JOURNAL OF CLINICAL CARE AND MEDICAL ADVANCEMENT

https://doi.org/10.58460/jccma.v1i1.32

Open Access

ORIGINAL ARTICLE

MJM BIOLABS

Road Safety Practices and their Influence on Motorcycle Accidents: A Descriptive Cross-Sectional Analysis of Victims at Nakuru Level 5 Hospital, Kenya

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Article History
Submitted: 18th June 2023
Accepted: 2nd October 2025
Published Online: 2nd October 2025

To read this paper online, please scan the QR code below:

ABSTRACT

Motorcycle accidents constitute a serious public health problem globally and in Kenya, where the boda boda sector dominates local transportation. Unsafe road safety practices, poor knowledge of traffic rules, and socio-economic vulnerabilities contribute to high morbidity and mortality. This study assessed road safety practices influencing motorcycle accidents among victims treated at Nakuru Level 5 Hospital, Kenya. A descriptive cross-sectional design was used. A total of 136 motorcycle accident victims were selected through simple random sampling. Data were collected using a structured questionnaire capturing socio-demographic characteristics, knowledge of traffic rules, and risky riding behaviors. Analysis was conducted using SPSS version 28, with results presented in tables and explanatory narratives. The majority of participants were male (82.96%) and aged 25–29 years (59.23%). Most were engaged in boda boda transport (89.23%) and earned less than KES 10,000 per month (52.96%). Educational attainment was predominantly secondary level (51.29%). Helmet use was high (94.85%), but only 26.47% demonstrated knowledge of traffic rules. Risky behaviors were widespread: overspeeding (94.85%), overtaking from the left (73.53%), riding while tired (73.53%), riding under intoxication (73.53%), and using phones while riding (73.53%). Ignorance of traffic rules was cited by 69.85% as a key factor contributing to accidents. The findings demonstrate that motorcycle accidents in Nakuru are driven by unsafe practices, knowledge gaps, and socio-economic constraints. Helmet use alone does not prevent accidents when risky behaviors persist. Interventions should include structured rider training, public awareness campaigns, stricter law enforcement, and subsidies for protective gear. A multisectoral approach involving NTSA, government, health institutions, and community leaders is critical to reduce the growing burden of motorcycle-related accidents in Kenya.

Keywords: Motorcycle accidents, Road safety practices, Boda boda, Risky behaviors, Nakuru, Kenya

How to Cite this Paper: Ngetich, E., Suge, V., Nyaga, A., & Cherotich, G. (2025). Assessment of Road Safety Practices Influencing Motorcycle Accidents Among Victims Seen at Nakuru Level 5 Hospital, Kenya: A Descriptive Analysis. Journal of Clinical Care and Medical Advancement, 1(1). https://doi.org/10.58460/jccma.v1i1.32

INTRODUCTION

Road traffic injuries (RTIs) represent one of the most pressing yet under-recognized public health crises of the 21st century. Globally, they account for approximately 1.3 million deaths each year, with an additional 20–50 million individuals sustaining non-fatal injuries, many of which result in long-term disabilities and economic hardship (World Health Organization [WHO], 2022). RTIs are the leading cause of death among people aged 5–29 years and remain a major threat to sustainable development, particularly in low- and middle-income countries (LMICs). In addition to the loss of human life, RTIs place significant strain on health systems, reduce productivity, and perpetuate cycles of poverty by disproportionately affecting economically active age groups (WHO, 2018).

Among the various modes of transport implicated in RTIs, motorcycles stand out as both a facilitator of mobility and a contributor to road trauma. Motorcycles are increasingly preferred for their affordability, fuel efficiency, and ability to maneuver through congested roads. These features have made motorcycles indispensable in many LMICs, where public transport systems are often inadequate or inaccessible (Bachani et al., 2012). However, the very attributes that make motorcycles popular speed, flexibility, and low cost also heighten their vulnerability to crashes. The lack of protective enclosures exposes riders and passengers to severe injuries, while behavioral and environmental factors compound the risks (Nakitto et al., 2017).

The burden of motorcycle-related injuries is particularly acute in LMICs, which account for over 90% of global road traffic deaths despite owning only about 60% of the world's vehicles (WHO, 2022). In sub-Saharan Africa, motorcycles have rapidly expanded as a dominant mode of transport and a major contributor to injury-related morbidity and mortality. Studies across the region have consistently shown that motorcycles contribute substantially to trauma admissions, long-term disability, and premature deaths (Chimba et al., 2018; Moshiro et al., 2020; Olumide & Owoaje, 2016). The rapid growth of motorcycle use has occurred in the absence of robust safety regulations, effective enforcement, and structured rider training, creating a perfect storm for escalating road traffic crashes (Konlan & Hayford, 2022).

