Road accidents in Kenya: a case of poor road network or human error?

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Abstract

Considering the recent increase in reported accidents in Kenyan roads, there is need to identify the major causes for effective interventions. Using data from The Ministry of Transport -Traffic department- on 135,277 road accidents reported between the years 2000 and 2010, drivers and motorcyclists, pedestrians, and vehicle defects were identified as the major causes of accidents, while passengers and road defects did not significantly cause accidents. Passengers and pedestrians were however, amongst the major victims of road accidents and therefore reforms in the transport sector should as well target them.

Keywords: Michuki rules, Poisson regression models, Public Service Vehicles (PSV) .

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1 Introduction

Road accidents are the third leading causes of death after malaria and Hiv/Aids in Kenya according to Odero, Khayesi and Heda (2003) as cited in [6], more often than not affecting the economically productive population in Kenya. There is need therefore for enacting measures geared at reducing mortality, morbidity, disability and increased cost of healthcare resulting from preventable road accidents.

Quite often than not, the transport industry stakeholders blame the poor state of Kenyan roads as the leading cause of accidents. With the recent improvement of infrastructure in Kenya however, fatal road accidents continue to be reported. This has resulted to a blame game between especially the operators of the Public Service Vehicles (PSV) and The Traffic department of Kenya Police, with the former blaming the poor state of Kenyan roads on accidents while the latter blames PSV operators especially drivers on flouting the laid down regulations. PSV drivers have been blamed for careless driving, incompetence, over speeding, drunk driving and a myriad of other vices that render them prone to causing accidents that could have been avoided in the first place [4].

The Traffic Police on the other hand, while charged with enforcing The Traffic Act, have on numerous occasions been caught on camera receiving bribes, and have featured in various corruption indices reports as leading in the vice. In fact, while the Kenyan Police was reported as the most corrupt institution in Kenya by the East African Bribery Index Report, it's the traffic arm of this organization that tops the list [3].

According to the Kenya Roads board, there are 160,886 km of public roads with 11,197 km $\approx 7\%$ having tarmac. This therefore means that most of the roads may not be easily motorable. However, majority of the reported road accidents occur in the motorable sections with the three major highways- Nairobi-Thika road, Nairobi-Mombasa road, and the Nairobi- Nakuru- Eldoret

roads reporting most of the accidents. Thika road (50.4 km) and Mombasa road (470 km) happen to be some of the busiest roads in Kenya [2]; hence there has been a rigorous expansion plan in line with vision 2030. There are approximately 80 documented black spots, with the majority being along these three highways [5].

In examining the distribution of the accidents by various parameters, attention was given to the years 2004 and 2007. This is mainly due to the fact that 2003 saw the enactment and enforcement of more stringent traffic rules by the then minister of transport the late Hon. John Michuki mainly targeting the PSV's. Passenger capacity for matatu was reduced to 13; speed limit set to 80kph and speed governors introduced, safety belts for all passengers was made mandatory as well as the vetting of drivers and conductors, who now had to meet stricter guidelines [7]. On the other hand, 2007 marked the campaign period for presidential elections in Kenya.

1.1 Objectives

This report seeks to identify the leading causes of road accidents in Kenya and to verify that human error and vehicle defects and not road defects are the leading causes of road accidents. Therefore, effective interventions should focus more on human related controls than on the road network.

2 Methodology

Data from the Ministry of Transport (Traffic department) on 135,277 road accidents reported between the years 2000 and 2010 was used and various descriptive statistics derived. Moreover, Poisson regression was applied in modelling the total number of accidents reported per year.

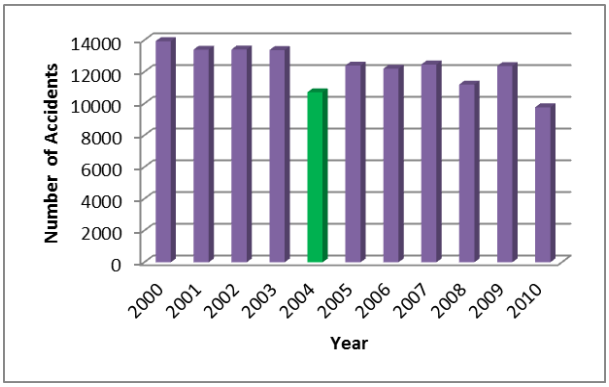
Poisson regression models are normally used for count data and have been a natural choice to model accident data in various research projects. The main underlying assumptions are that the observations are independent of each other and the mean and variance of the resulting distribution is equal. Challenges may however arise with overdispersed Poisson models rendering inference based on them questionable [1].

