Research Article

Behaviours of Drivers on Zambian Roads: A Cross Sectional Study

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Abstract

Objectives: The main objective of this paper is to document drivers' behaviours most prevalent in Zambia in order to inform the development and implementation of road safety interventions to deal with those behaviours.

Methods: A driver behavior survey adapted from the Manchester driver behavior survey was used to interview 879 motor vehicle drivers. Actual driver behavior was documented through direct observations at strategic points.

Results: Of the 879 drivers interviewed, 29.4% said they disregarded speed limit on a motor way, and 37.0% used a mobile phone while driving., 37.7% of the drivers said they underestimated the speed of an oncoming vehicle when overtaking and about a third (29.2%) of the drivers said they attempted to overtake someone they had not noticed to be signaling right turn. The most commonly observed potentially risky behaviours were: not wearing seat belts (45.5% among drivers and 61.1% among front seat passengers respectively), not stopping at pedestrians crossing while pedestrians were waiting to cross (44.5%), not dimming lights to on-coming traffic (29.1%), and overtaking another motor vehicle on solid lines (28.8%).

Conclusion: This study has demonstrated that adverse driver behaviour is prevalent in Zambia, implying the need to focus more on strategies that impact on modifying driver behaviours.

Keywords: Road traffic accidents; Road traffic crashes; Driver behaviour; Zambia

Abbreviations

AIDS: Acquired Immunodeficiency Syndrome; BAC: Blood Alcohol Concentration; CGHD: Centre for Global Health and Development; DBQ: Driver Behaviour Questionnaire; HIV: Human Immunodeficiency Virus; MOH: Ministry of Health; RTC: Road Traffic Crashes; RTSA: Road Traffic and Safety Agency; SUV: Sport Utility Vehicle; WHO: World Health Organization; ZCAHRD: Zambian Centre for Applied Health Research and Development

Introduction

Road Traffic Crashes (RTCs) and fatalities arising from these crushes continue to pose a global public health challenge. The World Health Organization (WHO) records that each year 1.3 million people die as a result of RTCs, translating into 3000 deaths per day or 125 deaths every hour. Ninety percent of these deaths occur in Low and Middle Income Countries (LMICs) [1]. Africa has some of the highest rates of road traffic deaths globally with a rate of 32 deaths per hundred thousand people annually. Zambia continues to experience a very high rate of road traffic crashes, ranked as the third leading cause of death after HIV/AIDS and malaria within Lusaka Province [2]. Apart from the physical impact that RTCs have at a personal level, they have negative impacts on the economic development of the country, with an estimated cost of 1-2% of a country's Gross National Product (GNP) per annum, as a result of morbidity, mortality and property – related costs [3]. While the growth of transport systems in our world contributes to economic development, such as facilitating the movement of goods and people [4], the development of the transport sector has also resulted in a number of RTCs [5,6], a matter that has raised great concerns [7]. Behavioural practices such as lack of seat-belt utilization, not wearing motorcycle helmets, driving while under the influence of drugs or alcohol, speeding, and the use of mobile phones to text messages while driving, are all risk taking behaviours that lead to increases in Road Traffic Injuries (RTIs) [8-11]. Very few studies have been done in Zambia on road user behaviour. One such a study was a pedestrian survey conducted in April 2013 to explore the
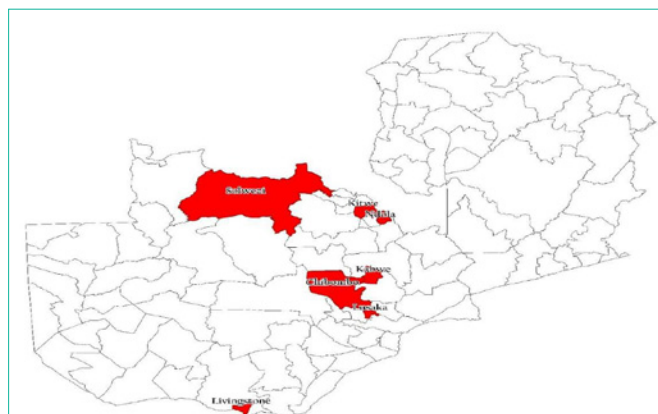
Figure 1: Study site locations for RTCs study.