In Kenya, motorcycles have revolutionized both rural and urban transport through the rise of the boda boda industry. This sector has become an essential part of the informal economy, offering employment to hundreds of thousands of predominantly young men and facilitating affordable mobility for millions of Kenyans (Mutiso & Asamba, 2015). For many unemployed youths, operating boda bodas provides an accessible livelihood option in the face of limited formal job opportunities. The industry has also stimulated rural economies by linking farmers and traders to markets. Yet, the socio-economic benefits of the boda boda sector have been accompanied by steep human and economic costs (Njenga et al., 2018).

Data from the National Transport and Safety Authority (NTSA, 2023) underscore the severity of the problem. In 2022, motorcycles were ranked as the most dangerous mode of transport in Kenya, accounting for more than 1,200 fatalities nationwide (Kinyanjui, 2023). Hospital-based studies have further highlighted the disproportionate burden of motorcycle crashes on healthcare systems. Research indicates that motorcycle-related injuries contribute between 22% and 64% of trauma admissions in Kenyan hospitals, and nearly half of all surgical interventions in referral facilities can be linked to motorcycle accidents (Sisimwo, Mwaniki, & Bii, 2014). These statistics highlight both the magnitude of the crisis and the urgent need for context-specific interventions.

Several factors have been identified as contributing to the high incidence of motorcycle-related accidents in Kenya. Poor knowledge of traffic rules, inadequate formal training, and limited enforcement of licensing requirements have left many riders ill-prepared for safe road use (Konlan & Hayford, 2022). Risky riding behaviors such as overspeeding, unsafe overtaking, alcohol consumption, distracted riding through mobile phone use, and non-compliance with helmet laws further exacerbate the risks (Borstlap & Saayman, 2018). In addition, economic pressures push many riders to work excessively long hours, leading to fatigue, impaired judgment, and heightened vulnerability to accidents (Mutiso & Asamba, 2015). These challenges are compounded by weak institutional enforcement, limited access to safety equipment, and socio-cultural norms that normalize risky practices (WHO, 2018).

Within this broader national context, Nakuru County provides a particularly compelling case for understanding the dynamics of motorcycle-related RTIs. Nakuru, one of Kenya's fastest-growing counties, is an economic hub connecting urban, peri-urban, and rural areas. Motorcycles have become the backbone of local transport, serving as the primary means of mobility for short

distances, feeder routes, and areas poorly served by conventional public transport (Njenga et al., 2018). The growth of the boda boda sector in Nakuru has created significant economic opportunities but has also contributed to an alarming rise in motorcycle-related injuries and fatalities. Hospital records indicate that motorcycle accidents constitute a large proportion of trauma cases in Nakuru Level 5 Hospital, the county's main referral facility (Sisimwo et al., 2014). This trend mirrors findings from other Kenyan counties but appears particularly acute in Nakuru, where rapid urbanization, heavy traffic flows, and economic dependency on motorcycles intersect.

Despite the evident burden, empirical research specifically investigating the knowledge, attitudes, and behaviors of motorcycle riders in Nakuru remains limited. While national and regional studies provide useful insights, there is a lack of localized data that can inform targeted interventions at the county level. Without such evidence, policymakers and stakeholders are left with insufficient guidance on how to design and implement effective road safety strategies tailored to the realities of Nakuru's boda boda sector. This study therefore sought to address this knowledge gap by examining the road safety practices of motorcycle accident victims treated at Nakuru Level 5 Hospital.

METHODOLOGY

Research Design

A descriptive cross-sectional study design was employed. This design was deemed appropriate as it enabled the collection of data on socio-demographic characteristics, knowledge of traffic rules, and risky riding practices among motorcycle accident victims at a single point in time. The cross-sectional approach allowed for the simultaneous assessment of multiple variables within the target population, providing a snapshot of their distribution and interrelationships.

