

Unearthing the Contribution of Driver Fatigue to the High Rate of Road Accidents in Zimbabwe: A Critical Analysis

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Abstract— This study sought to investigate the contribution of driver fatigue to the rate of road accidents in Zimbabwe. The attribution of human error to 90% of fatal road accidents motivated the researchers to seek to establish the relationship between driver fatigue and the chances of it contributing to high rate of fatal road accidents which are a major disruption of the supply chain. The Theory of Planned Behaviour (TPB) was used as the anchorage theory for the study while the Theory of Reasoned Action (TRA) was the supporting theory. A Critical Realism philosophy was adopted supported by a cross-sectional design and quantitative approach. A sample of 162 participants was drawn out of a target population of 250 using random sampling from which a response rate of 63% was achieved. Data collection was done using a structured questionnaire; whilst data analysis was done using the Statistical Package for Social Sciences (SPSS) Version 22. The major finding from the study was that driver fatigue significantly contributes to the chances of drivers being involved in fatal road accidents. However, in Zimbabwe this area has been to a greater extent ignored in previous research with more attention having been directed to human error which constitutes 97% of causes of road accidents. The conclusion drawn from this study is that while Zimbabwe's statistics give little attention to fatigue, it might be the underlying factor of human error as reflected by meta-data from international studies. This paper contributes new insights into the need for further rigorous studies in Zimbabwe on the actual contribution of driver fatigue to fatal road accidents making use of modern technologies such as artificial intelligence (AI) and new driving technologies.

Keywords— driver fatigue, detection, prevention, technology

1. Introduction

Road traffic accidents are a major cause of injury and death worldwide [1][2]. In Zimbabwe, the situation has been exacerbated by various factors, including vehicle conditions, road infrastructure, and driver behavior [3][4][5]. Of particular concern is driver fatigue, which impairs alertness and reaction times, contributing significantly to road crashes [6][7]. Despite its impact, the issue of driver fatigue has received limited attention in local research and policy discussions. This paper aims to fill that gap by examining the causes, consequences, and potential solutions for driver fatigue-related road accidents in Zimbabwe.

Fatigue falls under active and passive fatigue. Whilst active fatigue is related to deprivation of sleep and physical exertion, passive fatigue, on the other hand, develops over time when there appears to be little or no interesting stimulation [8]. Unfortunately, drivers do not view it as a hazardous condition and often do not realize how sleepy or fatigued they are [9]. Zimbabwe operates in a globally competitive environment which demands competing with a 'business as normal' approach though local transport and logistics companies operate under constrained conditions. In that view, business owners set targets for the drivers

benchmarking with regional and global industry targets which ultimately become unrealistic given the driving conditions prevailing in the Zimbabwe context. As at 2024, the vehicle population of Zimbabwe stood at 827 000 licensed vehicles [10]. This growing vehicle population on Zimbabwean roads increases congestion levels and reduces the average speed of drivers. The downside of the changes in traffic conditions is that these extend the time which drivers spend on the roads leading to high driver fatigue levels.

Referral made in [11] highlights that of the total estimated 84,000 km of Zimbabwe's road network, equivalent to 93% of the network was in fair or poor condition as at 2020; and required either rehabilitation or periodic maintenance. A conversion of 93% to actual kilometers translates to 78 120km of fair to poor road condition. Since the drivers' work stations are the roads, this means that the poor road infrastructure condition physically and mentally strain them, leading to fatigue. The NDS 1 target to increase the number of kilometres of road network converted to meet Southern Africa Transport and Communications Commission (SATCC) standards from 5% to 10% by 2025 was to increase the number of kilometres of road network in good condition from 14 702km to 24 500km. Although the recent statistics of the state of the road infrastructure network are yet to be reported, based on [11], target factors such as potholes, rough surfaces and constant changes in road elevation still remain a serious cause of increased physical and mental strain, leading to driver fatigue.

2. Literature Review

The consequences of fatigued driving can be severe, as it diminishes a driver's alertness, slows reaction times, and hampers decision-making abilities.

