decades—from 1.4 engine vehicles per 100 individuals in 1985 to 2.7 engine vehicles per 100 individuals in 2007 (WHO, 2009). Street utilization has correspondingly additionally gone up for each sort of vehicle (Assum, 1998). Bike use in Kenya has likewise fundamentally expanded in the course of the most recent decade. An examination directed in Nairobi demonstrated that in only 3 years, bike enrollment ascended from 4136 out of 2004 to 16,293 of every 2007 (Nesoba, 2010). Thus this investigation looks to distinguish chance elements for street crashes, and tries to answer the inquiries, do the hazard factors sufficient purposes behind unending street crashes in Kenya particularly in Nairobi County.

1.2. Research Objectives

The general objective of this research is to explore ways to assess the safety performance of roads in Kenya and in particular identify driver, road, and environmental factors enhancing crashes on road curves.
Specific objective is:

- To determine risk factors for road crashes in Nairobi County

1.3. Research Question

In order to achieve the purpose of the research, the following guiding question was adopted.
What are the risk factors responsible for road crashes in Nairobi County?

1.4. Significance

The study adds information to comprehension of the hazard factors which upgrade Road crashes in transport industry. The outcomes acquired in this investigation, can be utilized by the street security specialists for arranging and assessing street wellbeing measures. The bike clients will realize the different dangers engaged with utilizing the cruiser as a method of transport. The examination was led along the streets in Nairobi area Kenya;

1.5. Scope

The study was conducted in Nairobi County. The study was focused to roads in Nairobi county, urban roads based in Nairobi Town. It was further focused on roads in Nairobi County and the urban roads in Nairobi Town. The risk factors for road crashes in transport industry were investigated Nairobi County on the road net works. The target population was the Traffic police officers, Health workers, county Heads of transport, drivers of PSV vehicles, and drivers of private vehicles, Motor bike riders, lorry / tractor drivers, pedestrians, driving schools and opinion leaders in Nairobi County.

3. Materials and Methods

3.1. Study Site

3.2.1. Nairobi County

Nairobi County is a county in the rift valley province of Kenya. It has a total of 894,179; 202291 population and covers an area of 3, 3452, SQ.KM. The population density is 267Q KM and 50% of the population lives below the poverty line. Some Strengths of Nairobi County include; Natural resources as Forests, Tourist Attractions as Scenic Beauty, Sports Tourism, Cultural Tourism, Eco-Tourism, Main Economic Activities large-scale maize, wheat farming, dairy farming, sports tourism (Athletics), manufacturing and agro processing (Kenya Mpya, 2012).

3.3.1. Research Designs

The study employed survey, correctional and summative evaluation research designs. This enabled the researcher to collect both qualitative and quantitative data. Research Design as per the specific objectives as shown in table 1 below:

3.3.2. Sampling Strategy

The data will be generated from both primary and secondary sources. For primary data, questionnaires, Interview schedules and focus group discussion will be used as shown in the Table 3.2 Sampling strategies below;

Study Population Units	Sample Method	Sample Size
Hospitals Facilities in Nairobi (HF in UG)	purposive	20
Hospital Facilities in Nairobi (HF in BG)	Purposive	20
Nairobi police stations	Purposive	10
Nairobi police stations	purposive	10
Nairobi county office transport department	purposive	5
Nairobi county office transport department	purposive	5
Pedestrians in major estates: Nairobi East and West (Nairobi county) Nairobi North and South (Nairobi county)	Quotas sampling method	20 20

Table 1: Sampling Strategies

4. Results and Discussion

4.1. Introduction

In creating nations the pattern of mishaps in transport industry has achieved a disturbing state, yet next to no consideration is paid to the issue (Odero et al, 1997). Concentrates done worldwide have demonstrated that mishaps in the Transport Industry are the main sources of death of numerous youths and youthful grown-ups (Balogun et al 1992). In creating nations, including Kenya, mishaps in the Transport Industry are expanding with time (Asogwa, 1992). When considering the populace figures, creating nations in Sub-Saharan Africa have the most astounding recurrence of different mishaps around the world (Peden et al, 2004). In this issue of street crashes in transport industry, there are numerous players; The police who are keen on legitimate implementation; the insurance agencies and vehicle proprietors in the money related expense of street mishaps; the mishap unfortunate casualty and their relatives in loss of lives or handicap and related expense of therapeutic consideration; and the medicinal services framework and restorative staff who are in charge of the rise treatment and life reserve funds of mishap exploited people (Asogwa, 1992). Street transport is the fundamental method of transportation for products and travelers in Kenya; dealing with 90% of National cargo tonnage and 95% of the vehicle volume. In spite of the way that the improvement of street frameworks and transport is a critical factor in financial advancement. Down, (1997) saw that mishaps in Transport industry represent high demise rates in the nation and represent a danger to general wellbeing and formative advancement. Along these lines there is have to distinguish the hazard factors that improve crashes in Nairobi County, and utilize the current models to assess the protected street structuring strategies that will diminish the street crashes in Kenya.

