Road Safety Policy Formulation towards Road Traffic Accidents Risk Mitigation the Case of Zambia

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ABSTRACT

A study was conducted to determine the relationship between traffic laws enforcement as dependent variable and independent variables; latent and active failures such as over speeding, aggressive driving, poor road conditions, failure to put on seat belts, vehicle failures, distractive driving and insufficient safety campaign. In this case multiple linear regression model deployed with the sample size of 400. The results show that independent variables significantly correlate with the dependent variable. For instance, road conditions has a positive coefficient *(b=0.121, P<0.05)* implying that weak traffic law enforcement increases when road conditions worsens, proposing the need to upgrade the road infrastructure to improve on road users adherence to traffic laws consequently, safety. The implications of the predictive model suggest that safety culture improvement requires integration of safety in school curricular to create fertile grounds to traffic law enforcers in Zambia. The association between lack of safety campaign and weak traffic laws enforcement gives attention that the law enforcers must develop a deliberate safety education to the public so as to improve on traffic laws enforcement in Zambia. Additionally, the number of vehicles keeps on increasing prompting the use of latest technology to improve on monitoring and controlling of safety standards unlike highly dependence on traffic officers. Installation of safety monitoring system would great improve on enforcement of traffic laws. The multiple linear regression model proposes measures to address road traffic accidents in this study. The study argues for that mitigating road traffic accidents covers addressing latent and active failures. For instance, improve the status of the road infrastructure plays a key law in improving in enforcement of traffic laws. For safety or traffic laws to be in the minds of the public safety campaign must be conducted regularly.

Keywords: Multiple Linear Regression Model, correlation, measures, safety.

INTRODUCTION

Generally speaking, road traffic accidents accounts for 1.35 million fatalities per year worldwide. Road traffic accidents it is considered as one of the major causes of death in the world. It is estimated that 90 percent of the people in low and middle income countries have more deaths due to road traffic accidents regardless having a smaller share of motor vehicles owners. “According to the Zambian Annual Crash Statistics report, 2,163 individuals died in road traffic accident (RTA) in 2021 and the majority of fatalities were among pedestrians and cyclists”. (https://www.undp.org/sites/g/files/zskgke326/files/2023-12). The road traffic accidents have caused economic distress as vehicles get damaged and loss of life. The sensitivity of the adverse impact of traffic accidents it is significant for the country to formulate accurate policies and effective implementation. The motivation of the researcher to propose the possible policies to mitigate the road traffic accidents risks if put into practice will significantly contribute to the reduction of the road traffic accidents in the case of Zambia. The resent study shows that road traffic accidents are the major contributing sources of deaths in the world which requires serious attention especially low and middle income countries like Zambia(Nyangi & Waria, 2025).

The researchers have investigated the major causes of road traffic accidents such as lack of personal safety awareness, lack of proper training and mechanical failure. In addition, driving over the speed limits and inadequate safety management system are among the causes of road traffic accidents(S. Zhang et al., 2025). Furthermore, over speeding is taken as a common cause of the road accidents (Acosta-González et al., 2025). However, average speed is associated with accidents as drivers tend to be less attentive when driving than when

the speed is very high, and most the roads. In order to mitigate road traffic accidents road users must comply with the traffic rules and regulations. The issue of over speeding and unsafe behavior as causes of accidents is commonly in developing countries(Yahia et al., 2024). Additionally, speeding is seen as the major cause of accidents according to the public opinion(Alkaabi, 2023a). The other contributing factor is the driving skill for the drivers, and this becomes critical when behavior or skill levels for drivers are taken as a major risk factors. Both driving skills and driving style contribute to the crash risks(Alkaabi, 2023b).

It has been proposed by researchers that having a segregated lanes can help in preventing accidents e.g. e-bike riders mainly use motorized lanes which poses a danger on the smooth running of e-bikes and other road users(Zhou et al., 2024). Therefore, scholars proposes that installation of speed cameras, increasing fine for offenders can mitigate accidents related to over speeding (Abdulrahman et al., 2025a). However, some scholars oppose that travel speed may not be a serious factor especially in less populated areas as the root cause of accidents(Yamada et al., 2025). While there is a common ground that road traffic accidents are caused by three factors namely; human factors, external factors and vehicle failure(Soehodho, 2017). The results revealed that negligence, reckless and insufficient traffic laws enforcement due to excessive speed causes fatal accidents (Aati et al., 2024a). . Bus drivers cannot therefore obey and have regard to traffic regulations in the circumstance were doing so directly affect their social economic needs and expectations. They usually tradeoff between obeying traffic regulations and make adequate cash so as to enable them meet there daily cashing with an expected surplus for their daily need(Mwamba et al., p. 8).

