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Risk Factors of Motorcycle Accidents and Their Contribution to Trauma in Ndola, Zambia

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Abstract

Introduction

Motorcycle accidents represent a growing public health challenge in Zambia, particularly in urban centers such as Ndola where motorcycles are widely used for informal transport and delivery services. These crashes contribute significantly to trauma-related morbidity and mortality, especially among young male riders. Despite their increasing burden, motorcycle-related injuries remain underrepresented in national health policy and research.

Method

This study employed a retrospective cross-sectional design, analyzing hospital records of 157 patients treated for motorcycle-related injuries between January 2023 and December 2025. Data were collected on demographics, accident details, injury types, and clinical outcomes. Statistical analysis using SPSS version 25 included descriptive measures, chi-square tests, and logistic regression to identify associations between risk factors and trauma outcomes.

Results

Findings revealed alarmingly low helmet use (14.6%), high rates of alcohol involvement (40%), and speeding (34%), all significantly associated with increased injury severity and mortality. Licensing compliance was poor, with 83% of riders and 89% of motorcycles unlicensed. Accidents occurred predominantly in the evening (61%), coinciding with reduced visibility and peak transport activity. Injury patterns were dominated by fractures (38%) and head injuries (26%), with lower limbs (41%) and head (29%) most affected. Severity analysis showed that 53% of cases were moderate to severe trauma, with non-helmeted riders disproportionately sustaining head injuries ($p < 0.001$). Clinical outcomes included an average hospital stay of 7.2 days, 68% recovery, 25% referral for specialized care, and 6.4% mortality. Complications such as permanent disability (18%), infections (11%), and amputations (4%) were common, with 63% of patients requiring follow-up. Poor road conditions and substance use were significantly associated with prolonged hospitalization and adverse outcomes ($p < 0.05$).

Conclusion

This study highlights the urgent need for targeted interventions, including stricter enforcement of helmet laws, rider licensing, alcohol control measures, and infrastructure improvements. Evidence generated will inform trauma care strategies and public health planning, contributing to Zambia's efforts to reduce road traffic injuries in line with Sustainable Development Goal 3.6.

INTRODUCTION

1.1 Background

Motorcycle accidents pose a major global public health challenge, especially in developing countries where their frequency and severity are disproportionately high. These incidents often result in serious trauma and long-term disability (1). The rising incidence of road traffic accidents, particularly those involving motorcycles, has significantly contributed to global morbidity and mortality. Projections suggest they would become the third leading cause of disease burden by 2020 (2). Each year, approximately 1.3 million people die from road traffic accidents, with 90 percent of these fatalities occurring in low- and middle-income countries. This highlights a critically neglected area of public health (3).

Motorcycle-related fatalities hinder sustainable development due to their high prevalence among vulnerable road users (4). In Uganda, boda-boda accidents are the leading cause of physical injuries. Trauma patients average 30.8 years in age and 74 percent are male, demonstrating a clear demographic vulnerability (5,6). This pattern is echoed across low-income regions where young males often work in motorcycle-dependent occupations, increasing their exposure to crash risks (3,7). Substance use, including alcohol and illicit drugs, further elevates this risk (8). The fatality risk per kilometer traveled on a motorcycle is significantly higher than that of cars, emphasizing the inherent danger of this transport mode (9).

Understanding the risk factors and trauma patterns associated with motorcycle accidents is essential for developing effective prevention strategies (10,6). In Zambia, particularly in Ndola, increased motorcycle use driven by affordability and convenience has led to a surge in road traffic injuries. RTSA (11) reported 2,163 road traffic deaths in 2021, with 66 percent involving vulnerable road users. News Diggers (12) further noted 682 motorcycle crashes in the first quarter of 2025 alone, resulting in 89 deaths and 321 serious injuries.

Ndola’s strategic location and high motorcycle traffic, especially among young male riders in informal transport, mirror trends seen in other low-income settings. Weak enforcement of traffic laws, poor infrastructure, and low helmet usage contribute to severe trauma outcomes. Despite the growing burden, motorcycle-related injuries remain underrepresented in Zambia’s health policy. Hospitals in Ndola frequently manage high volumes of trauma cases, many resulting in long-term disability and socioeconomic strain. The absence of rider education, safety campaigns, and protective gear enforcement exacerbates the issue.

This study seeks to identify the specific risk factors contributing to motorcycle accidents and their traumatic outcomes in Ndola with the goal of informing evidence-based strategies for injury prevention.

1.2 Statement of the Problem

Motorcycle accidents have emerged as a pressing public health concern in Zambia, particularly in urban centers such as Ndola. Despite their increasing prevalence and the severe trauma they inflict, there remains a paucity of targeted research and policy interventions addressing the specific risk factors contributing to these incidents. According to the Road Transport and Safety Agency (11), Zambia recorded over 2,000 road traffic fatalities in 2021, with motorcyclists constituting a significant proportion of these deaths. More recently, 682 motorcycle crashes were reported in the first quarter of 2025 alone, resulting in 89 deaths and 321 serious injuries (News Diggers 2025).

In Ndola, the growing dependence on motorcycles for informal transport and delivery services has exposed a vulnerable demographic, primarily young male riders, to heightened risk of road traffic injuries. Several contributing factors have been identified, including inadequate road infrastructure, weak enforcement of traffic regulations, low rates of helmet use, substance abuse, and the overloading of passengers. These factors collectively exacerbate both the frequency and severity of motorcycle-related trauma.

Although local healthcare facilities report a substantial volume of motorcycle accident cases, there is a notable lack of empirical data detailing injury patterns and predictive risk factors. This information gap significantly hinders the development of targeted prevention strategies and the effective allocation of resources for trauma care. Addressing this gap is essential to inform evidence-based interventions and improve road safety outcomes in Ndola and similar urban settings.

1.3 Study justification

This study is justified by the urgent need to address the rising burden of motorcycle-related trauma in Ndola, Zambia, where young male riders are increasingly vulnerable due to occupational exposure, poor road infrastructure, limited enforcement of traffic laws, and low helmet usage. Despite alarming statistics such as the 682 motorcycle crashes and 89 deaths reported in the first quarter of 2025 alone (12), motorcycle injuries remain underrepresented in national health policy and research. By identifying the specific risk factors contributing to these accidents and their traumatic outcomes, this study will provide evidence-based insights to inform targeted prevention strategies, improve trauma care, and support public health planning. The findings will be crucial for developing localized interventions that enhance road safety and reduce the socioeconomic impact of motorcycle-related injuries in Ndola. Furthermore, the study aligns with Zambia's National Road Safety Policy and contributes directly to Sustainable Development Goal 3.6, which aims to halve the number of global deaths and injuries from road traffic accidents by 2030 (13).