There exist various methods of accounting for overdispersion including but not limited to Pearson and Deviance scaling and models to account for heterogeneous probability of an event such as negative binomial models. In this report however, mathematical modelling was restricted to simple Poisson regression with no attempt at correcting for overdispersion [1]. Drivers and Motorcyclists, pedestrians, passengers, vehicle defects, road defects and other causes (such as natural causes, animals, unidentified causes etc.) were considered as the covariates of interest in fitting this model. Other causes included among others; animals, weather, obstructions, natural and unknown factors.

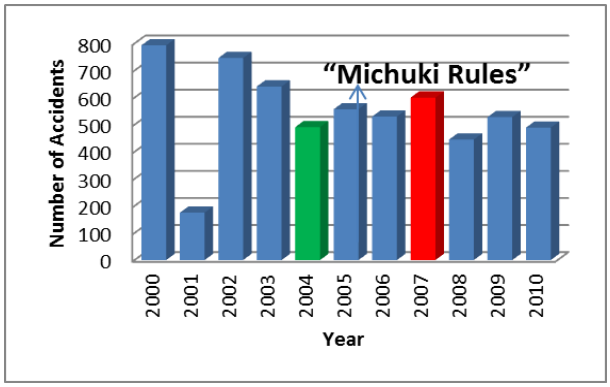
3 Results

The data was summarized using bar charts and tables where appropriate. The distribution of the total number of accidents in the years 2000-2010 is presented in figure 1(a).

While the number of reported accidents has been consistently high, the year 2004 and 2010 reported significantly lower number of accidents. The resulting distribution of accidents attributable to vehicle defects is presented in figure 1(b). There was a significantly lower accident rate due to defective vehicles in 2004, while more accidents resulted from defective vehicles in 2007.



(a) Distribution of the total number of accidents

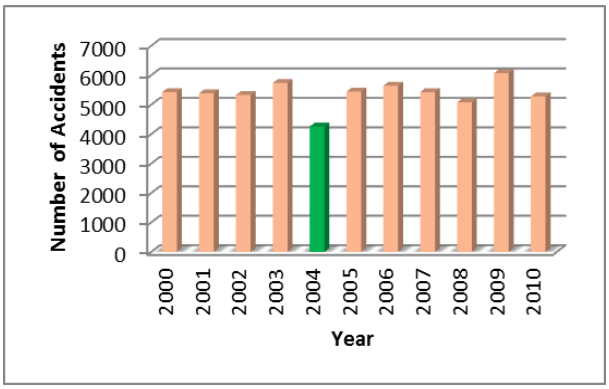


(b) Distribution of accidents caused by vehicle defects

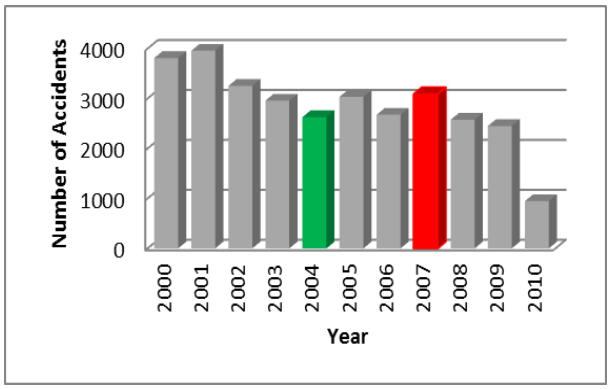
Figure 1: Bar charts depicting the distribution of road accidents: 2000-2010

Drivers and motorcyclists were consistently responsible for high number of accidents save for the year 2004 when interventions on road carnage majorly targeted reforming the public service vehicle drivers (Figure 2(a)).

Figure 2(b) presents the distribution of accidents caused by pedestrians in the 11 year period. A similar trend like before, where 2004 recorded a significant drop in number of accidents associated with the pedestrians and an increase in the year 2007. This can be attributed to the fact that more pedestrians were on the road attending campaign meetings in various parts of the country.



(a) Accidents caused by drivers and motor cyclists.