Table 1: Socio-Demographic Characteristics of Respondents.

VARIABLE	N	PERCENT (%)	BINOMIAL EXACT 95% CI
PROVINCE:			
Southern	192	21.8	19.2-24.7
North-Western	166	18.9	16.2-21.6
Copperbelt	151	17.2	14.7-19.8
Central	167	19.0	16.5-21.8
Lusaka	203	23.1	20.4-26.0
DISTRICT:			
Livingstone	171	19.5	16.9-22.2
Choma	16	1.8	1.0-2.9
Zimba	5	0.6	0.2-1.3
Solwezi	166	18.9	16.4-21.6
Ndola	151	17.2	14.7-19.8
Kabwe	137	15.6	13.3-18.2
Chibombo	30	3.4	2.3-4.8
Lusaka	203	23.1	20.4-6.0
SEX:			
Male	713	81.1	78.4-83.6
Female	132	15.0	12.7-17.6
Missing	34	3.9	2.7-5.4
EDUCATION LEVEL:			
None	12	1.4	0.7-2.4
Primary (Grades 1-7)	61	6.9	5.4-8.8
Secondary (Grades 8-12)	408	46.4	43.1-49.8
COLLEGE	250	28.4	25.5-31.6
University	143	16.3	13. 9-18.9
Missing	5	0.6	0.2-1.3
OCCUPATION:			
Technical/professional/managerial	256	29.1	26.1-32.3
Clerical	41	4.7	3.4-6.3
Sales/services	57	6.5	4.9-8.3
Skilled manual	176	20.0	17.4-22.8
Unskilled manual	39	4.4	3.2-6.0
Agriculture	17	1.9	1.1-3.1
Other	287	32.7	29. 6-35.9
No answer	6	0.7	0.3-1.5
MARITAL STATUS:			
Single	167	19.0	16. 5-21.8
Married	620	70.5	67.4-73.5
Separated	21	2.4	1.5-3.6
Widowed	9	1.0	
Missing	62	7.1	5.5-8.9.0

random behaviour and attitudes of pedestrians as they cross the roads or walk on the walk-ways in Lusaka district of Zambia [12]. The other study was also conducted in Lusaka and its objective was to monitor the rates of wearing seatbelts among drivers, front passengers, and rear passengers in the city of Lusaka, Zambia [13]. However, there has been no comprehensive study that explored the behaviour of Zambian drivers on the road covering different parts of Zambia and using mixed research methods. This paper uses the results of a larger study conducted in 2014 to describe specific behaviours of drivers on the Zambian roads. The goal of the paper is to highlight these behaviours, with the aim of providing road safety policy makers and strategists to develop appropriate measures to deal with negative deviant behaviours on the road.

Materials and Methods

The main study from which the data reported here is derived was

a cross-sectional survey of the status of road safety and road safety interventions in Zambia, using quantitative and qualitative methods, inspections, and observation methods. The study was conducted in five provinces and seven districts of Zambia along a zone from Livingstone in Southern province to Solwezi in the North-western province; an area known to have the highest rates of road traffic crashes in Zambia (Figure 1). The study districts were: Livingstone (Southern Province), Lusaka (Lusaka Province), Chibombo (Central Province), Kabwe (Central Province), Ndola (Copperbelt Province), Kitwe (Copperbelt Province), and Solwezi (North-Western Province). The study population included automobile drivers (both public and private), various other types of road users, road safety stakeholders, and policy makers.

For this paper we present data from a driver behaviour survey and direct observation of driver behaviour on the road. The study population for the driver behaviour survey included automobile drivers covering the following categories: Drivers of big buses, minibus drivers, taxi drivers, drivers of SUVs, truck drivers, and drivers of private cars. For direct observation of behaviours on the road, we observed drivers of various motor vehicles and motorcyclists. Below is a summary of the methods; a detailed description of these methods is being compiled for a separate methods paper.

Driver behaviour survey questionnaire

For this paper, we analyzed data from the driver behaviour survey questionnaire with some questions from the original Manchester Driver Behaviour Questionnaire (DBQ) [14].