1.4 Study Objectives

1.4.1 General Objective

To investigate the risk factors associated with motorcycle accidents and assess their contribution to trauma cases in Ndola, Zambia.

1.4.2 Specific Objectives

1. To identify the demographic characteristics of individuals involved in motorcycle-related trauma cases in Ndola.
2. To examine the common risk factors contributing to motorcycle accidents, including helmet use, substance abuse, road conditions, and traffic law compliance.
3. To analyze the types and severity of injuries sustained in motorcycle accidents treated at major health facilities in Ndola.
4. To assess the clinical outcomes of motorcycle-related trauma cases, including hospitalization duration, disability, and mortality.
5. To provide evidence-based recommendations for reducing motorcycle accident-related trauma through targeted interventions and policy

1.4.3 Research Questions

1. What are the demographic characteristics of individuals involved in motorcycle-related trauma cases in Ndola?
2. What are the most common risk factors contributing to motorcycle accidents in Ndola?
3. What types and severity levels of injuries are sustained in motorcycle accidents?
4. What are the clinical outcomes of motorcycle-related trauma cases, including hospitalization, disability, and mortality?
5. How can the findings inform targeted interventions and policy strategies to reduce motorcycle-related trauma?

1.5 Conceptual Framework

This framework illustrates how various risk factors contribute to the occurrence and severity of motorcycle accidents, which in turn lead to different trauma outcomes. It also considers intervening variables such as emergency response and hospital capacity that can influence the final health outcomes. The framework assumes that individual and environmental risk factors increase the likelihood and severity of motorcycle accidents. These accidents, when compounded by delays in emergency response and limited trauma care resources, result in varied clinical outcomes. Understanding these relationships will help identify leverage points for intervention and policy reform.

LITERATURE REVIEW

Motorcycle accidents are a growing global public health concern, particularly in low- and middle-income countries (LMICs) where they contribute significantly to trauma-related morbidity and mortality. According to the World Health Organization (14), road traffic injuries claim approximately 1.3 million lives annually, with motorcyclists accounting for nearly 28% of these fatalities. LMICs bear over 90% of this burden despite having fewer vehicles per capita, highlighting systemic gaps in road safety, infrastructure,

and emergency response (14). The vulnerability of motorcycle riders stems from the lack of protective barriers, making them more susceptible to severe injuries during collisions. Blankson et al. (9) emphasize that the risk of death per kilometer traveled on a motorcycle is significantly higher than for other vehicles, underscoring the inherent danger of this mode of transport.

In Sub-Saharan Africa, motorcycles have become a dominant form of transport due to their affordability and ability to navigate congested urban areas. However, this shift has led to a surge in motorcycle-related injuries and fatalities. A scoping review by Konlan and Hayford (1) identified consistent risk factors across African countries, including young male riders, low helmet usage, alcohol and drug consumption, poor road infrastructure, and weak enforcement of traffic laws. The Motorcycle Safety in Africa report (15), commissioned by the African Development Bank and the Global Road Safety Facility, revealed that motorcycle fatalities are rising faster than those of other road users. In many African cities, helmet use remains below 30%, and emergency response systems are often under-resourced, contributing to poor trauma outcomes.

Uganda presents a stark example of this regional crisis. Boda-boda (motorcycle taxi) accidents have reached epidemic levels, becoming the leading cause of physical injuries. Temizel et al. (6) and Okwada et al. (5) report that trauma patients in Uganda average 30.8 years in age, with 74% being male. This demographic pattern reflects broader vulnerabilities in LMICs, where young men are frequently employed in informal transport sectors and face heightened exposure to accident risks. Behavioral factors such as substance use further compound the problem. Mundenga et al. (8) found that alcohol and drug use are prevalent among young motorcycle riders, increasing the likelihood of crashes and severe trauma.

Zambia mirrors these regional trends, with motorcycles increasingly used for informal transport and delivery services. According to the Road Transport and Safety Agency (11), Zambia recorded 2,163 road traffic deaths in 2021, with 66% involving vulnerable road users, including motorcyclists. More recently, News Diggers (12) reported 682 motorcycle crashes in the first quarter of 2025 alone, resulting in 89 deaths and 321 serious injuries. These figures reflect a troubling rise in motorcycle-related trauma, particularly in urban centers like Ndola, which lies along a major transport corridor and sees high volumes of motorcycle traffic.

Despite the growing burden, motorcycle-related injuries remain underrepresented in Zambia's national health strategies. Hospitals in Ndola frequently report high caseloads of trauma patients from motorcycle crashes, many of whom suffer long-term disabilities that strain both families and the healthcare system. A retrospective study by Sichembe et al. (16) in rural Zambia found that motorcycle crashes were among the top contributors to trauma admissions, especially in areas with poor road conditions and limited access to emergency care. The study emphasized the need for robust data systems and localized research to inform policy and prevention efforts.

Existing literature consistently identifies demographic, behavioral, environmental, and systemic risk factors contributing to motorcycle accidents. These include young male riders, informal employment, low helmet use, substance abuse, poor road infrastructure, and weak enforcement of traffic laws.

However, there is a notable gap in context-specific data for urban centers like Ndola. The city's unique transport dynamics, demographic profile, and healthcare infrastructure necessitate localized research to understand the interplay between rider behavior, environmental conditions, and trauma outcomes.

This study aims to fill that gap by investigating the specific risk factors contributing to motorcycle accidents in Ndola and assessing their impact on trauma outcomes. By building on global and regional evidence, the research will generate locally relevant insights to inform public health interventions, policy reforms, and trauma care improvements. Such findings are essential for reducing the burden of motorcycle-related injuries and supporting sustainable development goals related to health, safety, and urban mobility in Zambia.

METHODOLOGY

3.1 Study Design

This study employed a retrospective cross-sectional design to investigate the risk factors associated with motorcycle accidents and their contribution to trauma outcomes in Ndola. The design was appropriate for analyzing existing hospital records and identifying patterns and associations among variables.

