

Profile of Polytrauma Patients Following Motorcycle Road Traffic Accidents Admitted to Intensive Care Unit in Kinshasa

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Abstract

Introduction: Road traffic collisions are a significant global health burden, with motorcyclists facing disproportionate risks due to limited protection. In low-resource settings like Kinshasa, this vulnerability is worsened by low helmet use and deficiencies in prehospital care. Characterizing polytrauma profiles is essential to inform targeted prevention and improve critical care strategies.

Objective: To describe the sociodemographic, clinical, and outcome profiles of motorcycle-related polytrauma patients admitted to intensive care units (ICUs) in Kinshasa, providing insights to inform policy and clinical practice.

Materials and Methods: A retrospective, multicenter study was conducted across six ICUs in Kinshasa from January 2021 to December 2023. We included adult patients with polytrauma following motorcycle accidents. Data on demographics, injury mechanisms, clinical presentation, management, and outcomes were analyzed using chi-square and Student's t-tests. Logistic regression identified independent predictors of mortality ($p < 0.05$).

Results: Of 450 screened cases, 238 were analyzed. The mean age was 36 ± 12 years, with men comprising 82.4%. Drivers accounted for 64.3% of victims, yet helmet use was documented in only 20.2%. Motorcycle-vehicle collisions were the primary mechanism (57.6%). Head trauma (59.7%) and musculoskeletal injuries (70.6%) predominated. Interventions included oxygen therapy (70.6%), fluid resuscitation (64.7%), and surgery (47.1%). The overall mortality rate was 38.7%. Helmet use was significantly protective, associated with a mortality rate of 25% compared to 42% in non-users ($p = 0.02$), highlighting its impact on outcomes.

Conclusions: Strengthening helmet legislation enforcement and trauma care capacity offers a meaningful opportunity for medical researchers and public health officials to reduce preventable deaths among young males with severe injuries.

Keywords: Motorcycles; Multiple Trauma; Injury Mortality; Intensive Care Units;

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Introduction

Global Context: Road traffic accidents represent a significant public health issue worldwide, accounting for approximately 1.35 million deaths annually and tens of millions of injuries, a significant proportion of which result in long-term disabling sequelae [1]. Among vulnerable road users, motorcyclists constitute a particularly exposed population. They are 34 times more likely to die and eight times more likely to sustain severe injuries compared to car occupants in the event of a collision [2]. This overrepresentation is mainly attributable to the lack of structural protection of motorcycles, the low use of helmets, and non-compliance with traffic regulations, particularly in low- and middle-income countries.

In many regions, motorcycles represent a rapidly expanding mode of transport. According to the World Health Organization (WHO), more than 75% of motorized two-wheelers are in circulation in Asia, 14% in Europe, 5% in Latin America, 2% in North America, 1% in the Middle East, and only 1% in Africa [3]. Despite their relatively small proportion in Africa, motorcycle-related mortality is disproportionately high due to deficient road infrastructure, lack of regulation, and weak prehospital care systems.

Studies conducted in Asia and the Middle East have highlighted the severity of injuries related to motorcycle accidents. In Iran, *Hoseinian et al.* (2019) investigated a cohort of 4,200 motorcyclists and reported a profile dominated by head trauma (35.8%) and lower limb fractures (30%), followed by thoracic and abdominal injuries [4]. Mortality remained relatively low (8%), mainly owing to the availability of specialized care units and an organized trauma management chain.

In West Africa, *Wade et al.* (2015) reported in Senegal that motorcycle accidents accounted for more than half of severe road traffic injuries, with a predominance of cranioencephalic trauma (57%) and musculoskeletal injuries (fractures, dislocations). The observed mortality rate in that cohort was 4.6%, considerably lower than that reported in Central Africa, likely reflecting differences in patient recruitment (emergency department cases rather than exclusively intensive care unit admissions) [5].

African and Congolese Context: In sub-Saharan Africa, several recent studies confirm that motorcyclists represent between 50% and 70% of severe trauma cases managed in emergency departments. In Cotonou (Benin), the incidence of motorcycle taxi accidents was estimated at 1.77%, with a fatality rate of 5.2% [6]. In Chad, 70% of patients admitted for road traffic trauma were motorcyclists [7].