We interviewed 879 drivers of various motor vehicles. The survey instrument was designed in such a way as to enable the research team to document both negative and positive deviant driver behaviours. We used the Manchester DBQ questions to capture negative driver behaviours and designed questions that capture positive deviant behaviours. As the study was not designed to evaluate effect of driver behaviours on incidence and prevalence of RTCs the research team did not do a factor analysis of the different components of the questionnaire for validity of each factor in the Manchester DBQ in the Zambian context. However, the survey questionnaire was pretested to ten (10) respondents within Lusaka city for clarity of questions and reliability. We used participating rather than undeclared type of survey pretesting. This involved administration of the survey instrument to respondents after they were told that this was a test run of the questionnaire and then the respondents were asked to comment on the questionnaire in terms of clarity of wording and any other issues. To assess reliability we analyzed the consistencies in responses to different questions by different respondents. No validity tests were done.

Table 2: Observations of Traffic Violations by Drivers.

Variable	Never N (%)	Hardly ever N (%)	Occasionally N (%)	Quite often N (%)	Frequently N (%)	Nearly all the time N (%)	No answer N (%)
Sound your horn to indicate your annoyance to another road user	312 (35.5)	96 (10.9)	255 (29.0)	101 (11.5)	51 (5.8)	56 (6.4)	8 (0.9)
Become angered by another driver and give chase with the intention of giving him/her a piece of your mind	638 (72.6)	93 (10.6)	82 (9.3)	36 (4.1)	14 (1.6)	12 (1.4)	4 (0.5)
Pull out of a junction so far that the driver with right of way has to stop and let you out	578 (65.8)	96 (10.9)	89 (10.1)	41 (4.7)	32 (3.6)	23 (2.6)	20 (2.3)
Disregard the speed limit on a residential road	584 (66.4)	89 (10.1)	111 (12.6)	45 (5.1)	20 (2.3)	19 (2.2)	11 (1.3)
Stay in a motorway lane that you know will be closed ahead until the last minute before forcing your way into the other lane	611 (69.5)	103 (11.7)	86 (11.7)	23 (2.6)	22 (2.5)	15 (1.7)	19 (2.2)
Overtake a slow driver on the inside	608 (69.2)	73 (8.3)	96 (10.9)	42 (4.8)	22 (2.5)	29 (3.3)	9 (1.0)
Race away from traffic lights with the intention of beating the driver next to you	719 (81.8)	69 (7.9)	53 (6.0)	22 (2.5)	6 (0.7)	1 (0.1)	9 (1.0)
Drive so close to the car in front that it would be difficult to stop in an emergency	606 (68.9)	99 (11.3)	79 (9.0)	49 (5.6)	32 (3.6)	11 (1.3)	3 (0.3)
Cross a junction knowing that the traffic lights have already turned red	684 (77.8)	106 (12.1)	51 (5.8)	28 (3.2)	5 (0.6)	2 (0.2)	3 (0.3)
Disregard the speed limit on a motorway	520 (59.2)	91 (10.4)	133 (15.1)	74 (8.4)	31 (3.5)	21 (2.4)	9 (1.0)
Use mobile phone while driving	449 (51.1)	100 (11.4)	152 (17.3)	87 (9.9)	58 (6.6)	28 (3.2)	5 (0.6)

Table 3: Observations on Traffic Errors by Drivers.

Variable	Never N (%)	Hardly ever N (%)	Occasionally N (%)	Quite often N (%)	Frequently N (%)	Nearly all the time N (%)	No answer N (%)
Queuing to turn left onto a main road, you pay such close attention to the main stream of traffic that you nearly hit the car in front of you	581 (66.1)	119 (13.5)	127 (14.5)	22 (2.5)	8 (0.9)	8 (0.9)	14 (1.6)
Fail to notice that pedestrians are crossing when turning into a side street from a main road	496 (56.4)	123 (14.0)	141 (16.0)	59 (6.7)	23 (2.6)	29 (3.3)	8 (0.9)
Fail to check your rear-view mirror before pulling out, changing lanes, etc.	642 (73.0)	106 (12.1)	79 (9.0)	30 (3.4)	11 (1.3)	7 (0.8)	4 (0.5)
On turning left nearly hit a cyclist who has come up on your inside	493 (56.1)	147 (16.7)	136 (15.5)	45 (5.1)	24 (2.3)	29 (3.3)	5 (0.6)
Miss "Give Way" signs and narrowly avoid colliding with traffic having right of way	586 (66.7)	117 (13.3)	89 (10.1)	48 (5.5)	15 (1.7)	14 (1.6)	10 (1.1)
Attempt to overtake someone that you had not noticed to be signaling a right turn	469 (53.4)	150 (17.1)	138 (15.7)	71 (8.1)	36 (4.1)	11 (1.3)	4 (0.5)
Underestimate the speed of an oncoming vehicle when overtaking	400 (45.5)	141 (16.0)	170 (19.3)	88 (10.0)	50 (5.7)	24 (2.7)	6 (0.7)