Theory of Reasoned Action (TRA)

Developed by Ajzen and Fishbein in 1980, the Theory of Reasoned Action (TRA) proposes that individual behaviour is driven by behavioural intentions where behavioural intentions are a function of an individual's attitude toward the behaviour and subjective norms surrounding the performance of the behaviour [12]. It suggests that a person's behaviour, in this case a driver, is determined by an individual's intention to perform

the behaviour and that this intention is, in turn, a function of their attitude toward the behaviour and their subjective norm. Attitude toward the behaviour entails the individual's positive or negative feelings about performing a behaviour. Using the TRA, a driver's beliefs and understanding of the consequences arising from driving under fatigue makes them evaluate and desire a certain outcome that is safe and less risky.

Theory of Planned Behavior (TPB)

The Theory of Planned Behaviour (TPB) seeks to predict the deliberate behaviour based on the belief that behaviour can be deliberative and planned [13]. The TPB was propounded by Ajzen in 1988, and it proposes that intention is the predictor of a person's behaviour is. It is the cognitive representation of a person's readiness to perform a given behaviour, is considered to be the immediate precursor of an individual's behaviour [14]. This intention is determined by three things, namely: an individual's attitude toward a specific behaviour, subjective norms, and perceived behavioural control. The theory of planned behaviour holds that only specific attitudes toward the behaviour in question can be expected to predict that behaviour [15][16].

Common causes of driver fatigue

Some of the common causes of driver fatigue include: inadequate sleep, long hours spent on work task, use of specific medications that induce drowsiness, high stress levels, lack of exercise, poor diet, and environmental factors such as trip duration, time of day, and roadway/weather conditions can impact fatigue [17][18]. Although the degree to which each factor contributes to driver fatigue vary, it must be noted that one, or a combination of two or more can still carry life-threatening magnitude in relation to causing driver fatigue [19].

As referred in [20], it is believed that a high number of serious crashes may be due to fatigued driving. Shocking statistics [21] reveal that 52.3% of commercial drivers in South Korea experienced drowsy driving, while a further 9.6% experienced fatigue-related crashes. Some of the internal factors attributed to driver fatigue include: attitude, personality, motivation and risk perception. In some instances, perception of symptoms of sleepiness as trivial and a strong motivation to reach one's destination are the other reasons that

result in driver fatigue. The recommendation given was for an investigation on a deeper understanding of why drivers decide to continue driving while fatigued to allow for the implementation of fatigue management measures among drivers.

Detecting the factors affecting drivers' safe driving and taking early warning measures is critical in effectively reducing road crashes [21]. The study reviewed intelligent detection methods for driver fatigue and distraction detection for a 5-year period. It went further to incorporate machine vision detection based on facial features for the same period, making a comparison of the two methods' innovation points. The findings concluded that advanced fatigue detection technologies significantly improved the accuracy of checking on the driver's alertness and fatigue levels during driving [22][23].

Lack of rest stops was found as a major contributor to driver fatigue in Nigeria [24]. Employing the mixed methods to research, the study drew a comparison with guidelines from the National Highway Traffic Safety Administration (NHTSA) in the United States, which recommends that drivers take a break every two hours to prevent fatigue. However, the survey results showed that the respondents often drive for an average of 6 hours and 12 minutes without a break, leading to severe fatigue, which causes lots of dangerous driving conditions. The study also revealed a negative perception among respondents towards the existing rest stops in Nigeria, indicating that these facilities do not meet their needs adequately. To address the issue of fatigue-related traffic accidents, the research proposed a comprehensive strategy that includes education on the dangers of driver fatigue, governmental interventions to improve road conditions, technological advancements to monitor driver fatigue, and organizational activities to enforce safety measures.