3.2 Study Setting

The study was conducted in Ndola, a major urban center in Zambia's Copperbelt Province. Data were collected from Ndola Teaching Hospital (NTH) and Chifubu Level 1 Hospital. Ndola lay along a key transport corridor and experienced high volumes of motorcycle traffic, particularly among informal transport workers.

3.3 Study Population

The target population included all patients who sustained motorcycle-related injuries and were treated at selected health facilities in Ndola between 1st January 2023 to 31st December 2025.

3.4 Inclusion Criteria

- Residents of Ndola
- Patients of any age and gender involved in motorcycle accidents
- Cases with complete documentation of injury type, cause, and clinical outcome.
- Motorcycle riders, passengers, and pedestrians struck by motorcycles.

3.5 Exclusion Criteria

- Non-motorcycle-related trauma cases.
- Incomplete or illegible medical records.

- Repeat visits for the same injury episode.

3.6 Sample Size Determination

The sample size was calculated using the Cochran formula for proportions, which is appropriate for estimating sample sizes in large populations:

$$N_o = Z^2 \cdot p\,(1-p)/e^2$$

Where:

- $Z = 1.96$ (Z-score for 95% confidence level)
- $p = 0.5$ (assumed proportion for maximum variability)
- $e = 0.05$ (margin of error)

Substituting the values:

$$N_o = (1.96)^2 \cdot 0.5 \cdot (1-0.5) / (0.05)^2$$

$$= 3.8416 \cdot 0.25 / 0.0025$$

$$= 0.9604 / 0.0025$$

$$= 384.16$$

Thus, the initial sample size required is approximately **384 cases**.

Finite Population Correction (FPC)

Given that the total number of motorcycle-related trauma cases in Ndola in 2023 was **262** (RTSA, 2023), which is less than 10,000, the finite population correction was applied using the formula:

$$n = N_o / [1 + (N_o - 1)/N]$$

Where:

- $N_o = 384.16$ (initial sample size)
- $N = 262$ (total population)

Substituting the values:

$$n = 384.16 / [1 + (384.16-1)/262]$$

$$= 384.16 / [1 + 383.16/262]$$

$$= 384.16 / 2.462$$

≈ 156.1]

Therefore, the **adjusted sample size** is approximately **157 cases**.

3.7 Sampling Technique

A **purposive sampling** method was used to select cases that meet the inclusion criteria. This technique is suitable for retrospective studies where specific characteristics (motorcycle-related trauma) are required.

3.8 Data Collection Methods

Data was extracted from hospital records using a structured **data abstraction tool**. Variables to be collected include:

- Demographics (age, gender, occupation)
- Accident details (location, time, helmet use, substance use)
- Injury characteristics (type, severity, body region affected)
- Clinical outcomes (hospitalization duration, disability, mortality)

Trained research assistants conducted the data abstraction under supervision to ensure consistency and accuracy.

3.9 Data Analysis

Quantitative data were entered into SPSS version 25 for statistical analysis. Descriptive statistics, including frequencies, means, and percentages, were used to summarize demographic profiles and injury characteristics of the study population. Inferential statistics, specifically Chi-square tests and logistic regression models, were applied to examine associations between identified risk factors and trauma outcomes. Statistical significance was determined at a threshold of $p < 0.05$.

3.10 Ethical Considerations

Ethical approval

was obtained from the Ndola College of Biomedical Sciences Research Ethics Committee. Permission to access hospital records was sought from the Ministry of Health and the participating health facilities. Patient confidentiality was maintained by anonymizing all data and securing records during and after data collection. No personal identifiers were used in reporting. All methods were carried out in accordance with relevant institutional guidelines, national regulations, and international ethical standards.

RESULTS AND INTERPRETATION

4.1 Demographic Characteristics of Victims

A total of 157 individuals were recorded, comprising both riders and passengers. Figure 1 illustrates that the majority of riders were young adults aged 18–33 years (74%), while only 1.3% were aged 50 years and above. This underscores the predominance of youth involvement in motorcycle-related incidents.

Figure 2 highlights a distinct gender imbalance: all riders were male (62%), whereas females appeared exclusively as passengers (21%). Male passengers accounted for 17%. This pattern reflects the gendered dynamics of motorcycle use, with men overwhelmingly occupying the role of operators and women more frequently positioned as passengers.

Figure 3 illustrates occupational exposure among riders: 70% were engaged in informal transport activities, while 30% used motorcycles primarily for personal purposes. This underscores the dual function of motorcycles as both livelihood assets and private means of mobility, with informal transport clearly dominating.

In terms of residential distribution, Fig. 3 further shows a strong peri-urban concentration, with 61% of cases originating from peri-urban zones, compared to 28% from urban areas and 11% from rural settings. This pattern suggests that motorcycles are most prevalent in transitional regions where formal transport systems are limited.

Time-of-day analysis showed that accidents occurred predominantly in the evening (61%), compared to 20% in the morning and 19% during the day. This pattern coincides with reduced visibility and peak informal transport activity, further compounding risk.

4.2 Risk factors for Motor Cycle accidents

Table 1
Risk Factors and Statistical Associations

Risk Factor	Prevalence (%)	Statistical Test	Result
Helmet use	14.6	χ^2	$\chi^2 = 12.7$, $p < 0.001$ (protective)
Alcohol use	40	Logistic regression	OR = 2.8, p = 0.004 (↑ severity/mortality)
Speeding	34	Logistic regression	OR = 1.9, p = 0.03 (↑ crash risk)
Licensing status	83% unlicensed	χ^2	Single-vehicle crashes, p = 0.02
Motorcycle licensing	89% unlicensed	Descriptive	Regulatory non-compliance
Time of accidents	Evening 61	χ^2	Evening predominance ($p < 0.05$)
Passenger presence	72	Descriptive	Often exceeded safe limits
Mechanical faults	12	Descriptive	Brake failure/tire bursts reported

Table 1 summarizes the risk factor analysis, revealing several critical trends among motorcycle riders. Helmet use was notably low at 14.6%, and chi-square testing confirmed a strong protective effect against severe head injuries ($\chi^2 = 12.7$, $p < 0.001$). Alcohol use was suspected in 40% of cases, with logistic regression showing a significant association with increased injury severity and mortality (OR = 2.8, p = 0.004).