Table 4: Observations of Traffic Lapses by Drivers.

Variable	Never N (%)	Hardly ever N (%)	Occasionally N (%)	Quite often N (%)	Frequently N (%)	Nearly all the time N (%)	No answer N (%)
Hit something when reversing that you had not previously seen	444 (50.5)	185 (21.1)	165 (18.8)	59 (6.7)	18 (2.1)	5 (0.6)	3 (0.3)
Get into the wrong lane approaching a roundabout or a junction	586 (66.7)	146 (16.6)	103 (11.7)	30 (3.4)	7 (0.8)	4 (0.5)	3 (0.3)
Misread the signs and exit from a roundabout on the wrong road	626 (71.2)	124 (14.1)	82 (9.3)	25 (2.8)	9 (1.0)	6 (0.7)	7 (0.8)

Table 5: Observations on Positive deviant behaviors by Drivers.

Variable	Never N (%)	Hardly ever N (%)	Occasionally N (%)	Quite often N (%)	Frequently N (%)	Nearly all the time N (%)	No answer N (%)
I show courtesy to other motorists	16 (1.8)	16 (1.8)	42 (4.8)	94 (10.7)	210 (23.9)	497 (56.5)	4 (0.5)
I show courtesy to pedestrians	12 (1.4)	20 (2.3)	37 (4.2)	106 (12.1)	210 (23.9)	488 (55.5)	6 (0.7)
I show courtesy to cyclists	13 (1.5)	26 (3.0)	59 (6.7)	104 (11.8)	211 (24.0)	461 (52.5)	45 (0.6)
Subtotal Courtesy	41 (1.6)	62 (2.4)	138 (5.2)	304 (11.5)	631 (23.9)	1,446 (54.8)	55 (0.6)
I wear a seat belt while driving	12 (1.4)	20 (2.3)	45 (5.1)	100 (11.4)	139 (15.8)	559 (63.6)	4 (0.5)
I insist on my passengers wearing seat belts	29 (3.3)	25 (2.8)	79 (10.0)	88 (10.0)	142 (16.2)	513 (58.4)	3 (0.3)
I observe speed limits (where they are displayed)	13 (1.48)	22 (2.50)	86 (9.8)	124 (14.1)	158 (18.0)	472 (53.7)	4 (0.5)
I make sure my car is roadworthy	10 (1.1)	12 (1.4)	32 (3.6)	60 (6.8)	131 (14.9)	630 (71.7)	4 (0.5)
I dim my lights to oncoming traffic at night	26 (3.0)	23 (3.0)	35 (4.0)	40 (4.6)	140 (15.9)	612 (69.6)	3 (0.3)

Table 6: Percentage of drivers overtaking on a curve by district and by type of motor vehicle.

District	SUVs	Public vehicle (minibus)	Private car	Small open van	Truck (light and big)	Average	Median
Kabwe	0.0	4.0	15.0	0.0	30.0	9.8	4
Chibombo	30.0	4.0	25.0	0.0	0.0	11.8	4
Livingstone	30.0	56.0***	30.0	30.0	0.0	22.5	30
Ndola	20.0	8.0	10.0	0.0	0.0	7.6	8
Lusaka	30.0	24.0	5.0	40.0	0.0	19.8	24
Solwezi	20.0	12.0	15.0	0.0	10.0	11.4	12
Average	21.7	10.4	16.7	11.7	6.7	13.4	

Table 7: Percentage of drivers overtaking on solid lines by district and by type of motor vehicle.