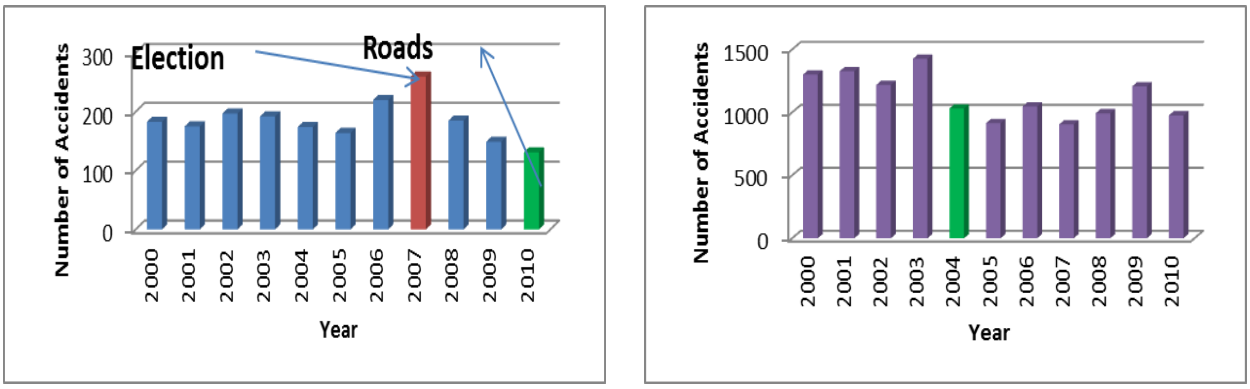
(b) Accidents attributable to pedestrians

Figure 2: Bar charts depicting the distribution of road accidents: 2000-2010

Defective roads on the other hand recorded quite lower accidents associated with them as is evident from figure 3(a), save for 2007. 2010 also recorded a significant drop in accidents due to defective roads, a fact that can be attributed to infrastructural expansion and improvement

in the country within this period.

Other causes of road accidents were responsible for accidents on a higher magnitude compared to defective roads and defective vehicles (Figure 3(b)).



(a) Accidents caused by drivers and motor cyclists.

(b) Road accidents attributable to other causes

Figure 3: Bar charts depicting the distribution of road accidents: 2000-2010

3.1 Statistical modelling: Poisson regression

The results of fitting a Poisson regression model to the data are presented in table 1. Only the p-values were reported. Drivers & motorcyclists, pedestrians, and vehicle defects significantly resulted in accidents while passengers and road defects did not significantly cause accidents. (Evaluation at 5% significance level)

Parameter	P-Value
Drivers & Motor cyclists	<.0001
Pedestrians	<.0001
Vehicle Defects	<.0001
Other Causes	<.0001
Passengers	0.2969
Road Defects	0.156

Table 1: Results for Poisson regression model fit.

4 Conclusions and limitations

It was observed that drivers and motorcyclists, pedestrians, and vehicle defects significantly resulted in accidents (P-value <0.0001 for each), while passengers (P-value 0.2969) and road defects (P-value 0.1560) did not significantly cause accidents. Passengers and pedestrians were however, amongst the major victims of road accidents and therefore reforms in the transport sector should as well target them.

Human error especially on the part of drivers and pedestrians is the leading accident cause in Kenyan roads. While drivers have been accused of careless driving, drunken driving, incompetence amongst others, pedestrians have been known to flout traffic rules by crossing the roads at

non-designated points, failure to use the laid out fly-over/underpasses foot bridges, blatant disrespect of the traffic lights among others. Passengers on the other hand, should ensure they have the safety belts on, inform the relevant authorities of over speeding /careless drivers and generally adhere to the traffic act by for instance not boarding un-roadworthy vehicles, overloaded vehicles or where the driver is clearly intoxicated.

Reforms in the transport sector should therefore target passengers and pedestrians as well, since they suffer more in case of accidents. Moreover, stringent law enforcement is necessary to get rid of un-roadworthy vehicles, reduce incidences of corruption and return sanity to the transport industry. Various reforms have been proposed in this respect including a review of The Traffic act with an aim of disbanding the traffic police department and charging all police arms with enforcement of the traffic laws, re-introduction of alcohol meters for drivers to curb drunk-driving, speed cameras to reduce human-human contact that breeds bribing on the roads amongst others.

All these interventions are informed by the fact that the health and well-being of the population can be improved greatly by human interventions geared at reducing road accidents.

4.1 Limitations of this analysis

- Covariates may not be independent.

  An accident may be caused by multiple factors. There is need therefore to assess the correlation between the covariates used in modelling, especially due to possibility for multicollinearity

- Overdispersion may be an issue hence future analysis should seek to correct for this aspect.

- There is need for better documentation of road accidents in Kenyan roads and dissemination of the information gained.

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