4.2. Risk Factors for Road Crashes in Transport Industry

Driver fatigue ('falling asleep at the wheel') is a major cause of road accidents, accounting for up to 38.4% of serious accidents on motorways and monotonous roads in Kenya

4.2.1. The Circadian Rhythm

Fundamentally people need to rest. Rest designs are represented by the circadian mood (the body clock) that finishes a full cycle around once every twenty four hours. Individuals are typically conscious amid sunshine and sleeping amid obscurity. There are two pinnacles of sluggishness: the early hours of the morning and the center of the evening. The more extended an individual stays conscious, the more noteworthy the need to rest and the more troublesome it is to oppose nodding off. Rest will at long last overwhelm the most grounded aims and endeavors to remain wakeful. The requirement for rest varies between people, however dozing for eight hours out of twenty four hours is normal, and seven to nine hours rest is required to streamline execution. There are two pinnacles of drowsiness: the early hours of the morning and the center of the evening. Some factors that disruption sleeps are:

- The individual's hours of work, such as long hours and shift work
- The individual's family responsibilities
- The individual's social activities
- The individual's illness, including sleep disorders
- The individual's medication
- The individual's Stress.

The Twenty four economies appears to pressurize numerous individuals to forfeit rest for other financial exercises, without understanding the negative effects this has on their wellbeing and capacity to perform numerous errands, particularly driving.

4.2.1.1. Road crashes as a result of Sleepiness and Impairment

Sleepiness reduces reaction time which is a critical element of safe driving. It reduces vigilance, alertness and concentration hence impairs drivers. The speed at which information is processed is reduced by sleepiness. The quality of decision-making may also be affected especially when driving.

4.2.3. Findings of Driver Fatigue and Road crashes

These results in varying estimates of the level of sleep related road crashes, and in particular, evidence based on crashes reports. It was found that driver fatigue caused up to 38.4 of road crashes on monotonous roads.

(d) Many road crashes on two of BC/AGC busiest roads indicated that 50% of fatal road crashes on those roads were fatigue related. From the study puts 30% - 40% of road crash involving heavy trucks are caused by driver sleepiness.

4.3. A Road Crash Patterns and Risk Factors

4.3.1. Type of Driver

This study has identified young male drivers, aged less than 30 years, as one of the groups most at risk of being involved in sleep related road crashes. It has been found that about half of the drivers involved in sleep related road crash were males aged below 30 years, with the peak age being 21 – 25 years.

Age	No Of Crashes/Year 2008-2009	No of Crashes/Year 2010-2011	No of Crashes/Year 2011-2012	No of Crashes/Year 2012-2013	Total
18-25	350	300	290	340	1280
26-35	270	230	250	220	970
36-46	150	200	180	130	660
47 +	104	11o	98	100	412
Total	874	840	818	790	3322

Table 2: Road Crash Patterns and Risk Factors

AGE 18-25; 1280/3322=38.5%
AGE 26-35; 970/3322= 29.2%
AGE 36-46; 660/3322 =19.9%
AGE 47+; 412/3322 =12.4%
It was found that 38.5% of sleep related crashes involved drivers aged 25 years or younger, with the peak age being 20 years The study has identified three main risk groups among drivers:

- Male drivers aged 16 - 29 years
- Shift workers
- People with sleep problems.
- People on medicines/drunks

Main Risk Groups	No of Crashes/Year 2008-2009	No of Crashes/Year 2010-2011	No of Crashes/Year 2011-2012	No of Crashes/Year 2012-2013	Total
Drivers of age 18-29	300	310	280	330	1220
shift workers	200	210	220	210	840
people with sleep problems	100	130	140	110	480
People on medicines/drunks	110	90	90	70	360
Total	710	740	730	720	2900