Speeding was reported in 34% of accidents and, when analyzed through logistic regression, emerged as a significant predictor of crash risk (OR = 1.9, p = 0.03). This highlights speeding as an independent contributor to unsafe riding practices, alongside alcohol use.

Licensing status was particularly alarming: only 10% of riders held valid licenses, 6% had expired licenses, and 83% were unlicensed. Similarly, just 11% of motorcycles were licensed, while 89% were unlicensed, reflecting widespread regulatory non-compliance. Chi-square testing further linked rider licensing status to single-vehicle crashes (p = 0.02).

Time-of-day analysis showed that accidents occurred predominantly in the evening (61%), compared to 20% in the morning and 19% during the day, with chi-square confirming evening predominance ($p < 0.05$). Passenger presence was common (72%), often exceeding safe limits, while mechanical faults such as brake failure and tire bursts were reported in 12% of cases.

Taken together, Table 1 demonstrates that low helmet use, alcohol consumption, speeding, widespread licensing irregularities, and evening riding patterns constitute the most significant risk factors contributing to motorcycle-related incidents.

4.3 Injury Types and Severity

Figure 4 illustrates the distribution of injury types categorized by surgical trauma severity. Fractures (38%) were classified as moderate injuries, while soft tissue injuries (22%) were considered minor. Severe injuries included head injuries (26%), internal injuries (14%), and spinal/multiple injuries (12%).

Regional analysis showed that the lower limbs (41%) and head (29%) were the most affected anatomical sites, followed by the chest/abdomen (18%) and spine/multiple regions (12%). Overall, 53% of cases involved moderate to severe trauma, with chi-square testing confirming that head injuries were significantly more frequent among non-helmeted riders and passengers ($p < 0.001$).

Figure 5A: **Discharge Outcomes of Motorcycle Accident Victims**

The average hospital stay was 7.2 days, with longer durations observed among patients sustaining head trauma, internal injuries, or multiple fractures. Figure 5A reviews discharge outcomes, showing that the majority of victims achieved recovery (68%), while 25% required referral for specialized care such as rehabilitation, neurosurgery, or orthopedic follow-up. In-hospital mortality was recorded at 7%, reflecting the burden of severe trauma cases within this cohort.

Figure 5B shows that complications were frequent and clinically significant. Permanent disability was observed in 18% of patients, including neurological deficits, amputations, and chronic pain syndromes. Infections were reported in 11%, while amputations accounted for 4% of cases, predominantly affecting the lower limbs.

Follow-up care was required in 63% of patients, particularly those who underwent surgical interventions or long-term rehabilitation. Statistical analysis confirmed that poor road conditions and substance use were significantly associated with prolonged hospitalization and adverse outcomes ($p < 0.05$).

DISCUSSION AND POLICY RECOMMENDATIONS

5.1 Demographic Insights

The predominance of young males (18–33 years) in Ndola's motorcycle trauma cases reflects the demographic most engaged in informal transport. A recent cross-sectional study in Kisumu, Kenya, similarly found young men to be the majority of motorcycle crash victims, underscoring occupational exposure as a key risk factor (17). Female victims were exclusively pillion passengers, consistent with regional findings that women are more likely to be injured as passengers rather than riders (15). These patterns highlight the need for interventions tailored to both occupational riders and vulnerable passengers.

5.2 Risk Factors and Behavioral Patterns

Helmet use was strikingly low, with only 14.6% of riders reporting usage and negligible adoption among passengers. This aligns with findings from a multi-city African study, which reported that correct helmet use remains below 30% in most urban centers despite existing legislation (18). Alcohol involvement (21%) was also evident, reflecting broader trends in Sub-Saharan Africa where substance use among riders is strongly linked to erratic driving behavior and severe crashes (19).

Similarly, the predominance of night-time travel (61%) echoes evidence from a continental scoping review, which identified infrastructure deficits and reduced visibility as major contributors to accident risk (15).

Taken together, these findings emphasize the urgent need for embedding stricter enforcement of helmet laws, targeted anti-alcohol campaigns, and comprehensive road safety improvements into national policy frameworks.

5.3 Injury Burden

Fractures (38%) and head injuries (26%) dominated the trauma profile, with lower limbs (41%) and head (29%) most affected. These injury distributions are consistent with findings from Kisumu, Kenya, where orthopedic and head injuries were the most common outcomes of motorcycle crashes (17). The high proportion of moderate to severe trauma (53%) underscores the strain on hospital resources, reinforcing

the need for expanded orthopedic and neurosurgical services. Policies should prioritize equipping referral hospitals with trauma care resources and promoting protective gear beyond helmets.

5.4 Clinical Outcomes

Hospital stays averaged 7.2 days, with 18% permanent disability and 6.4% mortality. These outcomes are comparable to regional studies, which report prolonged hospitalization and high disability rates due to delayed emergency response and limited trauma care capacity (17). Head trauma was the leading cause of death, consistent with systematic reviews showing helmets as the most effective intervention for reducing fatalities (20). Strengthening emergency response systems, expanding rehabilitation programs, and integrating trauma registries into hospital practice are critical steps to improve survival and reduce long-term disability.

5.6 Recommendations for Policy and Practice

- **Helmet enforcement and distribution**: Stricter enforcement of helmet laws, coupled with subsidized helmet programs, would reduce head injury prevalence.
- **Licensing and regulation**: Strengthening rider and motorcycle licensing systems could curb widespread non-compliance and improve accountability.
- **Alcohol control measures**: Community-based awareness campaigns and targeted enforcement against alcohol use among riders should be prioritized.
- **Monitoring and evaluation**: Establishing integrated trauma surveillance systems within RTSA and hospitals would enhance data accuracy and policy responsiveness.

5.7 Limitations and Recommendations

This study relied on retrospective hospital records, which may introduce reporting bias and underestimation of accident prevalence, particularly for minor injuries that did not present to health facilities. Documentation inconsistencies could also affect data accuracy. Furthermore, the study was limited to two hospitals in Ndola, which may restrict generalizability to other urban centers in Zambia. Future prospective studies incorporating community-level surveillance and multi-center data would provide a more comprehensive understanding of motorcycle accident burden.

