Original Article

The epidemiology of Road Traffic Crashes in Rural Zambia: *A Retrospective Hospital-Based Study at Monze Mission Hospital*

W Sichembe[1*], S D Manyozo[2], R Moodie[2,3]

[1]*Monze Mission Hospital, Zambia*
[2]*School of Public Health and Family Medicine, College of Medicine, University of Malawi, Malawi*
[3]*Melbourne School of Population and Global Health, University of Melbourne, Australia*

ABSTRACT

Background: Road trauma represents a significant yet neglected public health challenge in Zambia leading to loss of lives, severe disabilities and hampering development. It disproportionately affects low and middle income countries (LMIC) with 90% of all road deaths occurring there. Zambia, like many other LMIC lacks robust evidence to guide road safety initiatives and program planning due to limited research, poor quality data and competing health priorities.

Objectives: We aimed to investigate the epidemiology of road trauma cases seen at a general hospital in Monze district from 2013 to 2017. We further assessed the road trauma data quality as captured by the hospital registry.

Methods: We reviewed records for all road trauma cases seen at Monze Mission Hospital from 2013 to 2017. Descriptive statistics were used to summarised using means and proportion. We further assess the variables captured for each case that presented at the hospital including socio-demographic and trauma-related details. Depending on the quality of data obtained, statistical methods were applied to explain the epidemiology including Chi-square, t-tests and proportional tests were used to assess the differences in means and proportions, respectively.

Results: The road trauma data at MMH are very poor evidenced by a lot of missing variables for road trauma cases that would aid understanding of the epidemiology of road trauma cases seen at the facility. However, of the 449 road trauma cases reviewed, 62.4% of these were males. The highest road trauma burden was recorded among those aged 15-44. Time trend analysis shows a decreasing pattern in road deaths in Monze district. The case-fatality rates were very high with more than 90% the of deaths occurring before arrival at the hospital. However, many case files lacked data on occupation, education level, type of road user, type of vehicles involved and time of collision.

Conclusion: The available data at MMH suggested that young and active people aged 15-44 years were the most affected of road trauma in Monze district, with males experiencing a higher burden than females. The data also

Corresponding Author
Wantula Sichembe,
Monze Mission Hospital,
P.O BOX 660029, Monze, Zambia
Tel.: +260978470704
Email: wantulasichembe@yahoo.com

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showed a decreasing trend in the road trauma burden in Monze district. However, these results should be interpreted with great caution as the data are highly unreliable due to suspected very high levels of underreporting.

INTRODUCTION

Road trauma kills over 1.3 million people annually and leaves 20 to 50 million people with severe injuries and disabilities[1,2,3]. Low-and middle-income countries (LMICs), with only 54% of the world's motor vehicles, share a disproportionate burden of 90% of all road trauma fatalities[3]. Furthermore, 50% of the road trauma victims are vulnerable road users including cyclists and pedestrians[3]. Poor road-user behaviour i.e. speeding, drunk-driving, poor seat-belt use, increasing number of defective vehicles, poor road infrastructure and poor road traffic law enforcement are some of the known risk factors[3]. These are then compounded by inadequate and poor access to health facilities[3,4].

Road trauma results in considerable cost to the healthcare systems as well as to affected individuals and their families. Many are left in poverty due to loss of breadwinners, loss of livelihood and high expenditures from hospital admission and use of rehabilitative services[5,6]. The economic cost associated with road trauma alone in LMIC is far more than what they receive in developmental aid from donor countries[7].

Zambia has one of the highest mortality rates from road trauma in the world[3]. The World Health Organisation (WHO) estimates that more than 3500 people die annually in Zambia from road trauma representing 24.7 deaths per 100,000 population[3]. On the other hand, the official Zambian reports indicate less than 2000 deaths per year, signalling potential underreporting[3]. Like many other LMIC, the overall authority in reporting estimates of road trauma in Zambia is the police[3]. The health care system also collects road trauma data but tends to collect data only on severe cases and deaths. However, to the authors' knowledge, there is no formal system that links the two data sources, the hospital and the police. Overwhelming evidence exists that suggests major underreporting of road trauma events reported by the police and/or the hospitals alone[8-12]. Compounded by inadequate road trauma research to inform decision-making, poor data quality, lack of a standardised road trauma surveillance system and competing health priorities, both the road trauma burden and underreporting in Zambia will only continue to worsen. It is, therefore, essential to begin to highlight the magnitude of the problem at a local level and lay a foundation for future research.