District	SUVs	Public vehicle (minibus)	Private car	Small open van	Truck (light and big)	Average
Kabwe	40.0	24.0	15.0	0.0	30.0	21.8
Chibombo	40.0	24.0	25.0	0.0	0.0	17.8
Livingstone	40.0	12.0	50.0	70.0	0.0	34.4
Ndola	20.0	8.0	5.0	0.0	0.0	6.6
Lusaka	70.0	28.0	20.0	60.0	20.0	39.6
Solwezi	60.0	32.0	50.0	80.0	40.0	52.4
Average	45.0	21.3	27.5	35.0	15.0	28.8

Direct observation of driver behaviours on the road

In order to document general driver behaviours on the roads, the data collectors observed 100 motorists for each variable of interest (overtaking at bends, overtaking on solid lines, not dimming lights to oncoming traffic at night, etc.) on the highways in each district and completed a data capture form that included data on province, district, and type of motor vehicle. In order to assess the prevalence of driving while under the influence of alcohol the data collectors randomly select 100 drivers from each district and tested them for Blood Alcohol Concentration (BAC) in collaboration with police traffic officers. The screening test result was recorded as positive or negative and then for all positive results a record the actual blood alcohol concentration was made. The tests were done at the following time points: 0700-0900hrs and 1800-2000hrs on Saturdays only. To assess the prevalence of drivers' adherence to speed limits, the data collectors were detailed to mount a speed sensor at a strategic location in each district to capture all left lane traffic at the following locations for a total of 100 drivers from each district: High way – intercity; Street in city centre; Street in high density residential area; Street in low density residential area.

Table 8: Percentage of drivers not dimming lights to on-coming traffic at night by district and by type of motor vehicle.

District	SUVs	Public vehicle (minibus)	Private car	Small open van	Truck (light and big)	Average
Kabwe	60.0	32.0	10.0	60.0	20.0	36.4
Chibombo	20.0	0.0	25.0	20.0	60.0	25.0
Livingstone	30.0	32.0	20.0	0.0	100.0	36.4
Ndola	30.0	16.0	25.0	0.0	0.0	14.2
Lusaka	40.0	28.0	10.0	50.0	80.0	41.6
Solwezi	50.0	24.0	20.0	10.0	0.0	20.8
Average	38.3	22.0	18.3	23.3	43.3	29.1

Table 9: Percentage of drivers stopping on red at traffic lights by district and by type of vehicle.

District	SUVs	Public vehicle (minibus)	Private car	Small open van	Truck (light and big)	Average
Kabwe	100.0	94.0	95.0	90.0	100.0	95.8
Livingstone	80.0	90.0	90.0	50.0	75.0	77.0
Ndola	65.0	90.0	88.0	70.0	85.0	79.6
Lusaka	65.0	66.0	68.0	75.0	85.0	71.8
Average	77.5	85.0	85.3	71.3	86.3	81.1

Table 10: Percentage of drivers stopping at pedestrian crossing when pedestrians are waiting to cross.

District	SUVs	Public vehicle (minibus)	Private car	Small open van	Truck (light and big)	Average
Kabwe	85.0	82.0	85.0	100.0	90.0	88.4
Livingstone	65.0	32.0	88.0	40.0	50.0	55.0
Ndola	50.0	34.0	58.0	45.0	40**	46.8
Lusaka	55.0	60.0	56.0	15.0	50.0	47.2
Solwezi	50.0	18.0	45.0	50.0	30.0	38.6
Average	61.0	45.2	66.4	50.0	55.0	55.5

Table 11: Percentage of drivers using phone or texting on the road.

District		% of Drivers using a phone or texting on the road			
District	Male		Female		All
	Youth	Older	Youth	Older	All
Solwezi	6	12	2	4	6.0
Kabwe	10	0	4	28	10.5
Livingstone	4	2	6	0	3.0
Lusaka	24	8	8	4	11.0
Ndola	34	16	14	14	19.5
Average	15.6	9.6	6.8	10.0	10.5

Results

Socio-demographic characteristics of respondents in the driver behaviour survey

879 out of a targeted sample of 1000 drivers were enrolled into the driver behavior survey giving a response rate of 87.9%. Most of the respondents were from Lusaka (23.1%) followed by Southern province with 21.8%. More than three quarters of the participants were male (81.1%); with less than a quarter (15.0%) being female (Table 1); there was some missing data, accounting for 3.9%. Most of the respondents had secondary level of education followed by college education and most respondents were categorized as technical, professional or managerial by occupation.