In the Democratic Republic of Congo (DRC), particularly in Kinshasa, the capital city of over 15 million inhabitants, the situation is even more concerning. More than 400,000 motorcycles were officially registered in the city (Provincial Ministry of Transport, 2022), primarily used as public transport (motorcycle taxis) [8]. The exponential increase in the number of motorcycles, combined with the

absence of strict regulatory frameworks, deteriorating road networks, and frequent violations of traffic regulations, has fueled a surge in accidents. Helmet use is poorly observed: in most cases, only the driver wears one, leaving passengers entirely unprotected.

Local Issue: Kinshasa lacks an organized prehospital care system. Victims are typically transported to hospitals by relatives or bystanders, sometimes on other motorcycles, thereby worsening their injuries. First-line hospitals generally lack the technical resources required for polytrauma resuscitation, leading to delays in treatment and poorer survival outcomes. Previous studies by Nsiala (2014, 2018) already demonstrated that mortality among severely injured trauma patients in intensive care units reached 90.7% in 2014, before decreasing to 73.3% in 2018 following the establishment of an embryonic trauma care network, which unfortunately was not sustainable [9, 10].

However, no study to date has specifically described the profile of polytrauma patients resulting from motorcycle accidents admitted to intensive care units in Kinshasa. Most available publications focus on overall mortality among severely injured patients or on general aspects of trauma management without distinguishing the underlying mechanism (vehicle collisions, falls, pedestrian injuries).

Rationale of the Study

This research aims to address this gap by providing a detailed description of the epidemiological, clinical, and outcome profiles of polytrauma patients admitted to intensive care units in Kinshasa following motorcycle accidents. It relies on a recent cohort (2021–2023), enabling comparisons between local characteristics and those reported in other contexts (Iran, Senegal, Benin, Chad).

Specifically, this study seeks to:

- Identify the dominant characteristics of victims (age, sex, role in the accident, circumstances);
- Describe the most frequent injury patterns (cranial, thoracic, abdominal, musculoskeletal).
- Analyze initial clinical parameters and therapeutic management;
- Assess mortality and compare it with international series, and formulate recommendations to improve the prevention and management of motorcycle-related polytrauma in Kinshasa.

Aims: To describe the sociodemographic, clinical, and outcome profiles of polytrauma patients admitted to intensive care units in Kinshasa following motorcycle accidents, and to compare these findings with those reported in the international literature.

Material and Methods

Study Design and Setting: We conducted a retrospective, observational, multicenter study in six intensive care units (ICUs) across Kinshasa Province, Democratic Republic of Congo. The participating institutions were the University

Clinics of Kinshasa, Kinshasa General Referral Hospital, Central Military Hospital, Monkole Hospital Center, Biamba Marie Mutombo Hospital, and HJ Hospital. The study period extended from January 1, 2021, to December 31, 2023. All eligible patients were followed from ICU admission until discharge or death.

Participants: Eligible participants were adults (≥ 18 years) admitted to the ICU following a motorcycle-related road traffic accident, either as drivers, passengers, or pedestrians struck. Polytrauma was defined as the presence of at least two significant injuries involving cranial, thoracic, abdominal, or musculoskeletal systems. Patients were excluded if the accident did not involve a motorcycle, if only a single isolated injury were sustained, or if medical records were incomplete for key variables. Patient selection was exhaustive and consecutive, based on hospital admission registers and medical charts.

Data Collection and Variables

Data were extracted using a standardized form by trained anesthesiology and intensive care physicians, with independent cross-checking by two investigators to ensure consistency. Collected variables were grouped into six domains:

1. *Sociodemographic:* age, sex, marital status, and educational level.
2. *Accident-related:* victim role (driver, passenger, pedestrian), helmet use, mechanism of accident (motorcycle–vehicle collision, motorcycle–motorcycle collision, fall, pedestrian struck), and admission type (direct vs. referred).
3. *Clinical parameters at admission:* systolic blood pressure, heart rate, respiratory rate, oxygen saturation (SpO_2), Glasgow Coma Scale (GCS), Injury Severity Score (ISS), and pupillary examination.
4. *Injury patterns:* cranioencephalic, thoracic, abdominal, musculoskeletal, and multiple injuries.
5. *Management:* medical interventions (oxygen therapy, fluid resuscitation, vasopressors, mechanical ventilation, blood transfusion, mannitol, tranexamic acid) and surgical procedures (laparotomy, thoracic drainage, bone fixation, among others).
6. *Outcome:* survival status at ICU discharge (primary endpoint).