STATEMENT OF THE PROBLEM

High rate of road accidents remain a persistent challenge that the government of Zimbabwe is battling with as shown in Table 1 [25]. This is a major disruption to logistics which forms the backbone of the supply chain thus significantly affecting economic activities [26]. Over 90% of road crashes in Zimbabwe are attributed to human error as shown in Table 2 [27]. Human error is attributed to poor judgment leading to wrong or

poor decision making that result in road crashes. Fatigue, which relate to exhaustion and low energy levels while driving, is one of the conditions that is attributed to driving crashes due to human error. While road traffic rules have focused on issues that include: the roadworthiness of the vehicle, correctness of loading, speed limits, and detecting drunken driving, it is unfortunate that no systems are in place yet to track and check on the condition of drivers on the road in terms of their levels of fatigue. The logistics and transport company owners are concerned more with pursuit of profits by setting targets on delivery times though this sometimes comes at the safety of the driver and other road users. It is against this background that this paper aims to fill this identified gap by examining the causes, consequences, and potential solutions to driver fatigue-related road accidents in Zimbabwe.

Table 1: Zimbabwe Republic Police Press Statement on 2024/25 Festive Season Road Accidents

Incident	15 December 2023 to January 2024	15 December 2024 to January 2025	% Change
Total Road Traffic Accidents	3 607	2936	23
Number of Fatal Accidents	118	133	(13)
Number of People Killed	162	155	6
Number of People Injured	821	938	(14)

[25] Zimbabwe Republic Police (2025)

Table 2: Causes of Major Fatal Accidents in Zimbabwe

Main Cause		Frequency	Percentage	Cumulative Percentage
Inattention/Misjudgment	Inconsiderate maneuvering of the vehicle	22 166	42.25	42.25
Following too close		7 797	14.86	57.11
Speeding		7 146	13.62	70.73
Reversing error		4 067	7.75	78.48
Failure to give way		4 369	8.33	86.80
Overtaking error		2 667	5.08	91.89
Turning error		2 169	4.13	96.02
Parking error		547	1.04	97.06
Animal		765	1.46	98.52

Negligent pedestrian	142	0.27	98.79
Vehicle defect	299	0.57	99.36
Other	203	0.39	99.75
Fatigue or illness	132	0.25	100.00
TOTAL	52 469	100.00	

[27] Traffic Safety Council of Zimbabwe (2025)

I. RESEARCH OBJECTIVES

The following research objectives were formulated for this study;

- How does driver fatigue contribute to high rate of road accidents?
- What are the causes of driver fatigue?
- What is the relationship that exists between driver fatigue and the rate of road accidents?
- What measures can be taken to reduce driver fatigue on Zimbabwean roads?

3. Research Methodology

A Critical Realism philosophy was adopted to allow for the in-depth analysis of the contribution of driver fatigue to the high rate of driver accidents [28]. A cross-sectional design was adopted whilst the quantitative approach was used in randomly selecting a sample of 152 participants out of target population 250 that was made up of transport owners, drivers, academics and researchers who made up the Chartered Institute of Logistics and Transport (CILT) Zimbabwe membership [29][30]. The Raosoft minimum sample size determination calculator (2025) [31] was used to calculate the minimum sample size that could be used for the study. A structured questionnaire was administered using a Google Forms and data was analysed using the Statistical Package for Social Sciences (SPSS) Version 22 [32][33][34].

4. Results and Discussion

A response rate of 63.2% was achieved after administering 152 questionnaires which is above 44.1% and acceptable for online surveys [35]. Table 3 presents the demographic profile of the respondents. The majority of participants were female (67.7%), while males accounted for 32.3%. In terms of age, most respondents fell within the 36–45 years category (68.8%), indicating that the sample consisted predominantly of mid-career professionals. Education-wise, more than half

(52.1%) held a diploma, while 40.6% possessed a degree, confirming that the study engaged a well-educated group. Regarding vehicle class, private light vehicle drivers dominated (80.2%), whereas heavy commercial and public passenger drivers were very few (7.3% and 1.0% respectively). Driving experience was relatively balanced, with most respondents having 11–15 years (31.3%) or more than 20 years (22.9%) of driving. These demographics suggest that the sample had adequate diversity, but with stronger representation from educated, mid-aged private vehicle drivers.

Table 3: Demographic descriptive results of respondents.