Driver behaviours from the driver behaviour survey

Below is a summary of the results of drivers behaviours categorized as Violations, Errors, Lapses, Positive deviant behaviour. Hence tables 2-5 below summarizes the results of the driver behavior survey according to whether they violated traffic regulations or committed errors or lapses or for that matter actually displayed positive deviant behavior. Unless otherwise specified, the percentages in this narrative refer to those who responded that they displayed the behaviour occasionally, quite often, frequently or nearly all the time. At least one in five drivers (22.2%) reported disregarding the speed limit on a residential road and nearly a third (29.4%) said they disregarded speed limit on a motor way. 21.5% of drivers said they overtook a slow driver on the inside while 9.8% of respondents reported beating traffic lights. 14.4% of the drivers reported driving even after consuming alcohol. And among all the drivers interviewed, 37.0% used mobile phone (called or received a call) while driving (Table 2).The results presented in (Table 3) show that 37.7% of the drivers said they underestimated the speed of an oncoming vehicle when overtaking and about a third (29.2%) of the drivers said they attempted to overtake someone they had not noticed to be signaling right turn. Approximately one third of the drivers (28.6%) failed to notice that pedestrians were crossing when turning into a side street from a main road.

In addition to errors, Zambian drivers admitted to committing a number of lapses. A common lapse that was reported by drivers

interviewed was hitting something when reversing that they had not noticed (28.2%), although a larger proportion of these (18.8%) said they only did so occasionally as shown in (Table 4).

Despite the fairly large proportions of drivers reporting traffic violations, errors and lapses, there were larger proportions of drivers that reported positive deviant behavior on the road. According to (Table 5) below, 95.4% of drivers reported showing courtesy to other motorists, pedestrians or cyclists; 54.8% said they did so nearly all the time. Approximately 63.6% said they wore seat belts nearly all the time, while 58.4% said they insisted on passengers wearing seat belts nearly all the time.

Highway driver behaviours based on direct observations

The tables below show the percentage of high way driver behaviours as directly observed by data collectors for the following districts: Lusaka, Chibombo, Livingstone, Kabwe and Solwezi, by type of vehicle. The data collectors observed 100 vehicles at a time; and so we report percentages only without actual numbers ('n') because each percentage represents the number out of 100 vehicles observed. Where the data collectors observed less or more than 100 motor vehicles, the actual denominator has been specified below each table.

On average, across all the five districts, drivers of SUVs were more likely to overtake on a curve than all other motorists; twice more likely to do so than drivers of minibuses (Table 6). Overall 13.4% of all drivers observed, irrespective of the district, overtook another vehicle on a curve; although we observed great variability in this driver behaviour among the districts, with 22.5% of all drivers observed in Livingstone overtaking on a curve, compared for example to only 7.6% of drivers doing so in Ndola.

About one third of all drivers observed (28.8%), irrespective of the type of motor vehicle they were driving or the district of observation overtook another motor vehicle on solid lines (Table 7). On average, close to half of all drivers of SUVs (45.0 %) overtook on a solid line; with 70.0% of SUV drivers in Lusaka doing so. Drivers of trucks were less likely to overtake on a solid line (15.0%) than other motorists (e.g. 21.3% minibuses, 35.0% small open vans).

Our observation of driver behaviours at night reveals that not dimming lights to on-coming traffic is quite prevalent among the Zambian drivers observed, with one third (29.1%) of all drivers across all the five districts displaying this behaviour (Table 8). Truck drivers were observed to be more likely not to dim their lights to on-coming traffic (43.3%) than other motorists (e.g. 18.3% of private cars, and 22.0% of minibus drivers).

Most (81.1%) of the drivers observed stopped on red at traffic lights (Table 9), with drivers in Lusaka least likely to stop at red traffic lights (71.8%) than those from the other districts. One of the behaviours that was found to be prevalent among the drivers observed was not stopping at pedestrians crossing while pedestrians were waiting to cross. (Table 10) shows that close to half (44.5%) of all the drivers, irrespective of the motor vehicle they were driving or the district of observation, did not stop at the pedestrian crossing; and for Solwezi district, 61.4 % of the drivers did not stop at the pedestrian crossing.