Abbreviations

WHO	World Health Organization
LMICs	Low- and Middle-Income Countries
RTSA	Road Transport and Safety Agency
NTH	Ndola Teaching Hospital
FPC	Finite Population Correction
SPSS	Statistical Package for the Social Sciences
Z	Z-score (standard normal deviate)
p	Assumed proportion
e	Margin of error
N_o	Initial sample size
N	Total population
NCBSREC	Ndola College of Biomedical Sciences Research Ethics Committee

Declarations

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Author Contributions

A.M. spearheaded the study design and conceptualization. He led methodology development, supervised data collection, and conducted formal analysis. In addition, A.M. prepared the original manuscript draft, provided editorial oversight, and coordinated project administration to uphold academic rigor and compliance with institutional standards. make corrections J.N. contributed to data curation, assisted in the investigation, and supported the analysis. He also participated in manuscript review and editing, strengthening the clarity and coherence of the work.

C.B. contributed to methodology refinement, visualization, and manuscript review. She provided critical feedback to enhance the intellectual content and ensure accessibility of findings.

E.M. contributed to data collection at Ndola Teaching Hospital and ensured quality assurance throughout the study process.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate

Ethical approval for this study was granted by the Ndola College of Biomedical Sciences Research Committee (IRB: 0032901; Reference No. NCBS-REC-075/29/OCT/25) and the National Health Research Authority, Zambia (NHRA-2888/11/11/2025) on 25 January 2026. Due to the retrospective design and minimal risk to participants, the requirement for written informed consent was waived. To safeguard confidentiality, all patient data were anonymized and securely encrypted within the data collection and analysis platform. Access to the dataset was strictly limited to the study authors through password-protected systems, thereby minimizing the risk of unauthorized use or disclosure.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Clinical trial number:

Not applicable.

References

1. Konlan K, Hayford A. Risk factors of motorcycle accidents in Africa: A scoping review. Afr J Trauma. 2022;7(1):33–41.
2. Mudenda, S. (2014). Road traffic accidents and disease burden projections in Zambia. Zambia Medical Journal, 41(2), 78–84.
3. Hulme, D. (2011). The neglected burden of road traffic injuries in low-income countries. Global Health Review, 5(1), 23–30.
4. Champahom T, Srichand P, Kittipong S. Motorcycle-related fatalities and sustainable development. Int J Public Health. 2023;18(2):112–20.
5. Okwada J, Temizel S, Mugisha P. Demographic vulnerabilities in boda-boda accidents. East Afr Med J. 2023;100(5):77–85.
6. Temizel S, Mugisha P, Okwada J. Trauma demographics in Uganda’s boda-boda accidents. East Afr Med J. 2021;98(4):55–63.

7. .Brown, T., Mweemba, C., & Banda, J. (2020). *Occupational exposure and road safety among informal transport workers in Zambia*. African Journal of Public Health, 8(2), 112–118.
8. Mundenga P, Kalaba M, Chanda S. Substance use among motorcycle riders and crash risk. Subst Abuse Afr. 2019;8(2):77–84.
9. Blankson R, Mensah K, Boateng J. Motorcycle crash risks per kilometre travelled. J Transport Safety. 2019;12(3):45–56.
10. Díez-Navarro, A., López-Valcárcel, B. G., & González López-Valcárcel, A. (2023). Understanding trauma patterns in motorcycle accidents: A public health imperative. Injury Epidemiology, 10(1), 1–9.
11. Road Transport and Safety Agency (RTSA). Annual road traffic accident statistics. Lusaka: RTSA; 2021.
12. News Diggers. Motorcycle crashes in Zambia: First quarter report. Lusaka: News Diggers Publishing; 2025.
13. United Nations. Transforming our world: The 2030 Agenda for Sustainable Development. New York: UN; 2015.
14. World Health Organization. Global status report on road safety. Geneva: WHO; 2023.
15. Tripodi A, Schermers G. Motorcycle safety in Africa: Report for the African Development Bank and Global Road Safety Facility. Abidjan: AfDB; 2022.
16. .Sichembe M, Banda P, Chileshe C. Motorcycle crashes and trauma admissions in rural Zambia. Rural Health J. 2020;15(2):55–63.
17. Cholo J, Odero W, Ogendi J. Occupational exposure and motorcycle crash victims in Kisumu, Kenya. East Afr J Public Health. 2023;19(1):22–30.
18. Ashraf, L., Shang, Y., Zia, N., Balugaba, B., Afukaar, F., Oporia, F., … Bachani, A. (2022). A multi-city study of helmet use in Africa. *Injury Prevention, 30*(Suppl 1), A136–A137.
19. .Ntramaha, S., Peters, K., Jenkins, J., Mugisha, M. M., Chettod, R., Owino, F., … Johnson, T. (2023). Safety, health and environmental impacts of commercial motorcycles in Sub-Saharan African cities. *Urban, Planning and Transport Research, 11*(1), 2259233. https://doi.org/10.1080/21650020.2023.2259233
20. Abdi, N., Robertson, T., Petrucka, P., & Crizzle, A. M. (2022). Do motorcycle helmets reduce road traffic injuries, hospitalizations and mortalities in low and lower-middle income countries in Africa? A systematic review and meta-analysis. *BMC Public Health, 22*(824). https://doi.org/10.1186/s12889-022-0824 (doi.org in Bing)