In this study, we assessed the road trauma burden in rural Zambia, looking at trends, epidemiology of road trauma cases in Monze district. We collected data from the trauma registry at MMH collected from 2013 to 2017. We further assessed the road trauma data quality and surveillance system at this district health facility.

METHODS

Research design

This study was a quantitative cross-sectional survey. We conducted a retrospective records review for road trauma records collected from 2013 to 2017 at a district general hospital in Monze district in Zambia.

Study setting

Monze Mission hospital is the only hospital and trauma centre in Monze district serving a catchment population of nearly 220,000 people[13]. A major highway crosses the district linking the Southern province to the rest of the country. Complicated cases are referred directly to the University Teaching Hospital (UTH), Zambia's largest tertiary hospital and trauma centre.

Study population

The study population included all road trauma cases seen at MMH from January 2013 to December 2017. We reviewed and analysed all case files of road trauma patients seen at MMH within the specified study period including those that died before arrival at the hospital.

Data collection instrument

The data were collected from the inpatient, outpatient and mortuary records in September 2018 into our study database. Key variables that were collected include age, sex, education level, occupation, types of vehicles involved, date reported to hospital, types of injuries, length of hospital stay, injury outcome and admission status. Road traffic crashes were defined using the WHO's International Classification of Diseases (ICD-10) as any collision occurring on a public roadway that involved at least one motor vehicle[14].

Research ethics

Ethical approval to conduct this study was granted by the University of Melbourne's Medicine and Dentistry Human Ethics Sub-committee (*ID-1851573*) and the Excellence in Research Ethics and Science (ERES) Converge, Zambia (*Ref:No.2018-Aug-017*). Further written authorisation was granted by the Ministry of Health's National Health Research Authority and the Monze Mission Hospital Management. To ensure privacy and confidentiality, codes were used in place of patients' names.

Data management and analysis

Data were extracted, organized and analysed in Stata version 15 (StataCorp, College Station, TX, USA). Descriptive statistics were used to summarize categorical variables using frequencies and proportions while means and standard deviations were used to describe numerical continuous variables. Age (in years) was grouped into Early childhood (<5 years), School-going (5-14 years), Early adulthood and active workforce (15-44 years), Late adulthood (45-59 years) and Elderly and retired (>60 years). Two-sided chi-square tests, two-sample t-tests and two-sample proportion tests were used to compare the records by sex, age, type of injuries, outcomes and other characteristics. Statistical significance was defined as p-values of less than 0.05. Although initially planned for, complex regression analyses could not be conducted due to high levels of missing data.

RESULTS

Characteristics of road trauma victims

Of the 449 road trauma cases recorded at MMH from January 2013 to December 2017, 62.4% were males. The mean age of all road trauma victims was 34.3 years (± 14.4 years) with the youngest victim being 10 months old while the oldest was 91 years old. There was no significant difference in the mean ages between males and females (*95%CI -0.4, 5.4 years, p=0.0849*). *Table 1* below presents a summary of the missing data variables and the characteristics of the road trauma victims seen at MMH from 2013 to 2017.