Location of the Study

The study was conducted at Nakuru Level 5 Hospital, a tertiary referral facility located in Nakuru County, Kenya. The hospital provides specialized healthcare services to a population of over two million people drawn from Nakuru and neighboring counties (Kenya National Bureau of Statistics [KNBS], 2019). It is strategically situated along major highways and urban centers, making it a critical referral point for road traffic accident victims from both rural and urban settings. The hospital has specialized orthopedic and trauma units, which are well-equipped to manage musculoskeletal injuries and other complications associated with motorcycle accidents (Nakuru County Integrated Development Plan [CIDP], 2018-2022). Its central role in the healthcare system, coupled with a high patient turnover from accident-related cases, made it an ideal setting for this study.

Study Population and Eligibility Criteria

The study population consisted of adult victims of motorcycle accidents aged 18 years and above who presented to Nakuru Level 5 Hospital during the study period. Eligibility was determined using defined inclusion and exclusion criteria. Participants were included if they were accident victims aged 18 years or older, hemodynamically stable at the time of data collection, and able to provide informed consent. Patients were excluded if they were younger than 18 years, critically ill and therefore unable to participate in interviews, or unwilling to provide consent.

Sampling Framework

The sample size of 150 participants was calculated using Yamane's simplified formula (1967). A simple random sampling technique was applied, ensuring equal chances of selection for all eligible participants. Out of 150 questionnaires, 136 were fully completed and analyzed, representing a response rate of 90.67%.

Data Collection Tools and Procedures

Data were collected using a structured questionnaire that was divided into three sections covering socio-demographic characteristics, knowledge and adherence to traffic rules, and riding behaviors. To ensure clarity and reliability, the tool was pilot tested on 15 participants, after which necessary adjustments were made. The questionnaires were then administered through face-to-face interviews conducted by trained research assistants, allowing for accurate capture of participant responses. To maintain confidentiality, each questionnaire was coded, and all responses were securely stored to prevent unauthorized access.

Data Analysis

Data were coded, cleaned, and entered into Statistical Package for the Social Sciences (SPSS) version 28 for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were generated to summarize socio-demographic characteristics, knowledge of traffic rules, and risky riding practices. Where appropriate, results were accompanied by 95% confidence intervals (CIs) to provide precision around estimates.

Ethical Considerations

Ethical approval for this study was obtained from the Kabarak University Research Ethics Committee (Approval No. KUREC -020422), and research clearance was granted by the National Commission for Science, Technology and Innovation (NACOSTI) (License No. NACOSTI/P/22/17384). In addition, institutional authorization was obtained from the administration of Nakuru Level 5 Hospital prior to data collection. All participants were fully informed about the purpose, procedures, potential risks, and benefits of the study, after which written informed consent was obtained before enrollment. Participation was entirely voluntary, and respondents were assured of their right to withdraw from the study at any stage without any consequences to their treatment. Confidentiality and anonymity were upheld throughout the research process. Questionnaires were coded to avoid the use of personal identifiers, and all data were stored securely with access limited to the research team. Findings are reported in aggregate form to prevent the identification of individual participants.

RESULTS

Response Rate

Of 150 questionnaires distributed, 136 were completed (90.67%).

Socio-Demographic Characteristics

A total of 136 participants were included in the study. The age distribution showed that the majority of respondents (59.23%) were between 25–29 years, followed by those aged 30–35 years (28.21%). A smaller proportion fell within the 18–24 years category (9.26%), while only a few participants were in the 40–45 years (2.30%) and 50–55 years (1.00%) brackets. This indicates that motorcycle accident victims were predominantly young adults, particularly those in their mid-to-late twenties. In terms of gender, the study population was overwhelmingly male (82.96%), with females accounting for only 17.04%. This highlights the male dominance in motorcycle riding and, by extension, their higher exposure to accident risk. Regarding education, slightly more than half of the respondents had attained secondary education (51.29%), while 40.23% had only completed primary education. A smaller fraction reported tertiary education (4.28%), and 4.20% had no formal education. This suggests that the majority of riders had basic or intermediate education levels, with relatively few having advanced training. Marital status analysis revealed that most participants were married (71.55%), while 28.45% were single. Occupationally, the vast majority (89.23%) identified as boda boda riders, with only 10.77% engaged in other forms of work, reinforcing the centrality of motorcycle taxi operations among accident victims. Monthly income levels further illustrated the socio-economic profile of participants. More than half (52.96%) reported earnings of KES 0–10,000, while 40.87% earned between KES 10,001–50,000. Only a small group (6.17%) reported incomes above KES 50,000. This indicates that most riders operate within low-income brackets, potentially influencing their risk behaviors and access to safety measures. See table 1 below.