Figures

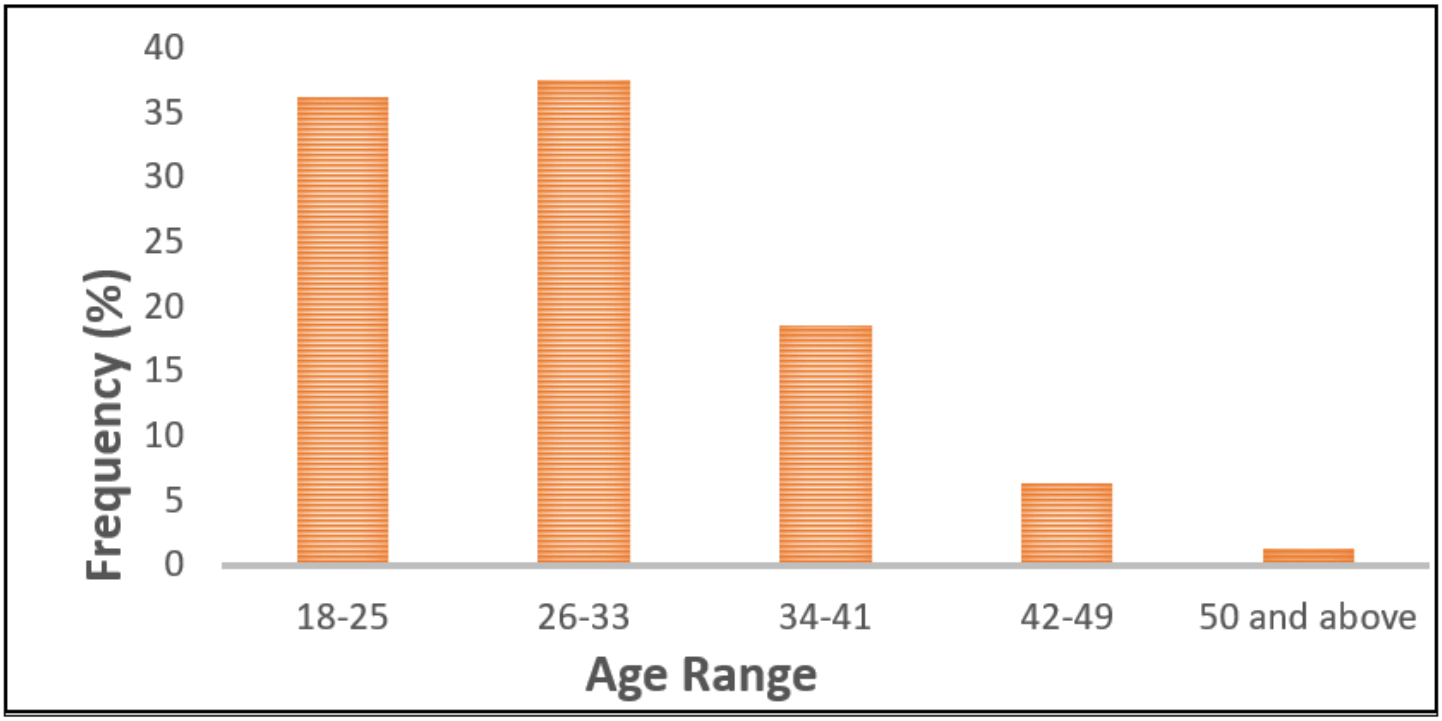


Figure 1

Age Distribution

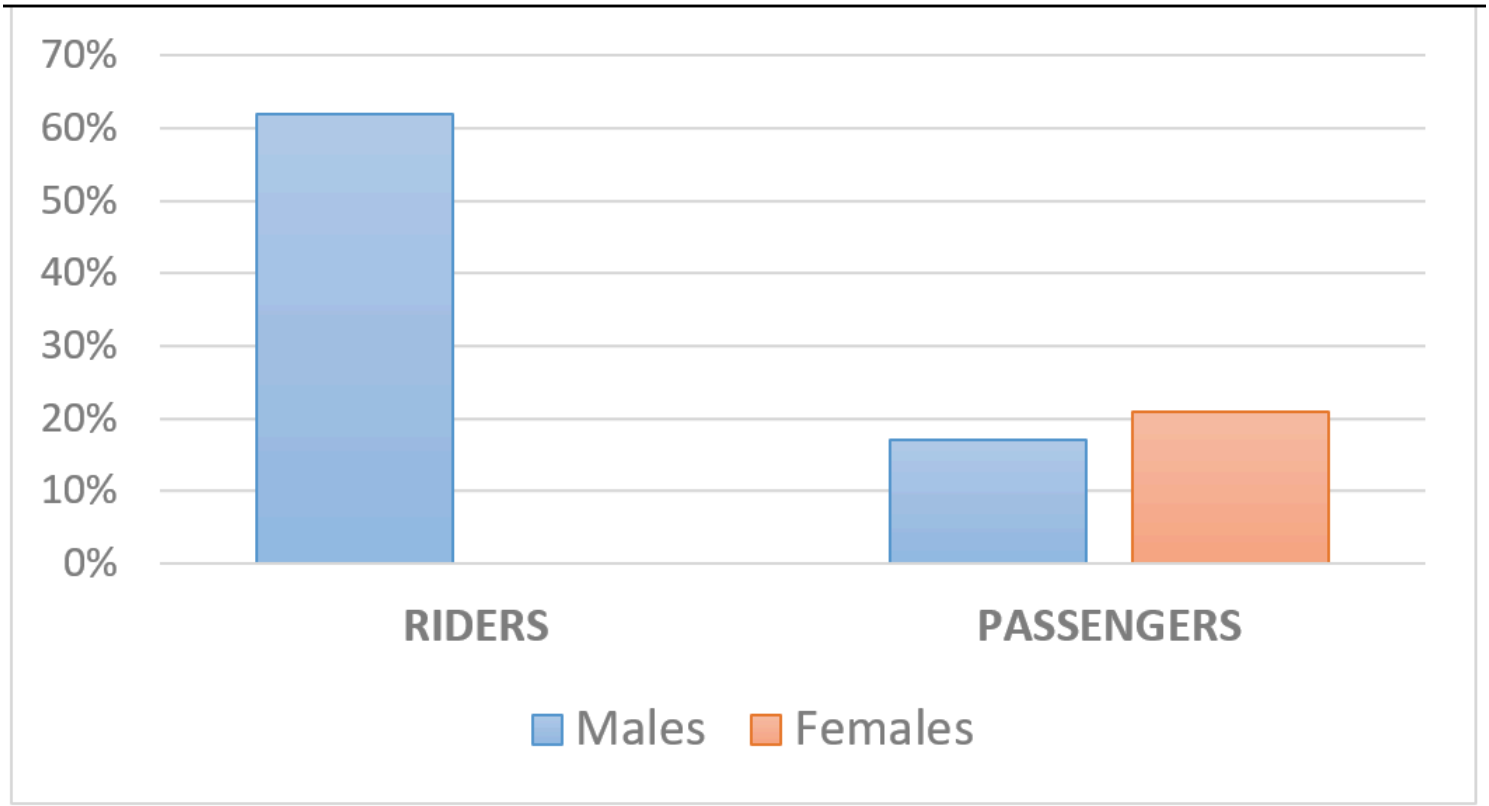


Figure 2

Gender Distribution-Riders and Passengers

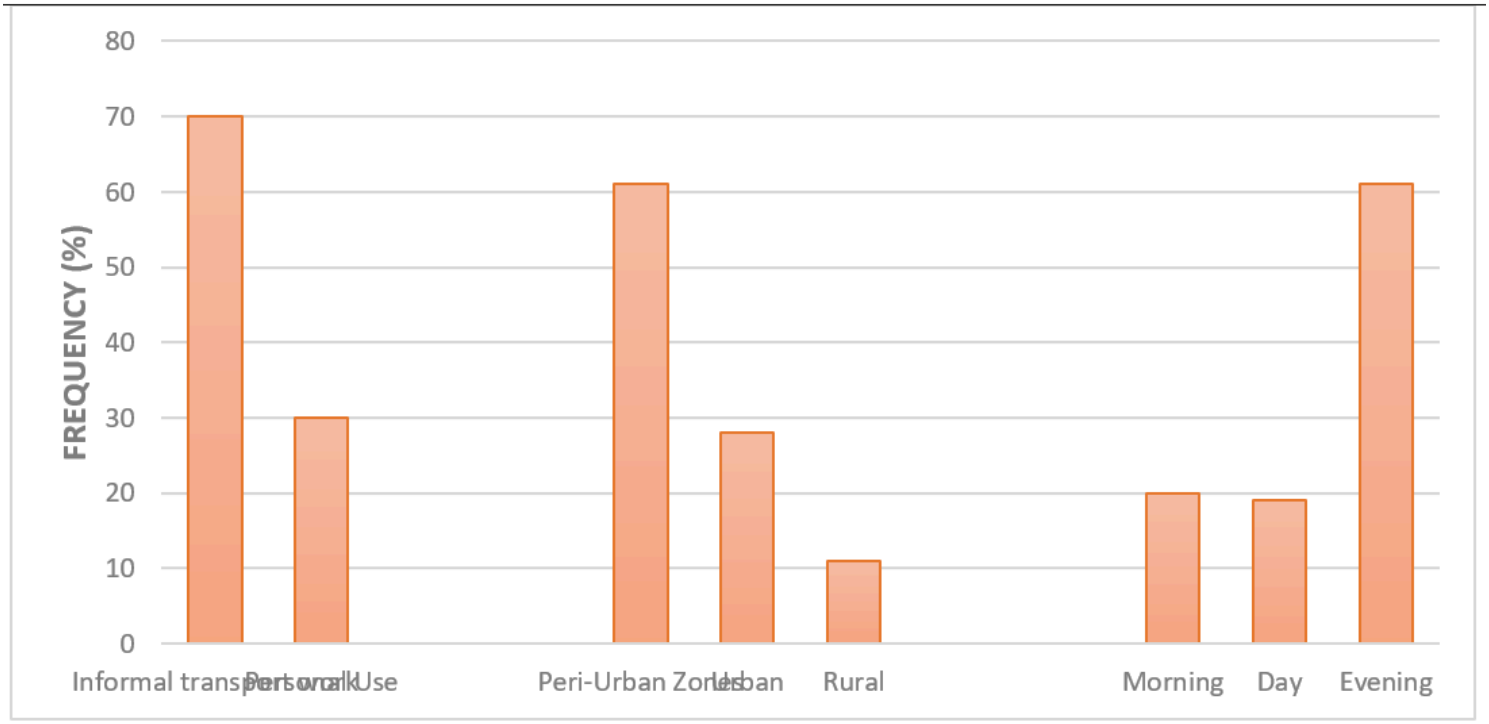