Bias Management

To minimize bias, patient selection was exhaustive across the study period, diagnostic definitions (polytrauma, GCS, ISS) were standardized, and missing data were explicitly recorded and analyzed separately.

Sample Size

The sample size corresponded to all eligible cases during the study period. Of 450 reviewed records, 238 met the inclusion criteria and were analyzed.

Statistical Analysis

Quantitative variables were summarized as means with standard deviations or as medians with ranges, depending on distribution. For clinical interpretation, variables were categorized into relevant groups: age (18–59 vs. ≥ 60 years), GCS (< 9 , 9–12, ≥ 13), and ISS (≤ 15 , 16–24, > 24). Categorical variables were presented as frequencies and percentages.

Group comparisons between survivors and non-survivors were performed using Pearson's chi-square test or Fisher's exact test for categorical variables, and Student's *t* test or Mann–Whitney U test for continuous variables. To identify independent predictors of mortality, binary logistic regression was conducted, including clinically relevant variables and those significant in univariate analysis. Results were expressed as odds ratios (ORs) with 95% confidence intervals (CIs). Statistical significance was defined as $p < 0.05$. Analyses were performed using IBM SPSS Statistics, version 26.0 (IBM Corp., Armonk, NY, USA).

Ethical Considerations

The study protocol was approved by the Ethics Committee of the School of Public Health, University of Kinshasa (reference: ESP/CE/21/2025). Participating hospitals granted authorization for access to medical records. All data were anonymized and managed confidentially in accordance with the principles of the Declaration of Helsinki.

Results

A total of 450 patients' records of motorcycle accident victims were collected from the six participating hospitals between January 2021 and December 2023. After application of the inclusion and exclusion criteria, 238 patients were retained for analysis (Table 1). Exclusions included isolated injuries ($n = 87$), accidents not involving motorcycles ($n = 95$), and incomplete records ($n = 30$).

Hospital	No. Of cases	%
Kinshasa University Clinics	52	21.8
Kinshasa General Referral Hospital	45	18.9
Central Military Hospital	40	16.8
Monkole Hospital Center	38	16.0
Biamba Marie Mutombo Hospital	33	13.9
HJ Hospital	30	12.6
Total	238	100.0

Table 1. Distribution of Patients by Hospital of Admission

Most motorcycle polytrauma patients admitted to the ICU originated from Kinshasa University Clinics and

Kinshasa General Referral Hospital. This distribution reflects both the capacity and accessibility of these facilities for managing severe trauma in Kinshasa.

The majority of admissions originated from the Kinshasa University Clinics (21.8%), followed by the Kinshasa General Referral Hospital (18.9%) and the Central Military Hospital (16.8%) (Table 1). Other facilities accounted for 9.7% to 14.3% of patients. This distribution reflects a concentration of admissions in the major urban hospitals of Kinshasa and highlights the accessibility and availability of intensive care units (ICUs) in the city.

The mean patient age was 36 ± 12 years, with a marked male predominance (82.4%) (Table 2). Most patients were motorcycle riders (64.3%), followed by passengers (25.2%) and struck pedestrians (10.5%). Helmet use remained limited, observed in only 20.2% of patients.

Variable	Mean \pm SD / N	%
Age (years)	36 ± 12	-
Male	196	82.4
Female	42	17.6
Role – Rider	153	64.3
Role – Passenger	60	25.2
Role – Pedestrian	25	10.5
Helmet use – Yes	48	20.2
Helmet use – No	190	79.8
GCS	10.2 ± 3.4	-
ISS	23.1 ± 8.7	-
SBP < 90 mmHg	68	28.6
HR > 100 bpm	102	42.9
SpO ₂ < 90%	77	32.4

Table 2. Sociodemographic and Clinical Characteristics of the Population

The majority of polytrauma patients were young males (18–59 years), reflecting increased exposure of young adults to motorcycle traffic. Low helmet use highlights this population's vulnerability to severe injuries.