Table 1: Characteristics of the road trauma cases seen at Monze Mission Hospital (2013-2017)

Patient characteristics (n=449)	N (Percentage) or Mean (±Standard Deviation)
Sex	
Female	169(37.6%)
Male	280(62.4%)
Age (years)	34.3(±14.4;0.83-91)
Residence	
Monze Residents	186(41.4%)
Non-Monze Residents	263(58.6%)
Occupation	-
Education level	-
Date of Collision	
2013	130(29.0%)
2014	85(18.9%)
2015	115(25.6%)
2016	85(18.9%)
2017	34(7.6%)
Time of collision	
Daylight	-
Night time	-
Dawn/Dusk	-
Type of vehicles involved	
Motor vehicle vs. motor vehicle	-
Motor vehicle vs. pedestrian	-
Motor vehicle vs. bicycle	-
Motor vehicle vs. motorcycle	-
Motor vehicle vs. other(specify)	-
Type of road user	
Driver	-
Passenger	-
Pedestrian	-
Cyclist	-
Motorcyclist	-
Other(specify)	-
Type of injury	
Soft Tissue Injuries	289(72.1%)
Dislocations	9(2.2%)
Fractures	69(17.2%)
Traumatic Amputations	5(1.3%)
Spinal Injuries	10(2.5%)
Head Injuries	19(4.7%)
Length of hospital stay (days)	3.3 (±5.6;1-60)
Patient outcome	
Discharged	371(82.6%)
Referred	25(5.6%)
Died	53(11.8%)
Died before arrival	48(90.6%)
Died in hospital	5(9.4%)

The young adults and the productive age group (15 to 44) accounted for most the cases. However, there was no significant difference in the proportions affected between males and females in each age group (Table 2).

Table 2: Road trauma cases seen at MMH by age group and sex (2013-2017)

Age group	Females		Males		Total road trauma cases at MMH		Percentage difference (Males-Females)	95%CI (p-value)
	n	%	n	%	n	%	%	%
<5 years	1	0.7	1	0.4	2	0.5	-	-
5-14 years	4	2.7	5	2.0	9	2.2	-0.7%	-20.6,19.2%, (p=0.9449)
15-44 years	106	70.2	200	78.4	306	75.4	-8.2%	-2.2, 18.6%, (p=0.1108)
45-59 years	24	15.9	37	14.5	61	15.0	-1.4%	-19.9,17.1% (p=0.8829)
60 years+	16	10.6	12	4.7	28	6.9	-5.9%	-25.2,13.4% (p=0.5713)
Total	151	100	255	100	406	100		

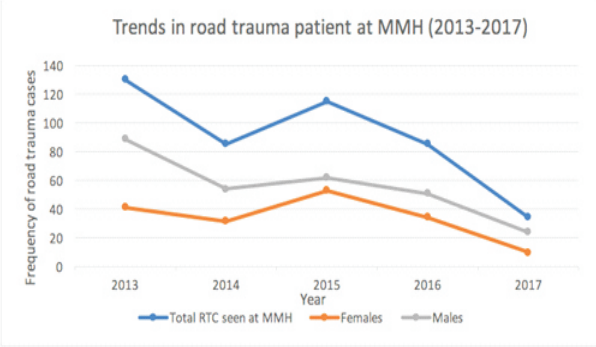
Distribution of road trauma cases by year of occurrence

Of the total cases reviewed in this study, 29% were from the year 2013, 18.9% were cases from the year 2014. Injuries that happened in 2015 constituted 25.6% of the cases while those from 2016 contributed 18.9% of the cases and year 2017 contributed 7.6% cases to the total seen. Across all these years, there was no significant difference between males and females affected by road trauma. *Table 3 below* presents the road trauma cases seen at MMH summarised by gender from 2013 to 2017. On overall, there appeared to be a 73.9% reduction in the total number of cases from those seen in the year 2013 to those seen in the year 2017, *figure 1 below* summarizes this trend.