Figure 3

Motorcycle Utilization Patterns

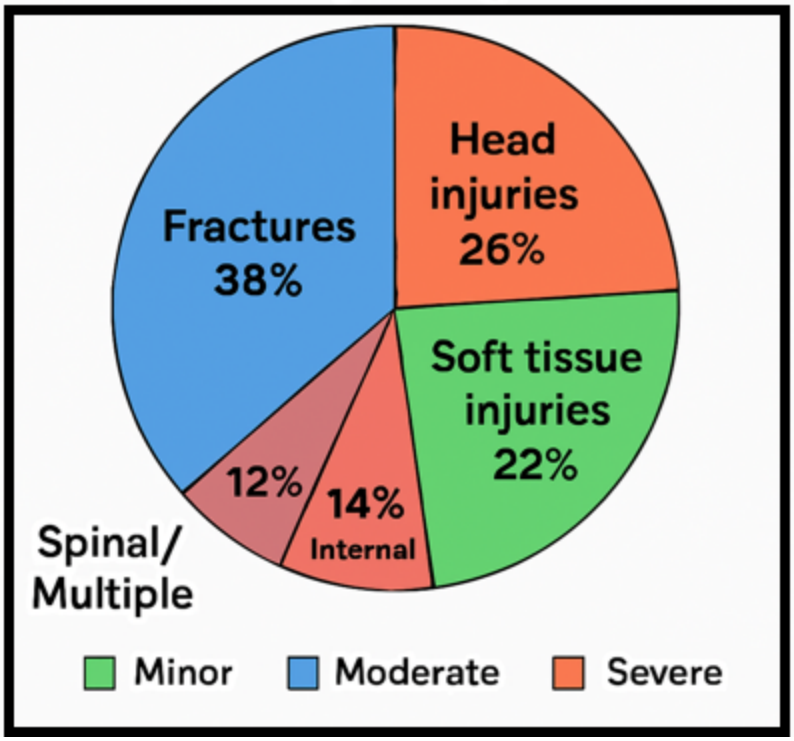


Figure 4

Distribution of Injury Types and Severity Categories among Motorcycle Accident Victims

