



Association between Utilization of Personal Protective Equipment and Prevalence of Road Traffic Injuries amongst Motorcycle Users in Kibera Constituency, Nairobi County Kenya

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ABSTRACT: Throughout the world, road traffic injuries (RTIs) are a vastly silent encroaching public health problem. Motorcyclists and pillion passengers are two of the most vulnerable road users worldwide. In Kenya, the annual incidence reports on RTIs amongst these groups had been on the rise in recent years. In 2017, 1,270 injuries were recorded while 2018 had 1,587 RTIs amongst these two groups. In 2019, 2,911 injuries were reported and 4,575 injuries in 2020. The purpose of the study was to assess the association between the utilization of Personal Protective Equipment (PPE) and the prevalence of Road Traffic Injuries (minor and major) amongst motorcycle riders in Kibera constituency, Nairobi County, Kenya. Specific objectives were to determine the prevalence of RTIs amongst motorcycle riders, to determine the level of PPE utilization amongst the motorcycle riders, to evaluate the association between the utilization of PPE and the severity of injury sustained by the riders, and to evaluate the effect size of the association between the utilization of PPE and the type of injury sustained by motorcycle riders. A cross-sectional analytical study design was used to gather both qualitative and quantitative data from the motorcycle riders in Kibera constituency. Questionnaires were used to gather information on injuries sustained from the local hospitals and clinics visited by the motorcycle riders in Kibera constituency. A checklist was used to gather data on the utilization of personal protective equipment by motorcycle users in Kibera constituency. The total number of registered motorcycles (2956) was subjected to Slovin's formula $(n) = N / (1 + Ne^2)$ to obtain a representative sample of 353 motorcycle riders who participated in the study. Data was analyzed using SPSS V22 and MS-excel software. Data was subjected to bivariate analysis with crosstabs for case classification, Chi square to evaluate the association, and Cramer's V to measure the effect size of the association. A 95 percent confidence level was used for the whole analysis of this study. The 0.05 level of significance was used throughout the study to test the significance of the association between PPE utilisation and severity of injury when an accident occurred. Utilisation of PPE was negatively associated with severity of injury. Further, while Helmet, Jacket, Heavy trousers and Gloves reduced severity of injury, Reflective vest and Boots were not significantly associated with severity of injury sustained by the Motorcycle riders.

KEY WORDS: Injury, Kibera-Kenya, Motorcycle, PPE.

INTRODUCTION

Road Traffic Injuries (RTIs) are a major public health problem worldwide, leading to a significant number of deaths and injuries. According to the World Health Organization (WHO), an estimated 1.3 million people die each year from road traffic crashes, with 93% of these deaths happening in low- and middle-income countries. Young males under the age of 25 are at a higher risk of involvement in road traffic crashes than females of the same age.

The Decade of Action for Road Safety 2011-2020, launched by the United Nations General Assembly in 2010, aimed to save 5 million lives by 2020. However, despite this global effort, RTIs are still a largely overlooked public health problem, particularly in low- and middle-income countries. In these countries, urbanization and motorization are increasing rapidly, yet there is lack of definitive data on RTIs and cost-effective interventions.

According to WHO, Africa has the highest road traffic mortality rate of 26.6 per 100,000 population, while Europe has the lowest at 8.3 per 100,000 population. Low- and middle-income countries have more than 50% of the world's vehicles but account for more than 90% of road traffic deaths. Preventive and mitigation measures need to be implemented sooner rather than later.



Pedestrians and users of two-wheel vehicles, such as motorcycle riders and pillion passengers, are at a higher risk than motor vehicle occupants. They often bear the greatest impact of newly-registered motorcycle units, with an average of 15,536 units per month in 2017 and 15,749 units per month in 2018.

RTIs are a significant public health problem worldwide, with the majority of deaths and injuries happening in low- and middle-income countries. Africa, in particular, has the highest road traffic mortality rate and is suffering the most from the burden of RTIs. Measures need to be taken to address this problem, including improving infrastructure, active safety campaigns and increasing access to cost-effective interventions. Additionally, more research is needed to understand the specific factors contributing to RTIs in different regions and socioeconomic backgrounds.