Variable	Class	Frequency	Percent
Gender	Male	76	79.2
	Female	20	20.8
Age of respondents	Less than 25 years	4	4.2
	26-35 years	22	22.9
	36-45 years	66	68.8
	56-70 years	4	4.2
Highest educational qualification	High school	4	4.2
	Certificate	3	3.1
	Diploma	50	52.1
Class of vehicle driven	Degree	39	40.6
	Private light vehicle	77	80.2
	Commercial light vehicle	11	11.5
	Heavy vehicle (commercial)	7	7.3
Driving experience	Public passenger vehicle	1	1.0
	Less than 5 year	22	22.9
	6-10 years	13	13.5
	11-15 years	30	31.3
	16-20 Years	9	9.4
	More than 20 years	22	22.9

Source: Primary data (2025)

Measures

In the latent variables as shown in Table 4 below, driver fatigue was derived from the Traffic Safety Council of Zimbabwe (TSCZ, 2025)'s statistics which attributed 90% of road accidents to human error. The measure of driver fatigue was assumed to manifest in the form of high accident rates caused by human error from poor judgement which could be as a result of low concentration levels while driving. The other latent variable, Road Accidents, becomes an outcome of the latter and is measured by the recorded evidence of one having lost control of the vehicle leading to a crash/accident.

Table 4: Reliability measures – factor loadings

Construct	Measured variable	Codes	Driver fatigue	Road accidents
Driver fatigue	Exhausted driver	DRF1	-.003	.677
	Dosed-off	DRF2	.772	-.123
	Lapse in concentration	DRF3	.581	.084
	Driven under fatigue	DRF4	.750	.129
	Fallen asleep	DRF5	.836	-.072
	Driving long hours	DRF6	.791	.005
Road accidents	Near-miss	ROA1	.117	.623
	Drift out	ROA2	.182	.552
	Reaction to hazard	ROA3	-.250	.753
	Traffic errors/violations	ROA4	-.076	.598
	Crash or minor collision	ROA5	.133	.636

Source: Primary Data (2025)

The factor loadings for the latent constructs (Driver Fatigue and Road Accidents) show varying degrees of reliability. Within Driver Fatigue, strong indicators included “Fallen asleep” (loading = .836), “Driving long hours” (.791), and “Dosed-off” (.772), confirming that these items reliably captured the construct. Conversely, “Exhausted driver” had a very weak loading (-.003), raising concerns about its validity as a measurement item. For Road Accidents, indicators such as “Reaction to hazard” (.753) and “Crash/minor collision” (.636) were strong predictors, while “Drift out” (.552) and “Traffic violations” (.598) showed moderate loadings. The pattern suggests that fatigue-related variables strongly align with unintentional lapses (sleeping, long hours), while accident outcomes are more consistently tied to hazard responses and collisions.

Table 5: Mean, Std. Deviation, Cronbach alpha, and Correlation coefficient

Construct	Mean	Std. Dev.	Cronbach alpha	Correlation coefficient	
				Driver fatigue	Road accidents
Measures	4.37	0.38	.826		
Causes of driver fatigue	4.17	0.42	.709		
Driver fatigue	3.33	0.907	.806	1.000	
Road accidents	4.49	0.441	.649	.488	1.000

Source: Primary Data (2025)

This Table 5 above reveals internal consistency and relationships among constructs. The Cronbach alpha values (.826 for measures, .806 for fatigue, .649 for accidents) indicate acceptable reliability, though the road accidents construct was slightly weaker. Descriptive statistics suggest that road accidents (M = 4.49, SD = 0.44) were perceived as more prevalent than driver fatigue (M = 3.33, SD = 0.91). Importantly, the correlation coefficient between fatigue and accidents was $r = .488$, significant and moderately strong, supporting the hypothesis that fatigue contributes to accident likelihood.

Table 6: An excerpt of Pearson correlation result -Driver fatigue indicators

	DRF1	DRF2	DRF3	DRF4	DRF5	DRF6
DRF1	1					
DRF2	.337**	1				
DRF3	.880**	.266**	1			
DRF4	.364**	.563**	.333**	1		
DRF5	.394**	.562**	.444**	.471**	1	
DRF6	.285**	.399**	.365**	.608**	.562**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Primary Data (2025)

As displayed in Table 6 above, significant positive correlations were observed among most fatigue indicators. For instance, “Lapse in concentration” (DRF3) strongly correlated with “Exhausted driver” ($r = .880$, $p < .01$), while “Fallen asleep” (DRF5) correlated with both “Dosed-off” ($r = .562$) and “Driving long hours” ($r = .471$). These interrelations confirm that fatigue manifests in interconnected ways—drivers who feel exhausted are more prone to concentration lapses, drowsiness, and extended hours of risky driving. The pattern validates the multidimensionality of fatigue.