Although the numbers were small, we observed that 10.5% of all motorists in the study sample were seen either texting or using a phone to call or receive a call (Table 11). Young males (15.6%) were twice more likely to text or use a mobile phone to call or receive a call than young females (6.8%). There was no gender difference in use of mobile while driving among the older drivers. There was great variability in the use of mobile phones while driving among the districts observed; with Ndola recording 19.5% of drivers using a mobile phone compared for example to 11.0% of drivers in Lusaka.

The prevalence of seatbelt wearing ranged from 37.2% in Solwezi to 65.1% in Lusaka district across all types of motor vehicles. Overall, irrespective of district or type of motor vehicle being driven, about half of the drivers (approximately 54.5%) were observed to be wearing a seatbelt (Table 12). We observed great variability in seat belt wearing based on the type of motor vehicle being driven. For example, 62.6% of drivers of private cars were observed to be wearing seatbelts compared to 36.0% of the mini bus drivers.

Seatbelt wearing among front seat passengers was much lower than for drivers. (Table 13) shows that overall, irrespective of type of motor vehicle being driven or the district of observation, only 38.9% of front seat passengers were seen wearing a seatbelt. Front seat passengers in mini buses were least likely to wear seatbelt (14.4%).

We observed a high prevalence of helmet wearing among both motorcyclists and their passengers; 87.5% for cyclists and 91.2% for passengers. Solwezi had the lowest percentage of motorcyclists wearing helmets (Table 14).

Discussion

Results from self-reported survey of 879 drivers of various motor vehicles shows that the most common road traffic violations committed by the drivers of these vehicles were underestimating the speed of an oncoming vehicle when overtaking (37.7%), using a mobile phone while driving (37.0%), disregarding the speed limit on a high way (29.4%), and attempting to overtake someone they

Table 12: Percentage of drivers wearing seatbelt by district and by type of motor vehicle.

District	SUVs	Public vehicle (minibus)	Private car	Small open van	Truck (light and big)	Average
Kabwe	65.0	46.2	57.4	55.0	70.0	58.7
Livingstone	40.0	50.0	85.0	90.0	55.0	64.0
Ndola	75.0	20.0	43.0	60.0	40.0	47.6
Lusaka	60.0	56.0	74.5	60.0	75.0	65.1
Solwezi	50.0	8.0	53.0	35.0	40.0	37.2
Average	58.0	36.0	62.6	60.0	56.0	54.5

Notes: In Kabwe: 78 minibuses and 101 private cars were counted; In Lusaka 102 private cars were counted.

Table 13: Percentage of front seat passengers wearing seatbelts by district and by type of motor vehicle.

District	SUVs	Public vehicle (minibus)	Private car	Small open van	Truck (light and big)	Average
Kabwe	40.0	0.0	71.7	60.0	37.5	41.8
Livingstone	20.0	22.0	55.0	66.7	65.7	45.9
Ndola	55.0	2.0	30.7	35.0	20.0	28.5
Lusaka	66.7	44.1	35.7	60.0	62.5	53.8
Solwezi	35.0	4.0	12.9	40.0	30.0	24.4
Average	43.3	14.4	41.2	52.3	43.1	38.9

Notes: For Kabwe: Only 20 minibuses, 46 private cars, 40 trucks were observed. In Livingstone: 180 small open vans and 175 trucks were observed. In Lusaka: Only 75 SUVs, 68 minibuses, 28 private cars, 25 small open vans, 40 trucks were observed. In Solwezi: 101 private cars were observed.

Table 14: Percentage of motorcyclists and their passengers wearing helmets by district.