On admission, the mean Glasgow Coma Scale (GCS) score was 10.2 ± 3.4 , and the mean Injury Severity Score (ISS) was 23.1 ± 8.7 . Signs of shock were frequent: 28.6% of patients had a systolic blood pressure < 90 mmHg, 42.9% a heart rate > 100 bpm, and 32.4% a SpO₂ < 90% (Table 2). These data illustrate the clinical severity of polytrauma in this population.

Motorcycle-vehicle collisions were predominant (57.6%), followed by motorcycle-motorcycle collisions (21.4%), isolated falls (15.5%), and pedestrian strikes (5.5%) (Table 3). Most patients were admitted directly to the ICU (71.0%), highlighting the significant contribution of vehicle collisions to trauma severity.

Variable	No. Of cases	%
Motorcycle-vehicle collision	137	57.6
Motorcycle-motorcycle collision	51	21.4
Isolated fall	37	15.5
Pedestrian struck	13	5.5
Admission type – Primary	169	71.0
Admission type – Secondary	69	29.0

Table 3. Circumstances of the Accident

Most victims were motorcycle riders, frequently without helmets, increasing the risk of severe trauma. Collisions with motor vehicles were the most common mechanism, emphasizing the main hazard for motorcyclists in Kinshasa's urban traffic. Primary admissions predominated, reflecting direct ICU management.

Traumatic brain injuries were the most frequent (60.5%), followed by musculoskeletal (48.3%), thoracic (37.0%), and abdominal injuries (19.7%) (Table 4). Additionally, 41% of patients presented with injuries affecting three or more anatomical sites, indicating severe and complex polytrauma.

Parameter	Mean \pm SD	Median (Min–Max)
Age (years)	34.8 ± 12.5	32 (18–72)
Systolic BP (mmHg)	110 ± 18	108 (70–150)
Heart rate (bpm)	102 ± 22	100 (60–160)
Respiratory rate (breaths/min)	24 ± 6	23 (12–36)
SpO ₂ (%)	91 ± 8	92 (70–100)
GCS	11 ± 3	12 (4–15)
ISS	22 ± 8	21 (9–45)

Table 4. Clinical Parameters at ICU Admission

Patients presented with severe polytrauma, with reduced blood pressure and oxygen saturation, and neurological compromise suggested by GCS scores. The elevated mean ISS confirms the overall severity of trauma in this population.

Anatomical Injury	No. Of cases	%
Traumatic brain injury	142	59.7
Thoracic	78	32.8
Abdominal	46	19.3
Musculoskeletal	168	70.6
Multiple injuries	96	40.3

Table 5. Injury Profile of Polytrauma Patients

ICU-admitted motorcycle polytrauma patients predominantly sustained musculoskeletal fractures and head injuries, highlighting the severity and multiplicity of lesions. The high frequency of multiple injuries (40%) indicates exposure to complex trauma requiring multidisciplinary management.

ICU management combined medical measures and surgical interventions. Mechanical ventilation was required in 54.2% of patients, fluid resuscitation in 59.7%, vasopressor support in 23.9%, and transfusions in 38.7%. The most common surgical procedures were bone fixation (29.8%) and laparotomy (18.5%) (Table 5, 6). These data underscore the intensity of care required for this high-risk population.

Intervention	No. Of cases	%
Oxygen therapy	168	70.6
Fluid resuscitation	154	64.7
Vasopressors	46	19.3
Mechanical ventilation	52	21.8
Blood transfusion	78	32.8
Mannitol	28	11.8
Tranexamic acid	34	14.3
Surgery (all procedures)	112	47.1

Table 6. Therapeutic Management of Polytrauma Patients

Most patients required intensive medical management, frequently including oxygen therapy and fluid resuscitation. Mechanical ventilation and vasopressor use affected about one-fifth of patients, reflecting the severity of polytrauma. Surgery was performed in nearly half of the patients, illustrating the complexity of injuries and the importance of rapid multidisciplinary care.

Overall ICU mortality was 31.1% (Table 7). The risk of death was significantly associated with a GCS < 9 (OR = 4.2; 95% CI: 2.1–8.3) and an ISS > 24 (OR = 3.5; 95% CI: 1.8–6.8). Secondary analyses revealed that helmet use was associated with lower mortality (25% vs. 42%; $p = 0.02$), whereas no significant difference was observed between drivers and passengers. These findings highlight the importance of initial clinical factors and preventive measures in predicting outcomes for motorcycle polytrauma patients.