Table 7: An excerpt of Pearson correlation result - Road accidents indicators

	ROA1	ROA2	ROA3	ROA4	ROA5
ROA1	1				
ROA2	.374**	1			
ROA3	.242*	.384**	1		
ROA4	.236*	.180	.408**	1	
ROA5	.373**	.250*	.231*	.293**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Primary Data (2025)

The accident indicators as shown in Table 7 also exhibited significant interrelations. “Near-miss” correlated with “Crash/minor collision” ($r = .373$, $p < .01$), while “Reaction to hazard” correlated with both “Traffic violations” ($r = .408$, $p < .01$) and “Drift out” ($r = .384$, $p < .01$). This indicates that accidents are not isolated events but cluster around behavioural patterns such as drifting, hazard misjudgements, and violations. The correlations strengthen the construct validity of “road accidents” as a latent variable.

Table 8: The causes of driver fatigue

Indicator variable	Percentage						Descriptive statistics
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	N	Mean Std. Deviation
Medications	1.0	2.1	-	36.5	60.4	96	2.96 1.239
Health conditions	2.1	18.7	2.1	49.0	28.1	96	3.20 1.175
Driving for long hours	1.0	5.2	1.0	41.8	51.0	96	3.82 1.105
Time of driving	3.1	2.1	-	46.9	47.9	96	4.21 .939
Driver incentives	5.2	32.3	12.5	37.5	12.5	96	4.33 .777
Stress concentration	8.3	42.7	4.2	34.4	10.4	96	4.34 .856
Road conditions	-	5.2	3.1	36.5	55.2	96	4.36 .835
Employers targets	-	5.2	3.1	44.8	46.9	96	4.42 .790
Human error	-	-	-	25.0	75.0	96	4.53 .710
Sleeping conditions	-	2.1	-	40.6	57.3	96	4.53 .615
Congested roads	2.1	5.2	7.3	40.6	44.8	96	4.60 .533
Inadequate sleep	-	-	2.1	35.4	62.5	96	4.75 .435

Source: Primary Data (2025)

Respondents overwhelmingly attributed fatigue to lifestyle and working conditions (Table 8). The highest-rated causes included inadequate sleep ($M = 4.75$), congested roads ($M = 4.60$), and poor sleeping conditions ($M = 4.53$). Conversely, medications ($M = 2.96$) and health conditions ($M = 3.20$) were seen as less influential. This highlights that fatigue is largely environmental and situational rather than medical. Stress concentration ($M = 4.34$) and employer targets ($M = 4.42$) further emphasize organizational pressures as significant

contributors. Overall, the data point to modifiable external factors as key drivers of fatigue.

II. THE RELATIONSHIP THAT EXISTS BETWEEN DRIVER FATIGUE AND THE RATE OF ROAD ACCIDENTS

This section presents hypotheses test results;

III. HYPOTHESIS TESTING

H₀: Driver fatigue has no contribution to the high rate of road accidents in Zimbabwe.

H₁: Driver fatigue significantly contributes to the high rate of road accidents in Zimbabwe.

Table 9: Model Summary for driver fatigue on road accidents

Model Summary ^b				
Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.289 ^a	.084	.074	2.12102

a. Predictors: (Constant), Driver fatigue

b. Dependent Variable: Road accidents

Table 10: ANOVA

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.608	1	38.608	8.582	.004 ^b
	Residual	422.881	94	4.499		
	Total	461.490	95			

a. Dependent Variable: Road accidents

b. Predictors: (Constant), Driver fatigue

Source: Primary Data (2025)

Table 11: Bootstrap for Coefficients

Bootstrap for Coefficients							
Model	B	Bootstrap ^a			95% Interval (2- Lower	Confidence	
		Bias	Std. Error	Sig. tailed)		Upper	
1 (Constant)	20.086	-.027	.886	.000	18.213	21.742	
Driver fatigue	.141	.001	.047	.005	.050	.237	

a. Unless otherwise noted, bootstrap results are based on 2000 bootstrap samples

Source: Primary Data (2025)

The regression model (Table 9) showed a modest but significant relationship between fatigue and accidents ($R^2 = .084$, $F = 8.582$, $p = .004$), meaning fatigue explains about 8.4% of accident variability. Though the explanatory power is limited, the relationship is statistically significant.