Table 3: Road trauma cases seen at MMH by year and sex (2013-2017)

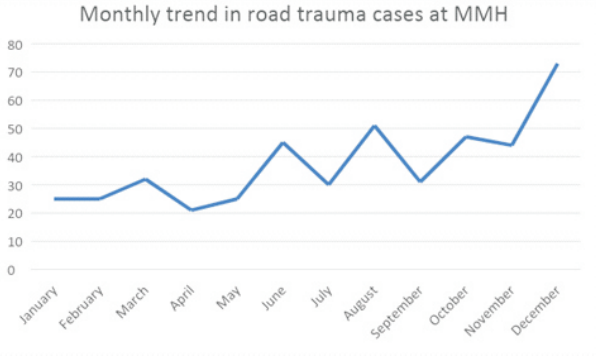
Year	Females		Males		Total road trauma cases at MMH		Percentage difference (Males-Females)	95%CI (p-value)
	n	%	n	%	n	%	%	%
2013	41	31.5	89	68.5	130	29	37	19.7,54.1 (p=0.0001)
2014	31	36.5	54	63.5	85	18.9	27.1	5.8,48.3 (p=0.016)
2015	53	46.1	62	53.9	115	25.6	7.8	-10.5, 26.1 (p=0.4031)
2016	34	40	51	60	85	18.9	20	-1.3, 41.3 (p=0.0706)
2017	10	29.4	24	70.6	34	7.6	41.2	7.6,74.8 (p=0.0264)
Total	169	37.6	280	62.4	449	100	24.7	15.5,34 (p=0.0000)

Figure 1: Trends in the road trauma case at MMH from by sex (2013-2017)



Road trauma cases, summarised by months, the number of road trauma cases grew towards the end of each year and peaked in December. The lowest road trauma cases were recorded in the early months of each year. *Figure 2 below* presents summary monthly trends for road trauma cases seen at MMH from 2013 to 2017.

Figure 2: Monthly trend in the road trauma cases at MMH (2013-2017)



Distribution of road trauma cases by seasons

We also assessed the burden of road trauma cases by the season in which they happened. Cases that happened during the rainy season were significantly more compared to road trauma cases seen in the cool dry season (15.4%; 95% CI 5.4, 25.4%, p=0.0033) and the hot dry season (31.6%; 95% CI 20.9, 42.3%, p=0.0000). Table 4 below presents a summary of the seasonality of the road crashes and the associated p values.

Table 4: Road trauma cases seen at MMH by seasons of the year (2013-2017)

Season	Total road trauma cases at MMH		Percentage difference (Compared to Rainy season)	95% CI (p-value)
	n	%	%	%
Rainy (November-April)	220	49	-	-
Cold dry (May-August)	151	33.6	15.4	5.4, 25.4 (0.0033)
Hot dry (September-October)	78	17.4	31.6	20.9, 42.3 (0.0000)
Total	406	100		

The documented type of injuries seen within the period varied from soft tissue injuries (72.1%), fractures (17.2%) head injuries (4.7%), spinal injuries (2.5%), dislocations (2.2%) and traumatic amputations (1.3%). There was no statistically significant difference in the distribution of these injuries based on gender and age groups. *Tables 5 & 6* below presents these summaries.

Table 5: Road trauma cases seen at MMH by type of injury and sex (2013-2017)

Type of injury	Females		Males		Total road trauma cases at MMH		Percentage difference (Males-Females)	95%CI (p-value)
	n	%	n	%	n	%	%	%
Soft Tissue Injuries	101	67.3	188	74.9	289	72.1	7.6	-3.5, 18.6 (0.1706)
Joint dislocations	1	0.7	8	3.2	9	2.2	2.5	-17.6, 22.6 (0.8876)
Fractures	34	22.7	35	13.9	69	17.2	8.7	-26.9, 9.4 (0.3478)
Traumatic amputations	4	2.7	1	0.4	5	1.3	-	-
Spinal injuries	3	2	7	2.8	10	2.5	0.8	-19.2, 20.8 (0.9421)
Head injuries	7	4.7	12	4.8	19	4.7	0.1	-19.6, 19.9 (0.9913)
Total	150	100	251	100	401	100	24.72	15.5,34 (0.0000)

Table 6: Road trauma cases seen at MMH by type of injury, sex and age group (2013-2017)