The model in this study shows a vital insight to mitigate road traffic accidents in the case of Zambia. The association between over speeding and weak traffic laws enforcement shows a positive relationship with the implication that drivers tend to over speed due to the weakness in the traffic laws implementation. In other words over speeding is the reflection of weakness of traffic laws enforcement. However, this can be solved through implementation of policies to aid traffic law enforcement. Additionally, sufficient traffic law enforcement can also solve the issue of aggressive driving. The current situation of solely depending on traffic officers is insufficient instead technology mast be deployed to monitor active failures. The study proposes the need to upgrade road infrastructure to prioritize safety in order to reduce latent failures. The conditions of the roads determine the safety of the road users. The study reviews that the poor conditions of the road infrastructure is associated with weak traffic laws enforcement. For the safety agencies to mitigate road traffic accidents safety must be integrated into school curricula to enhance safety culture in Zambia.

METHODOLOGY

The introduction of the methodology includes the data collection tools, data analysis tools, methods, the study population and sample size, and the research philosophy.

The research design is grounded by the positivism philosophy approach that emphasizes the application of quantitative methods and empirical data to comprehend the world (Apuke, 2017) and (Ghanad, 2023). Additionally, the philosophy establishes an ontological position i.e. reality can be measured in a single way (Park et al., 2019, p. 3). Furthermore, the nature of knowledge is obtained through empirical verification and measurement free from researchers influence.

In this case, the quantitative approach is used to attain the objectives of the research and generalize the findings. The multiple linear regression analysis in SPSSVS 23 will examine the relationship between independent variables and dependent variable.

Data collection

The primary data was collected through the structured survey questionnaire given to road users using a scale of 1 to 5 from strongly disagree to strongly agree. In order to determine the sample size the Monte Carlo approach was used, a sufficient study must at least meet the rule $N \geq 100$ (Constantin et al., 2023). In this regard, the study covers the population of 3000000 elements, sample size 400 with a confidence interval level of 95% and a significance level of 5 %. The sample size was determined using an online sample size calculator. Additionally, the sample size is supported by Yamen formula (1967).

The secondary data collected from existing documents about the road traffic accidents e.g. RATSA website, books, newspapers and relevant literature.

Reliability test

In order to determine the reliability and internal consistency of the scale, the Cronbach's Alpha (α) is applied indicating how closely related a set of items are as a group. In this case the value between 0 and 1. The interpretation is that if the factor is ≥ 0.70 is treated as acceptable (good consistency) and < 0.70: Not consistent recommended for removal. The reliability test results show that the Cronbach's Alpha ratio is 0.969 for all the ten items.

RESULTS

Table 1. Reliability Test

Reliability Statistics	
Cronbach's Alpha	N of Items
.969	10

Table 2. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.965[a]	.931	.929	.338
a. Predictors: (Constant), Safety Campaign, Impaired, Fatigue, Aggressive, Road condition, Vehicle failure, Speed, Seat belts, Distractive				
b. Dependent Variable: Law enforcement				

The multiple linear regression model explains that the multiple correlations are positive strong between dependent (Law enforcement) and independent variables in the model *(R = 0.965).* According to the coefficient of determination (*R 2 = 0.931*) implying the independent variables explain *93.1%* of the variability of the dependent variable. Additionally, *R 2* and adjusted *R 2 =0.929* values are very close (adjusted *R 2* decreased by only *0.002* points), the multiple regression model in this study has a strong explanatory power of the dependent variable. Furthermore, P-value *(P<0.05)* of the F-ratio *(F =584.329, p<0.05*) indicate that the results of the multiple regression model could not have occurred by chance and that the combination of independent variables significantly predicted the dependent variable.

The multiple linear regression model below presents the significance values of the model between the independent variables and dependent variable to determine the predictability of the independent variables.