Table 10 (ANOVA) confirms the model's significance, while Table 11 (Bootstrap Coefficients) strengthens the reliability of the findings, showing a stable positive coefficient for fatigue ($B = .141$, 95% CI = .050–.237, $p = .005$). Residual statistics indicated no serious bias or error distortions. Collectively, these findings confirm that driver fatigue significantly predicts accidents, though other external variables likely play a larger role.

IV. THE MEASURES CAN BE TAKEN TO REDUCE THE CONTRIBUTION OF DRIVER FATIGUE TO THE HIGH RATE OF ROAD ACCIDENTS IN ZIMBABWEAN ROADS

Table 12: The measures can be taken to reduce the contribution of driver fatigue

Indicator variable	Percentage					Descriptive statistics	
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	N	Mean
							Std. Deviation
Psychological techniques	-	1.0	19.80	60.4	18.8	96	3.97
Road infrastructure	1.0	5.2	3.1	50.0	40.7	96	4.24
Benchmarking safety standards	0.0	1.0	4.2	46.9	47.9	96	4.42
Continuous research	0.0	0.0	4.20	38.5	57.3	96	4.49
Review of driving targets	0.0	2.1	5.2	49.0	43.7	96	4.34

Awareness campaigns	1.0	1.0	3.1	38.5	56.4	96	4.48
stakeholder engagement	-	0.0	2.1	40.6	57.3	96	4.55
policy reviews	-	0.0	2.1	55.2	42.7	96	4.41
Research and development	-	-	4.20	57.3	38.5	96	4.34
Technological advancements	-	1.0	7.30	52.1	39.6	96	4.30
Thorough investigations	0.0	1.0	4.2	37.5	57.3	96	4.51
Collaboration	1.00	1.00	2.1	46.9	49	96	4.42

Source: Primary Data (2025)

In Table 12 above, respondents strongly endorsed preventive measures. The highest-rated strategies included stakeholder engagement ($M = 4.55$), thorough investigations ($M = 4.51$), and awareness campaigns ($M = 4.48$). Continuous research ($M = 4.49$) and benchmarking safety standards ($M = 4.42$) were also well supported. Interestingly, psychological techniques ($M = 3.97$) received the lowest endorsement, suggesting scepticism about their practicality. The findings imply that respondents prefer structural and policy-driven interventions—such as infrastructure, collaboration, and regulation—over individual behavioral approaches. This aligns with the earlier identified causes of fatigue, which were mostly organizational and systemic.

5. Conclusion

The conclusion drawn from the findings is that driver fatigue significantly predicts accidents, though other external variables likely play a larger role. It is observed that statistics collected by road safety and law enforcement authorities reflect the factual causes of road accidents. However, data collected in this study goes deeper to unravel the fact that fatigue is an underlying factor that ultimately causes human error that manifests as wrong/poor judgment, overtaking errors and many others. It is also concluded that loss of concentration on the road can be a result of driver fatigue hence the need for more research to help detect it before it causes fata road accidents. Finding a lasting solution to driver fatigue has potential of improving the logistics component of supply chain ultimately improving supply chain performance. Future researchers are recommended to incorporate artificial intelligence (AI) and advanced driving technologies in their studies with the goal of further establishing the contribution of driver fatigue to the rate of road accidents in other geographic contexts other than Zimbabwe [36].

This paper contributes new insights into the need for further rigorous studies in Zimbabwe on the actual contribution of driver fatigue to fatal road accidents linked to human error that constitute about 97% making use of modern technologies such as artificial intelligence (AI) and new driving technologies [37][38].

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