Type of injury	Age group										Total	
	<5 years		5-14 years		15-44 years		45-59 years		60 years +			
	n	%	n	%	n	%	n	%	n	%	n	%
Soft tissue injuries	2	100	6	75	228	75.5	36	59	17	60.7	289	72.1
Joint dislocations	0	0	0	0	8	2.6	1	1.6	0	0	9	2.2
Fractures	0	0	1	12.5	45	14.9	16	26.2	7	25	69	17.2
Amputations	0	0	0	0	4	1.3	1	1.6	0	0	5	1.3
Spinal injuries	0	0	0	0	8	2.6	2	3.3	0	0	10	2.5
Head injuries	0	0	1	12.5	9	3	5	8.2	4	14.3	19	4.7
Total	2	100	8	100	302	100	61	100	28	100	401	100

Length of hospital stay following road trauma

Among all road trauma victims, those that were admitted at the hospital, the average number of days spent in the hospital was 3.3 days (± 5.6 days). However, the days admitted varied from 1 day to 60 days in hospital. On average, the female patients stayed 2.10 days longer in hospital compared to the male patients and this was significant at 5% for injury victims aged 15 to 44 (95% CI 1, 3.2 days, p=0.0003). *Table 7 below* presents a summary by gender of the victims, the length of stay in hospital following the road trauma event.

Table 7: Road trauma cases seen at MMH by the length of hospital stay (in days)

Age group	Females		Males		Total road trauma cases at MMH		Mean difference (Females-Males)	95%CI (p-value)
	n	Mean days (±SD)	n	Mean days (±SD)	n	Mean days (±SD)	Days	Days
<5 years	1	2(-)	1	2(-)	2	2(-)	-	-
5-14 years	4	10.3 (±15.9)	4	1(0)	8	5.6 (±11.5)	9.3	-10.2,28.7 (0.2883)
15-44 years	104	4.4 (±5.7)	194	1.8 (±1.2)	298	2.7 (±3.7)	2.6	1.8, 3.4 (0.0000)
45-59 years	24	4.2 (±4.9)	37	4.7 (±8.9)	61	4.5 (±7.6)	-0.4	-4.4, 3.6 (0.8261)
60 years+	16	5.2 (±6.2)	12	7.4 (±16.6)	28	6.1 (±11.6)	-2.2	-11.5, 7.0 (0.6246)
Total	149	4.6 (±6)	248	2.5 (±5.2)	397	3.3 (±5.6)	2.1	1, 3.2 (0.0003)

Injury outcomes and admission status

Overall, 82.6% of the cases were discharged, 5.6% were referred for specialised care and 11.8% died either on scene, on route to the hospital and while in hospital. There was no statistically significant difference in the population case fatality rate between females and males (-0.04%; 95% CI -18, 17.9 p=0.997). The discharge and referral rates were also similar between males and females. *Table 8 below* presents a summary by gender the injury management outcomes.

Table 8: Outcomes of the road trauma cases seen at MMH (2013-2017)

Age group	Females		Males		Total road trauma cases at MMH		Percentage difference (Males-Females)	95%CI (p-value)
	n	%	n	%	n	%	%	%
Discharged	135	79.9	236	84.3	371	82.6	4.4	-3.8, 12.6 (0.280)
Died	20	11.8	33	11.8	53	11.8	-0.04	-18, 17.9 (0.997)
Referred	14	8.3	11	3.9	25	5.6	-4.4	-22.8, 14.1 (0.658)
Total	169	100	280	100	449	100		

Among the fatalities, 90.6% of them died before reaching the hospital, and this was consistently high in all the study years except for 2015, which recorded no pre-hospital deaths (Table 9). Most of these deaths occurred in the rainy season (43.4%), followed by the cool-dry season (37.7%) and the lowest number was in the hot-dry season (18.9%).