Table 3: Main Risk groups

- Drivers of age 18-29 =1220/2900= 42.1%
- Shift workers 840/2900 =30%
- People with sleep problems 480/2900= 16.6%
- People with medicines/trucks problems 360/2900 =12.4%

4.3.2. Time of Day

Sleep related road crashes peak in the early hours of the morning, between 2:00 and 6:00 am, and in the mid afternoon, between 3:00 and 4:00 pm, due mainly to circadian rhythms. The study has shown that drivers are 50 times more likely to fall asleep at the wheel at 2:00 am than at 10:00 am. The risk is three times as great between 3:00 - 4:00 pm as at 10:00 am.

Time of The Day	No of Crashes/Year 2008-2009	No of Crashes/Year 2010-2011	No of Crashes/Year 2011-2012	No of Crashes/Year 2012-2013	Total
6.00 pm-11 pm (evenings)	800	780	900	870	3350
12.00am - 3.00pm (night)	1000	1300	1500	1600	5400
3.00am – 5.00 Night	1200	1280	1300	1279	3772
5.00- 8.00 Morning	890	870	789	799	3,348
9.00-7.00	680	700	649	620	2649
Total					18519

Table 4: Sleep Related Road Crashes Peak in the Early Hours of the Morning Table

4.3.4. Type of Road Crash

Rest related mishaps will in general be progressively extreme, conceivably in view of the higher paces included and in light of the fact that the driver can't make any staying away from move, or even brake, before the impact. In this the run of the mill rest related mishaps those ones where the driver keeps running off the street or crashes into another vehicle or an article, with no indication of hard braking before the effect. The danger of death or genuine damage to drivers might be more noteworthy in rest related mishaps than in different sorts of mishap. Consequently this investigation presumes that rest related mishaps would in general have progressively extreme outcomes;

Sleep Related Accidents	No of Crashes/Year 2008-2009	No of Crashes/Year 2010-2011	No of Crashes/Year 2011-2012	No of Crashes/Year 2012-2013	Total
Vehicle move high speed & crash	50	48	37	40	175
No braking prior to crash	45	38	48	38	167
driver runs off the road	30	27	20	22	110
severe consequences of crash	30	26	23	31	110
Total					562

Table 5 Type of Road Crash

4.3.5. Indications That an Accident Is Sleep Related Are That

- A single vehicle left the road
- The accident occurred on a high speed road
- The driver did not attempt to brake or swerve to avoid the accident
- The driver was alone in the vehicle
- The accident occurred in the early hours of the morning, or between 3:00and 4:00 pm.

Indications that an road crash is sleep related	No of crashes/year 2008 (sample size 100)	No of crashes/year 2009 (sample size 100)	No of crashes/year 2010 (sample size 100)	No of crashes/year 2011 (sample size 100)	No of crashes/year 2012 (sample size 100)	No of crashes/year 2013 (sample size 100)	Total
a single vehicle left the road	25	20	27	20	30	33	155
the accident occurred on a high speed road	23	20	17	21	31	44	156
the driver did not attempt to brake or swerve to avoid the crash	24	23	26	18	41	23	155
the driver was alone in the vehicle	20	22	19	13	34	31	139
the accident occurred in the early hours of the morning, or between 3:00 and 4:00 pm.	30	33	28	31	22	22	166
Total							771

Table 6: Indications That an a Road Crash Is Sleep Related

4.3.6. Drivers' Tactics to Avoid Falling Asleep

Given that drivers are usually aware that they are feeling sleepy, many employ a range of strategies to help themselves fight sleep and to stay awake. Maycock8 asked drivers to list the tactics they use.

- Open windows/turn up air conditioning 68%
- Stop and go for a walk 57%
- Listen to radio/cassette 30%
- Talk to a passenger 25%
- Drink coffee 14%
- Other 15%

The findings were recorded in Table (4.2) as follows:

Drivers' Tactics to Avoid Falling Asleep	Heavy Vehicle Drivers	Bus Drivers	Private Cars	Total
Open windows/turn up air conditioning	30	30	20	80
Stop and go for a walk	10	4	4	18
Listen to radio/cassette	20	30	40	90
Talk to a passenger	20	30	25	75
Drink coffee	20	20	20	70
Total	90	114	109	333

Table 7: Tactics to Avoid Falling a Sleep

4.3.6.1. Listening to the Radio

Drivers who had been restricted to five hours sleep the night before drove on a driving simulator for 2.5 hours on monotonous roads. Listening to the radio had no significant effect in reducing sleepiness or in reducing 'incidents' (i.e. drifting out of lane), other than for an initial, very short, 10 to 15 minutes.