Table 3. Multiple Regression Model

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.950	.336		-8.784	.000
	Speed	.487	.088	.327	5.502	.000

	Distractive	-.526	.130	-.320	-4.044	.000
	Aggressive	.694	.077	.250	9.019	.000
	Impaired	.029	.059	.017	.482	.630
	Seat belts	.172	.052	.161	3.308	.001
	Fatigue	.051	.115	.022	.443	.658
	Road condition	.132	.036	.121	3.652	.000
	Vehicle failure	.151	.048	.112	3.140	.002
	Safety Campaign	.407	.050	.334	8.152	.000
a. Dependent Variable: Law enforcement						

The outcome of the regression analysis shows that the independent variable (speed) has a statistically significant positive relationship with the dependent variable (Law enforcement) as denoted by beta coefficient *(b=0.327, P<0.05),* the independent variable (Distractive driving) has a significant inverse relationship with the dependent variable as indicated by the coefficient*(b=-0.320, P<0.05),* the independent variable (Aggressive driving) has a significant positive relationship with the dependent variable as indicated by the coefficient*(b=0.250, P<0.05),* the independent variable (Impaired driving) has a non-significant positive relationship with the dependent variable with the beta coefficient *(b= 0.17, P>0.05),* the independent variable(Seatbelts) has a positive significant relationship with the dependent variable with the coefficient*(b= 0.161, P<0.05*), the independent variable (Fatigue) has a non-significant positive relationship with the dependent variable with the coefficient*(b=0.022, P>0.05),* the independent variable (Road condition) has a statistically significant positive relationship with the dependent variable *(b= 0.121, P<0.05),* the independent variable (Vehicle failure) has a positive significant relationship with the dependent variable *(b=0.112, P<0.05).* Lastly, the independent variable (Safety campaign) has a positive relationship with the dependent variable (*b= 0.334, P<0.05).*

Objective 1: To determine causes of road traffic accidents in Zambia

1) The implication of the results between over speeding predicts weak traffic law enforcement which leads to accidents.

2) The regression results between distractive driving characterized by use of mobile phones, eating or adjusting the radio while driving impairing attention on the road can be reduced by sufficient traffic law enforcement in order to reduce accidents.

3) The correlation between aggressive driving (unsafe change of lane and other unsafe behavior) and weak traffic law enforcement indicates that aggressive driving tends to increase which is the reflection of weak traffic law enforcement in the case of Zambia. Failure to put on safety seat belts implies the increase of weak traffic law enforcement.

4) The interaction between road condition defined by potholes, poorly maintained surface and cracks and weak traffic law enforcement predicts that when the road condition worsens the weak traffic law enforcement increases.

5) Additionally, vehicle failure (faulty brakes, tires, malfunctioning of vehicle parts) has a positive relationship with weak traffic law enforcement indicating that vehicle failure predicts weak law enforcement.

6) Lastly, the association between insufficient safety campaign and weak traffic law enforcement postulate that weak traffic law enforcement increases when safety campaigns decreases in the case of Zambia

Objective 2: To establish policies to mitigate road traffic accidents in Zambia

1) Upgrade of road infrastructure to promote safety for road users.

2) Integrate road safety education into school curricula to enhance a safety culture from a young age.

3) Implementing interval speed measuring devices and electronic cameras in order to control and monitor speed timely.

4) Develop public safety awareness and education to ensure that the public is well informed of the traffic laws governing road safety.

Objective 3: To develop a mathematical regression model for road traffic accident mitigation in Zambia.

$Y_1 = -2.950 + 0.327_{x1} - -0.320_{x2} + 0.250_{x3} + 0.161_{x4} + 0.121_{x5} + 0.112_{x6} + 0.334_{x7} + e$

Where; x_1 (Over speeding), x_2 (Distractive driving), x_3 (Aggressive driving), x_4 (Seat belts), x_5 (Road condition), x_6 (Vehicle failure), x_7 (Safety campaign), e (error term)

CONCLUSION

The regression model of the study gives a significant insight regarding the relationship between the independent variables and dependent variable. The outcome of the study reviews that the prevailing safety culture reflects weak traffic law enforcement in Zambia. The other contributing factor is the condition of the roads which induce the drivers to disobey traffic laws. Hence, calling for policy makers to address the issue of improving the safety of roads and reduce the discrepancies between traffic laws and the current status of the roads in Zambia. The outcome of the regression model entails that the safety culture is less sensitive to safety. The process of transforming the culture will promote the economic value of safety in Zambia. The model results show that accidents are caused by latent failure and active failure which the law enforcers must take a balanced view to mitigate road traffic accidents in Zambia.

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