Table 1:

Socio-Demographic Characteristics of Participants (n = 136)

Variable	Category	Frequency	Percentage (%)
Age (years)	18–24	13	9.26
	25–29	81	59.23
	30–35	38	28.21
	40–45	3	2.30
	50–55	1	1.00
Gender	Male	113	82.96
	Female	23	17.04
Education Level	Primary	55	40.23
	Secondary	70	51.29
	Tertiary	6	4.28
	None	5	4.20

Marital Status	Single	39	28.45
	Married	97	71.55
Occupation	Boda boda	121	89.23
	Other	15	10.77
Monthly Income (KES)	0–10,000	72	52.96
	10,001–50,000	56	40.87
	>50,000	8	6.17

Knowledge and Adherence to Road Safety Practices

The findings revealed notable gaps in participants' knowledge of traffic regulations. Only 26.47% of respondents reported that they fully understood traffic rules, while the majority (73.53%) indicated they did not. Despite this, awareness of broader policy frameworks was relatively high, with 94.85% acknowledging knowledge of the national policy on motorcycle use, and only 5.15% reporting unawareness. With respect to training, just over half of the participants (58.82%) had attended a formal motorcycle training school, whereas 41.18% had not, suggesting that a substantial proportion of riders operate without structured training. On the issue of safety practices, the results were more encouraging. The vast majority of riders (94.85%) reported consistent use of helmets, with only 5.15% admitting non-use. Similarly, 58.82% of respondents reported adherence to traffic rules, although 41.18% acknowledged non-adherence, pointing to significant behavioral risks despite relatively high awareness levels. Overall, the results indicate a paradox: while riders are highly aware of national policy and demonstrate commendable helmet use, gaps persist in understanding traffic rules, undergoing formal training, and consistently adhering to regulations, all of which may contribute to accident risk. See table 2 below.

Table 2:

Knowledge and Adherence to Traffic Rules (n = 136)

Variable	Yes n (%)	No n (%)
Understand traffic rules	36 (26.47)	100 (73.53)
Aware of national policy on motorcycle use	129 (94.85)	7 (5.15)
Attended motorcycle training school	80 (58.82)	56 (41.18)
Consistent helmet use	129 (94.85)	7 (5.15)
Adherence to traffic rules	80 (58.82)	56 (41.18)

Riding Behaviors

The analysis of riding behaviors revealed mixed patterns of safety practices among participants. Regarding protective visibility, only a small proportion of riders (4.41%) reported never wearing reflective clothing, while 22.06% wore them occasionally. The majority (73.53%) indicated they "almost always" wore reflective clothing, though notably, none reported consistent use ("always"). Use of daytime headlights was less consistent. Nearly three-quarters of respondents (73.53%) reported never using headlights during the day, with only 22.06% indicating that they always did so. When asked about speeding, a similar pattern emerged: 73.53% admitted to riding above 50 KPH "not at all," while 22.06% reported "always" riding above this threshold. With respect to fatigue, none of the riders reported riding while tired "not at all" or "always." Instead, 26.47% acknowledged doing so "sometimes," and the majority (73.53%) indicated they "almost always" rode while fatigued. Equally troubling were behaviors related to alcohol use and distractions. For riding while drunk, 73.53% admitted to engaging in the behavior "almost always," with 22.06% reporting occasional involvement. A similar distribution was observed for use of mobile phones while riding, with 73.53% reporting "almost always" using their phones and 22.06% doing so "sometimes." Risky overtaking practices were also common. For overtaking at corners, 73.53% admitted to doing so "almost always," while 22.06% did so "sometimes." For overtaking from the left, a reverse trend was seen: 73.53% reported never engaging in the behavior, while 22.06% acknowledged always doing so, suggesting that a substantial minority consistently adopted a highly dangerous overtaking approach. See table 3 below.