4.3.6.2. Conclusion

- Most of the things that drivers do to fight off sleepiness when driving are ineffective for more than around 10 minutes. They are only useful in an emergency to provide time for the driver to find somewhere safe to stop and rest.
- The only measures that have an effect in reducing sleepiness when driving are taking a nap of around 15 minutes and taking at least 150 mg of caffeine. However, even these measures are no substitute for sleep. And there is some concern that drivers may use these tactics to enable themselves to continue driving when they should really stop.
- It is clear that while drivers are aware that they are becoming sleepy, and that this increases their risk of having an accident, many will persevere with their driving, and employ a number of measures to fight off sleepiness.
- Education and publicity measures are required to raise awareness amongst drivers of the dangers of driver fatigue. Such measures could focus on**.** Recommendation;

4.3.7. Highway Engineering

The research has established that driver fatigue has identified that dull, monotonous roads increase the risk of sleep related accidents; there are some highway design and engineering measures that can be used successfully.

4.3.7.1. Hard Shoulder Rumble Strips

As sleep related accidents often involve a vehicle drifting out of lane, it is thought that rumbles strips along the edge of a road, and particularly along the hard shoulder of motorways, may wake up a drowsy driver and so avoid an accident.

4.3.8. In-Vehicle Technology

4.3.8.1. Devices to Detect When Drivers Are Falling Asleep

The devices to detect when drivers are falling asleep and to provide warnings to alert them of the risk, or even to control the vehicle's movement, can be developed. Some can be designed to monitor the driver and detect changes in, for example, blink rates or head position. The other sets of detectors can be developed to monitors the changes in vehicle movement, such as drifting out-of lane which can give a warning.

- An analysis of collision warning devices can be developed such that a system can alert a driver to a potential accident due to an unintentional lane change or roadway departure.
- An evaluation of three fatigue monitors (an eye closure monitor, a head nodding monitor and a reaction time monitor) can be developed such that the devices showed can show the ability to detect fatigue. There could be instances of the audible alarms startling the driver to stop him from sleeping

5. Conclusion

Driver exhaustion is a major issue bringing about a huge number of street mishaps every year. It isn't right now conceivable to compute the correct number of rest related mishaps as a result of the trouble in recognizing whether weariness was a factor and in surveying the dimension of weakness. Notwithstanding, look into proposes that up to 38.4% of mishaps on repetitive streets in Nairobi districts are weariness related.

Young male drivers, truck drivers, organization vehicle drivers and move laborers are the most in danger of nodding off while driving. Be that as it may, any driver voyaging long separations or when they are drained is in danger of a rest related mishap. The early hours of the morning and the center of the evening are the pinnacle times for weakness mishaps, and long adventures on tedious streets, especially motorways, are the well on the way to result in a driver nodding off.

Most of the things that drivers do to attempt to keep themselves wakeful and ready when driving are insufficient, and should just be viewed as crisis measures to permit the driver time to discover safe place to stop.

The best and most secure alternative is for drivers to abstain from driving when lethargic or when they are sick or taking prescription which contraindicates driving or utilizing apparatus. Recommend drivers should:

- Try to ensure that drivers get good rest, and feeling fit and healthy and are not taking medication which contra-indicates using machinery, before starting long journeys
- The drivers Plan the journey to include regular rest breaks of at least 15 minutes at least every two hours of drive.
- If possible, the driver should plan for an overnight stop.
- They should Avoid setting out on a long drive after having worked a full day
- They avoid driving into the period when they would normally be falling asleep
- The drivers should avoid driving in hours between 2am and 6am
- The drivers should be careful when driving between 2pm and 4pm, especially after having eaten a meal or drunk any alcohol.
- When the driver feels sleepy during a journey, should stop, take drinks containing caffeine and take a short nap.
- Technical devices to detect when drivers are feeling sleepy and provide warnings to them can be developed.

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