Table 9: Road trauma fatalities by place of death from 2013 to 2017

Year	Died before arrival at the hospital		Died in hospital		Total road trauma deaths at MMH	
	n	%	n	%	n	%
2013	16	100	0	0	16	30.2
2014	18	90	2	20	20	37.7
2015	0	0	2	100	2	3.8
2016	1	50	1	50	2	3.8
2017	13	100	0	0	13	24.5
Total	48	90.6	5	9.4	53	100

The case fatality rates at Monze Mission Hospital were highest in 2017 (38.2%) and lowest in 2015 (1.7%) (Table 10). There was an upward trend of both mortality and case fatality rates from 2013 to 2014 and then a deep drop from 2014 to 2015 where they plateaued until 2016. From 2016 to 2017, there was an upward spike in both rates with the case fatality rate having a 16-fold increase from 2.4% to 32.2% (*Figure 3*).

Data completeness

We observed high level data on *Type of Injury* for 11% of the cases *Age* for 10% of the cases. However, data on *Occupation, Education level, Type of road user, Type of vehicles involved and Time of collision* were completely missing. Information on the residences of the road trauma victims was unreliable as all fatalities were recorded as non-Monze residents.

DISCUSSION

The findings of this study indicate that there is poor road trauma data management at Monze Mission Hospital. This, therefore, results in major under-reporting and consequently, the epidemiological discussion in this paper may not truly represent the situation in Monze district. The general trend as observed from road trauma victims that were attended to at MMH showed a declining trend. However, road trauma remains an important public health problem mainly for the young adults aged 15 to 44 representing the productive age group in many countries. Our findings further indicate that men are the highest affected with road trauma compared to females. These results agree with findings from many other studies that report similar results[15-22]. This therefore means that young people, young men in particular, are at a highest risk of being affected in road trauma and require particular targeted interventions to protect them from this worsening public health problem.

Furthermore, our study showed a huge healthcare demand to cover for the non-fatal injuries which contributed to high admission rates and extended hospital stays. Studies show that a high proportion of non-fatal injuries puts pressure on the healthcare system due to increased usage of medical, surgical and rehabilitative services[6,23-25]. Additionally, road trauma victims and their families are drawn deeper into poverty due to loss of livelihood, delayed and inability to return to work[23,32,43]. Finally, Road trauma victims are further at risk of both physical disability and mental illness such as depression and post-traumatic stress disorder[29,30].

Our study also indicates that, a significantly high rate of road trauma events occurred during the rainy season, this suggests the importance of seasonality in the aetiology of road trauma. Similar results have also been reported generally in other African countries[16,31]. However, in the current study the highest risk of road crashes was at the beginning of the rainy season and the lowest risk towards the end. It is further important to also note that this is also the period of festivities in this region. In this season therefore, road-user behaviour, such as drunk-driving and over-speeding are important factors to consider in interpreting these findings. Therefore, better road infrastructure and enforcement of road traffic laws and regulations, particularly at the beginning of the rainy season is a critical preventive measure for road trauma in Zambia.

The overall case-fatality in our study is at 11.8% for both sexes with the mortality rate being consistently below the estimated national average of 24.7 deaths per 100,000 people[3]. For a rural district, higher numbers than these are expected, as shown by studies done in similar rural settings which have consistently shown that road trauma causes more mortalities and morbidities among poorer communities as compared to urban ones[21,32,33]. As such, road trauma has been implicated as one of the drivers of underdevelopment and poverty in these communities[3]. Our study on the contrary, may have been affected by poor quality data with a high potential for underreporting, hence could not show

similar findings as the other studies.

In our study, more than 90% of the deaths occurred before the victims arrived at the hospital, either at the scene or in-transit to the hospital. However, this finding is not particular to underdeveloped nations, similar estimates have also been reported among developed communities[33,34]. These findings highlight the critical need for emergency response and coordination in both these settings if we are to save lives from road trauma. Seidenberg et al.[35] found that only 5.8% of injury cases seen at Zambia's largest trauma centre, the University Teaching Hospital, arrive by ambulance. For a rural district like Monze, the proportion of trauma victims that arrive by ambulance is likely to be less than this. This, therefore, presents as an opportunity for reducing this extremely high prehospital fatality rate, through investment in quality emergency response for road trauma.