Kabwe	93.0	100.0
Livingstone	82.8	84.8
Lusaka	98.0	100.0
Solwezi	76.0	80.0
Average (all districts)	87.5	91.2

Notes: In Livingstone, only 99 motorcyclists and their passengers were observed.

had not noticed to be signaling right turn (29.2%). These are all regarded as risky driving behaviours as they have been associated with higher incidence of road traffic injuries. For example, Elvik et al. (2004) suggested that speed is likely to be the single most important determinant in the frequency of road traffic fatalities [15]. They report that a 10% reduction in the mean speed of traffic is likely to reduce fatal road crashes by 37.8%. The Indian Tri-level study cited driver inattention/distraction as the most important human factor contributing to road traffic crashes (20.3% of crashes) [16]. But later studies suggest that visual inattention and engaging in secondary tasks contributed to nearly 60% of crashes [17]. Klauer and team also report that looking away from the forward roadway for greater than two seconds was associated with nearly a doubling of the odds of being involved in a crash or near-crash, as compared to periods when the driver's eyes were not diverted from the forward roadway for as long as two seconds (OR = 1.9, 95% CI = 1.4 – 2.5) [18]. Recent meta-analysis of 28 experimental studies reports that typing and reading text messages while driving adversely affected eye movements, stimulus detection, reaction time, collisions, lane positioning, speed and headway [19]. From the above cited literature, there is sufficient evidence that the behaviours displayed by Zambian drivers are risky and have potential to contribute to the current high rates of road traffic accidents and fatalities. In addition to the self-reported behaviours, direct observation also revealed a number of risky behaviours. The most commonly observed potentially risky behaviours were: not wearing seat belts (45.5% among drivers and 61.1% among front seat passengers), not stopping at pedestrians crossing while pedestrians were waiting to cross (44.5%), not dimming lights to on-coming traffic (29%), and overtaking another motor vehicle on solid lines (29.1%). Our results on frequency of seat belt wearing corroborates very well with the results of a seat belt wearing survey done in Lusaka in 2012 which found that out of 21,292 drivers of various motor vehicles directly observed 50.8% were not wearing seatbelts and out of 8,599 front seat passengers, 60.0% were not belted [13]. Although there is high variability among countries with regard to frequency of seat belt wearing, our results from Zambia are similar to what has been observed in other Low and Middle Income Countries (LMICs) recently. In a paper describing the prevalence of seatbelt use and associated factors in drivers and front seat passengers across eight sites in Egypt, Mexico, Russia, and Turkey, Vecino-Ortiz and others found seatbelt wearing rates ranging from 4 to 72% in drivers and 3–50% in front-seat, with an overall seatbelt wearing below 60% in most sites [20].

From the discussion above, it is clear that something needs to be done to change the behaviours of Zambian drivers and passengers to improve road safety in Zambia; the question is what should be done? Various behaviour change interventions have been tested globally and within the African region to improve road safety. Tineke Hof in a study entitled "Strategies to influence habitual road user behaviour" explored the hypothesis that habitual road user behaviour can be altered by applying behaviour change strategies in such a way that seizes the underlying motive and therefore enables road users to detect the changes in the traffic situation [21]. He concluded and argued that behaviour change strategies have to be noticeable enough to road users who behave habitual to detect changes in traffic situations. A number of strategies to change adverse driver or other road users' behaviours focus on increasing awareness of the risks associated with a particular road user behaviour and the severity of the potential adverse consequences [22]. The finding of a fairly high prevalence of high risk driver behaviours suggests that the Zambian government should focus on strategies that modify road user behaviour. Also the fact that some of the findings, like frequency of seat belt wearing are comparable to other LMICs signifies the importance of behaviour change communication and other behaviour change strategies to road safety. The Global Plan for the decade of action for road safety 2011-2020 recommends WHO member states to implement road safety activities along the following five pillars: Road safety management; Safer roads and mobility; Safer vehicles; Safer road users; Post-crush response. There is no doubt all these intervention areas are important. However, it is our considered view that as much as countries focus on all these intervention areas, a focus and a priority on safe road users would more likely produce greater positive impact on the rate of road traffic crashes and fatalities. This view is in the light of overwhelming evidence that human factors are the commonest cause of road traffic crashes globally [16]. It is also important to note that according to WHO in the Global status reports on road safety, 2015, one of the intervention areas that member countries have not done well is addressing risky behaviours [23].

Conclusion

This study has demonstrated that adverse driver behaviour is

prevalent in Zambia, like in many other LMICs. This implies that the road transport and safety stakeholders in Zambia must focus more on strategies that impact on modifying driver behaviours such behaviour change campaigns, road safety law enforcement, and improvements in road signage and other road infrastructure features that influence driver behaviours on the road.

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