Figure 5A: Discharge Outcomes of Motorcycle Accident Victims

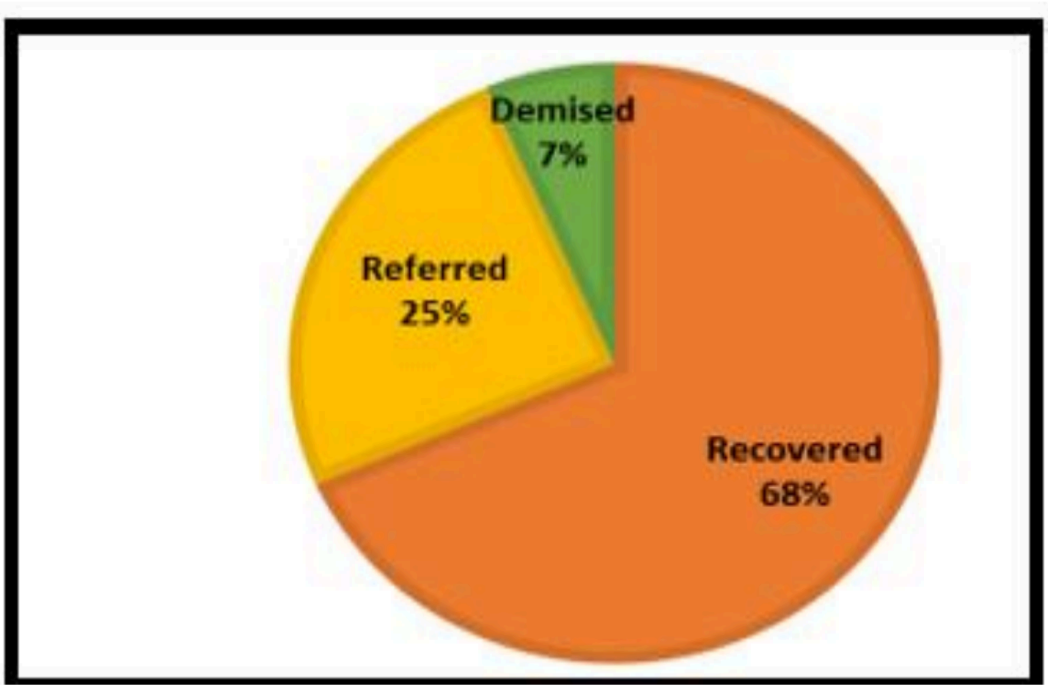


Fig 5B: Complications and Follow-Up Needs

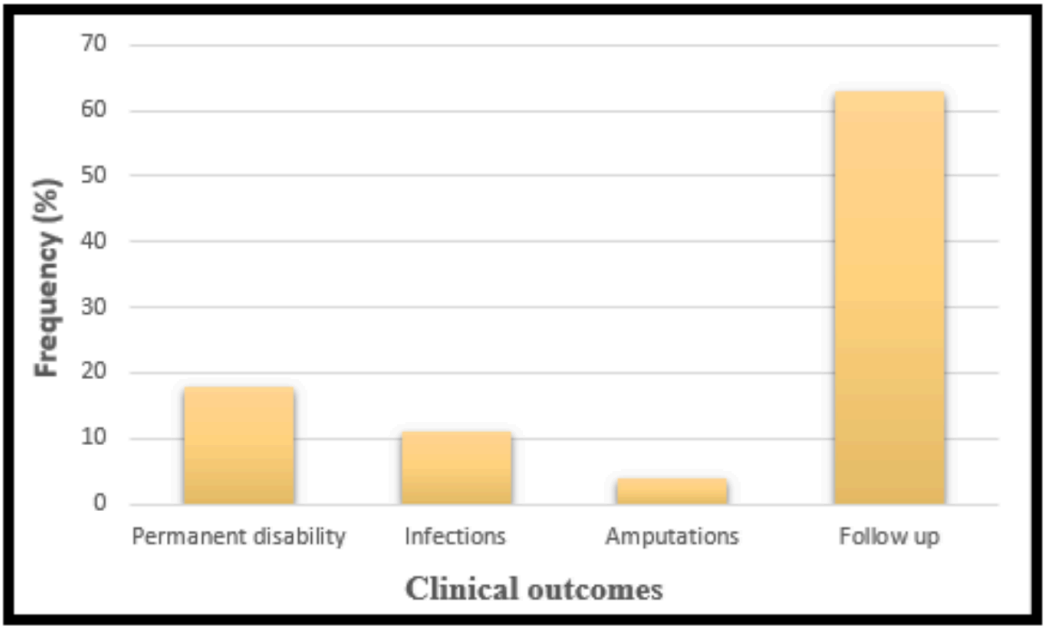


Figure 5

See image above for figure legend

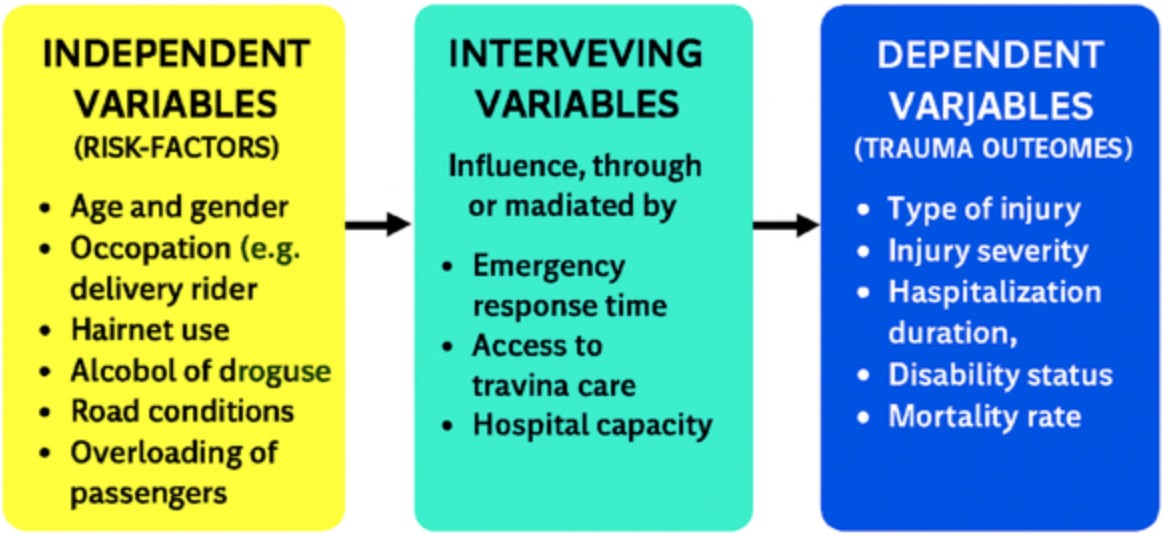


Figure 6

Unnumbered image in the Introduction section.