Furthermore, our findings show a reduction in the number of road trauma cases and mortality rates from 2013 to 2017. However, to the best of the authors' knowledge, there were no specific programs targeting reduction of road trauma in the district during this period. This unexplainable reduction in the road trauma cases, together with the high level of missing data, make these findings unreliable and difficult to use. It is, therefore, likely that the burden of road trauma in Monze district is higher than reported and reflects the high-level of underreporting many African countries experience[9-11,36].

An effective injury surveillance system is required to be simple, flexible, reliable, timely, sustainable and useful to those for whom the data are collected[37]. Our study highlights critical reflections for road trauma surveillance in Zambia. The data collected through the current surveillance system is not reliable compounded by a lot of missing data and indicates potential for massive underreporting of road trauma events. Consequently, this information captured is not very useful in guiding road safety initiatives and road safety policy. Furthermore, the information collected in the current road trauma hospital based surveillance system is not readily available as it requires to be manually collated from different handwritten, paper-based records. This poor data quality may reflect the general incompleteness of health data in Zambia which handicaps the decision-making process and priorities for health.

Though not fully utilised, Hospital-based trauma registries have been reported to be more cost-effective way of road trauma surveillance for resource-limited countries as opposed to relying on police data alone[38]. Some African countries have established integrated country-wide or facility-based injury surveillance systems that have had varying levels of success[39-42]. Kobusingye and Lett[42] described a low-cost approach in setting up this system, that integrated data collection into already existing and functional systems. Their one-page tool ensures minimal data burden for users and meets the attributes of an effective surveillance system[37]. However, Sango et al[20] cautions against setting-up a surveillance system that is based entirely on health facility data. They advised that such a system should be linked to the police records to ensure more efficiency and lower levels of underreporting. There is thus, no better opportunity than now for Zambia to start rethinking her surveillance approach toward road trauma surveillance particularly with the *"Decade of Action of Road Safety, 2011-2020"* nearing its end[3]. This would be an important step towards reducing road trauma injuries and deaths in Zambia.

Strengths and limitations

Our study describes the burden of road trauma and in part assesses the reliability of the district hospital based trauma registry for surveillance purposes in Zambia. Therefore, the study helps to highlight the district-level trauma burden and the challenges facing road trauma surveillance in similar settings. These findings will be useful at the local level in

planning for both road safety regulation, data collection for road trauma and health services planning for trauma care.

However, we used a cross-sectional design and use of pre-existing hospital data which may introduce some selection bias into the study, since not all road trauma cases made it to the hospital. It is possible that those that do not present to the hospital have different characteristics to those that do. Additionally, the poor data quality and missing information did not allow us to conduct complex analyses and adjust for potential confounders and predictors of road trauma-related deaths. This poor data quality also make it difficult to make meaningful inferences and recommendations.

CONCLUSIONS AND RECOMMENDATIONS

Road trauma remains a significant public health challenge in Monze district in Zambia. However, assessing its epidemiology was very challenging due to poor quality data. This is likely to be the general picture in Zambia and therefore, impacts on decision-making and resource allocation within the road safety agencies and the health services organisation.

Health planners and policymakers in Zambia should consider setting up active and reliable hospital-based trauma registries. We further recommend data linkages between the hospital based registries and police databases. The low-cost approaches used by other countries in the region could easily be replicated, particularly with already existing validated tools. There is also a great need for investing in emergency response services as well as improvements in post-crash care to improve survival of victims of road trauma.

Finally, we recommend conducting a larger population-based study that would assess both the burden of road trauma and the current surveillance system at a larger scale. We further recommend, conducting further studies to explore timeliness, simplicity, usefulness of the existing road trauma surveillance system in Zambia. With a lot of young people being affected by the road trauma, assessing the burden of mental and physical disability among road trauma victims as well as the economic impact of road trauma on families and the healthcare system is critically needed. Finally, it is imperative for Zambia to estimate the true road trauma burden using advanced methodologies such as the capture-recapture method by using multiple data sources.

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