Table 3:
Risky Riding Behaviors (n = 136)

Behavior	Not at all (%)	Sometimes (%)	Almost Always (%)	Always (%)
Wear reflective clothing	4.41	22.06	73.53	0.00
Use daytime headlights	73.53	4.41	0.00	22.06
Ride above 50 KPH	73.53	4.41	0.00	22.06
Ride while tired	0.00	26.47	73.53	0.00
Ride while drunk	4.41	22.06	73.53	0.00
Use phone while riding	4.41	22.06	73.53	0.00
Overtake at corners	4.41	22.06	73.53	0.00
Overtake from the left	73.53	4.41	0.00	22.06

DISCUSSION

The findings of this study provide critical insights into the socio-demographic characteristics, knowledge and adherence to road safety practices, and risky riding behaviors of motorcycle accident victims treated at Nakuru Level 5 Hospital. With a high response rate of 90.67%, the results are representative of the sampled population and underscore the urgent need to strengthen interventions targeting boda boda riders in Kenya. These findings align with global evidence that road traffic injuries disproportionately affect young men in low- and middle-income countries, reflecting an intersection of socio-economic vulnerability, risky behavior, and weak regulatory enforcement (World Health Organization [WHO], 2022).

The socio-demographic profile demonstrated that the majority of victims were young adults, particularly those aged 25–29 years, followed by those aged 30–35 years. This finding is consistent with evidence from Kenya, Uganda, Nigeria, and Tanzania, where motorcycle crashes are concentrated among riders in their twenties and early thirties (Chimba et al., 2018; Moshiro et al., 2020; Olumide & Owoaje, 2016). Young riders often exhibit greater risk-taking tendencies, lower compliance with traffic rules, and limited life experience, which contribute to heightened vulnerability (Nakitto et al., 2017). Moreover, this age group represents the most economically productive segment of the population, meaning that injuries and fatalities among riders in this bracket translate into significant socio-economic losses for households and communities.

The dominance of men in the sample, accounting for 82.96% of participants, reflects the male-dominated nature of boda boda operations. This aligns with studies from Western Kenya and Uganda, which reported that more than 90% of motorcycle taxi riders are men (Mutiso & Asamba, 2015; Nakitto et al., 2017). Cultural norms that discourage women from engaging in physically demanding or risky jobs, as well as barriers such as limited access to capital for motorcycle purchase, have reinforced this gender imbalance (Moshiro et al., 2020). While female participation remains minimal, gender-sensitive interventions could be important in addressing the unique vulnerabilities faced by the small proportion of female riders.

Education levels among riders in this study indicated that most had only primary or secondary education, with very few having tertiary-level training. This finding is significant, as educational attainment is often correlated with knowledge and understanding of road safety practices. Studies from Nigeria and Ghana confirm that riders with lower education are less likely to appreciate the importance of formal training, compliance with rules, and protective equipment (Olumide & Owoaje, 2016; Ackaah & Afukaar, 2010). Limited education also constrains alternative employment opportunities, forcing many into boda boda riding as one of the few accessible sources of livelihood. This highlights the broader structural issue of youth unemployment, which fuels the expansion of the boda boda industry in Kenya (Njenga et al., 2018).

Occupational and income data further illustrated the precarious socio-economic position of riders. Nearly 90% of participants identified as boda boda riders, with over half earning less than KES 10,000 monthly. These low earnings drive riders to work long hours, contributing to fatigue, which was a highly prevalent risky behavior reported in the study. Similar observations have been made in

Uganda and Tanzania, where economic pressures led riders to extend working hours and compromise on safety measures to maximize income (Moshiro et al., 2020; Nakitto et al., 2017). Low socio-economic status not only increases exposure to road crashes but also limits access to quality healthcare after accidents, thereby exacerbating injury outcomes.

Knowledge and adherence to road safety practices revealed a paradox. While helmet use was commendably high, with 94.85% reporting consistent use, only 26.47% of respondents indicated that they fully understood traffic rules. Furthermore, just over half (58.82%) had attended formal motorcycle training school. These findings suggest that awareness campaigns and enforcement around helmet use have been relatively successful in Kenya, likely due to NTSA regulations and public sensitization programs (NTSA, 2023). However, the gaps in traffic rule comprehension and formal training point to systemic weaknesses in licensing and education frameworks. Similar findings were reported in Uganda and Ghana, where awareness of safety policies was high but practical adherence to rules and structured training remained low (Ackaah & Afukaar, 2010; Nakitto et al., 2017). These discrepancies highlight the limitations of policy communication without adequate implementation and monitoring.

Helmet use findings in this study contrast with earlier research in Kenya and Tanzania, where compliance was often below 60% (Bachani et al., 2012; Moshiro et al., 2020). The improvement could reflect progress in enforcement and public education campaigns in recent years. Nevertheless, even small gaps in compliance can have devastating consequences, as helmets are proven to reduce the risk of head injuries by 69% and fatalities by 42% (WHO, 2018). Strengthening enforcement of helmet standards, including quality control to prevent counterfeit helmets, is therefore essential.