Outcome	No. Of cases	%
Death	92	38.7
Survivors	146	61.3

Table 7. ICU Outcomes

Approximately one-third of ICU-admitted motorcycle accident patients did not survive, highlighting the severity of polytrauma in this context. These data emphasize the urgent need to enhance prevention, rapid care, and availability of ICU resources in Kinshasa.

Discussion

In this study, motorcycle polytrauma patients admitted to ICUs in Kinshasa were predominantly young males (82.4%; mean age 36 ± 12 years), illustrating the increased exposure of young adults to motorcycle traffic [1,2]. These results are consistent with findings from *Alghnam et al.* in Riyadh, where most victims were male with a comparable mean age [11]. Similarly, *Zomalheto et al.* in Porto-Novo reported that motorcycle taxi drivers were mostly young men [12]. These observations indicate that young males are at the most significant risk for motorcycle-related injuries, particularly in urban African settings [3,6].

Motorcycle-vehicle collisions were the predominant mechanism (57.6%), followed by motorcycle-motorcycle collisions, isolated falls, and pedestrian strikes [3]. Most patients (71%) were admitted directly to the ICU, reflecting the initial severity of trauma and the need for rapid intervention [4,5].

These results align with those of *Alghnam et al.*, who identified collisions with motor vehicles as the primary type of severe accident [11].

Traumatic brain injuries (59.7%) and musculoskeletal injuries (70.6%) were most frequent, with 40% of patients presenting multiple injuries affecting at least three anatomical sites [5,6]. The high frequency of multiple injuries reflects severe polytrauma requiring multidisciplinary management. These proportions exceed those reported by *Alghnam et al.* in Riyadh, where cranial injuries and limb fractures were less frequent [11]. Low helmet use (20.2%) in Kinshasa and the absence of an organized prehospital system partly explain this severity [2,3].

Zomalheto et al. also demonstrated that prolonged and repeated exposure among motorcycle taxi drivers increases the risk of severe musculoskeletal trauma, particularly spinal injuries [12].

ICU management combined medical interventions and surgery: oxygen therapy (70.6%), fluid resuscitation (64.7%), mechanical ventilation (21.8%), and surgery (47.1%) [5,6]. This therapeutic intensity reflects trauma severity and aligns with observations from *Alghnam et al.*, who reported extensive use of resuscitative measures among motorcycle polytrauma patients [11]. The need for multidisciplinary management underscores the importance of advanced medical infrastructure and skilled personnel.

Overall mortality was 38.7%, higher than reported in international literature [4,5,11]. Major risk factors for death were GCS < 9 and ISS > 24 [5]. Helmet use was associated with lower mortality (25% vs. 42%, $p = 0.02$), while no significant difference was observed between drivers and

passengers [6]. These results reinforce the importance of preventive measures, including helmet use and improved prehospital care, in reducing mortality risk.

Limitations include the study's retrospective design and reliance on the quality of medical records, which may introduce information bias. Nevertheless, the multicenter design and comprehensive recruitment confer good representativeness of motorcycle polytrauma patients in Kinshasa. These findings emphasize the urgent need to strengthen road safety measures, enforce protective regulations, and improve ICU capacity for this high-risk population [1–3, 11, 12].

Conclusion

Motorcycle polytrauma patients admitted to ICUs in Kinshasa are predominantly young males involved in severe collisions with motor vehicles. The complex injury profile, clinical severity, and high mortality distinguish this population from those described in other contexts, such as Riyadh and Porto-Novo. These data highlight the urgent need to enhance road safety, preventive measures, and hospital care for motorcycle accident victims [1–12].

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Conflict of Interest statement

The authors declare no conflicts of interest related to this work.

Authorship contribution

AK, AMB, JN: Study conception and design; WM, KA, LL, AM, JPI, EA, JP, JJK, PM: Data acquisition;

GN, HA, LM, MBB, BB: Data analysis and interpretation; AK, AMB, JN: Manuscript drafting

All authors: Critical revision for important intellectual content, final approval, and accountability for the integrity of the work

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