Adherence to traffic rules was reported by 58.82% of participants, leaving 41.18% who admitted to non-adherence. This is consistent with studies from Uganda, which found that a significant proportion of boda boda riders knowingly violated traffic regulations (Nakitto et al., 2017). Non-adherence may be linked to poor enforcement, economic incentives to complete rides quickly, and a culture of impunity on the roads. Policy frameworks exist, but weak institutional enforcement reduces their effectiveness, creating conditions where unsafe behaviors persist (Konlan & Hayford, 2022).

Riding behavior data painted a concerning picture of risk practices. While the majority of riders "almost always" wore reflective clothing, none reported consistent ("always") use, suggesting partial but incomplete adoption of visibility measures. More troubling, nearly three-quarters of participants reported never using daytime headlights, despite global evidence that daytime running lights improve rider visibility and reduce collisions (WHO, 2018). Non-compliance with visibility practices has also been reported in Nigeria and Tanzania, where riders cited lack of awareness and cost-related barriers (Olumide & Owoaje, 2016; Moshiro et al., 2020).

Alcohol and distraction-related behaviors were among the most alarming findings. A large majority of riders (73.53%) admitted to "almost always" riding while drunk, while another 22.06% reported occasional alcohol use while riding. Similarly, 73.53% reported "almost always" using mobile phones while riding. These figures are substantially higher than those in comparable studies, where alcohol involvement was estimated at 20–40% among riders in Uganda and Nigeria (Bachani et al., 2012; Olumide & Owoaje, 2016). The normalization of such behaviors in Nakuru suggests serious enforcement gaps and highlights the need for targeted behavioral interventions. Impaired riding is among the strongest predictors of fatal crashes, underscoring the urgency of addressing alcohol use and distracted driving among boda boda riders.

Fatigue-related risk was nearly universal, with 73.53% of participants reporting that they "almost always" rode while tired. Long working hours, driven by low income and high competition, appear to force riders to prioritize earnings over safety. Fatigue has been identified as a major contributor to crashes in other Kenyan counties as well (Mutiso & Asamba, 2015). It reduces reaction time, impairs judgment, and increases the likelihood of risky maneuvers, thereby compounding the already high-risk profile of boda boda operations.

Risky overtaking practices further elevated riders' exposure to crashes. More than 70% of participants admitted to overtaking at corners "almost always," a behavior that drastically increases the risk of head-on collisions. While most riders avoided overtaking from the left, a significant minority (22.06%) reported always engaging in this practice. Improper overtaking has been identified as a leading cause of motorcycle crashes in Tanzania (Moshiro et al., 2020) and Ghana (Ackaah & Afukaar, 2010). These findings underscore the need for stricter enforcement of overtaking rules and targeted rider education on the dangers of such practices.

Overall, the results of this study align with global and regional evidence that road traffic injuries among motorcycle riders are driven by a combination of socio-economic vulnerabilities, inadequate training, poor adherence to safety practices, and risky behaviors. The paradox of high helmet use but low comprehension of traffic rules and persistent engagement in high-risk behaviors points to systemic shortcomings in training and enforcement. Importantly, these results emphasize that addressing motorcycle safety requires more than awareness campaigns; it demands integrated interventions that combine enforcement, structured training, socio-economic support, and community engagement.

Conclusion

In conclusion, this study revealed that motorcycle accident victims in Nakuru were predominantly young men of low socio-economic status, with limited education and earnings. While helmet use and awareness of policy were high, major gaps existed in understanding traffic rules, attending training schools, and consistently adhering to safe riding practices. Risky behaviors such as alcohol use, phone use while riding, riding while fatigued, and dangerous overtaking were widespread, posing serious safety risks.

Recommendations

Based on these findings, it is recommended that the Kenyan government, through mandated agencies, enforce mandatory training and licensing for all riders, strengthen enforcement of impaired riding laws, and implement targeted road safety education campaigns focused on practical rule understanding rather than policy awareness. Socio-economic interventions, such as supporting alternative livelihoods and structured working hours for boda boda riders, may also reduce fatigue-related risks. Without such integrated approaches, the burden of motorcycle injuries will remain disproportionately high among young men in Kenya and similar settings.

Conflict of Interest

All authors declare no conflict of interest.

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