The study set out to determine the prevalence of road traffic injuries amongst motorcycle users in Kibera constituency Nairobi county Kenya. It sought to determine the level of personal protective equipment utilization amongst the motorcycle users in the study area. In line with this, the study aspired to determine any association between the utilization of personal protective equipment and the severity of road traffic injuries amongst motorcycle users in Kibera constituency Nairobi County Kenya. This study further aimed to trigger a pursuit switch and motivate more studies and surveys on road traffic injuries and the utilization of personal protective equipment to create a further understanding of the magnitude of road traffic injuries as a problem in the community that had embraced motorcycle riding to the height of being the largest informal source of income both at the community and national level.

METHOD

Study Design

This study was a cross-sectional descriptive survey.

Sample and Population

The study included a sample of 353 participants from the general of 2956 registered motorcycle riders the motorcycle riders. Participants were recruited through random sampling from the city's electoral roll. The inclusion criteria were: being an active motorcycle rider in Kiera constituency Nairobi County Kenya, able to read and understand the informed consent form and willing to participate in the study.

Data Collection, presentation and analysis

The study aimed to gather data on the utilization of personal protective equipment (PPE) by motorcycle riders in Kibera constituency and the prevalence of RTIs amongst the motorcycle riders. A cross-sectional analytical study design was used, which included the use of questionnaires and a checklist. The data was collected over a period of 3 months, and analyzed using descriptive statistics including frequency, percentage, and the chi-square test with a set level of significance at $p < 0.05$. The study aimed to evaluate the any association between PPE use and severity of injury sustained.

Ethical Considerations:

Ethical clearance was obtained from the Ethics Review Committee of Mount Kenya University and NACOSTI to ensure that ethical considerations were strictly followed. The participants were informed about the study and provided written informed consent.

RESULTS

From the results majority of the respondents were male represented by 93.7% with most of them (79.1%) falling under the 15-29 years age bracket. Consistent with the WHO (2018), that highlighted the same on the RTIs vulnerable demographic groups. 69.2% of the respondents had completed high school and or advanced their level of education to undergraduate level which had 72 respondents and represented 21.5% of the study population.

The use of personal protective equipment (PPE) among motorcycle riders was high, with 91% of respondents reporting the use of a helmet and jacket while operating their motorcycles. Use of heavy trousers followed closely at 85.10%, while 67.20% of respondents reported using boots while riding. Gloves were utilized by 64.20% of respondents, and 52% reported using a reflector. The most utilized PPE among the respondents were helmets and jackets.



Utilization of PPE and injury categories

Table 1 presented the distribution of PPE utilization and prevalence of the injury types suffered by the respondents in the study.

Table 1: Utilization of PPE and injury categories

Utilization of PPE		Responses		Percent of Cases
		N	Percent	
PPE	Helmet	305	20.20%	91.00%
	Jacket	305	20.20%	91.00%
	Reflector	175	11.60%	52.20%
	Heavy trousers	285	18.90%	85.10%
	Boots	225	14.90%	67.20%
	Gloves	215	14.20%	64.20%
Total		1510	100.00%	450.70%
Individual injury category				
	Head	222	20.40%	66.30%
	Spinal	85	7.80%	25.40%
	Upper limbs	202	18.60%	60.30%
	Lower limbs	226	20.80%	67.50%
	Visceral organ injury	60	5.50%	17.90%
	Skin abrasions	292	26.90%	87.20%
Total		1087	100.00%	324.50%

a Dichotomy group tabulated at value 1.

There were 1087 injuries recorded from 335 patients. The highest percentage of injuries were reported to be skin abrasions, sustained by 87.20% of the respondents. Lower limb injuries followed at 67.5%, with head injuries at 66.3% and upper limb injuries at 60.3%. Spinal injuries were reported by 25.4% of respondents, and visceral organ injuries by 17.9%. These findings suggest that skin abrasions, head, and lower limb injuries were the most prevalent among motorcycle riders Congruous with earlier findings by Chukwuonye et al., (2019) on "Prevalence of Road Traffic Injuries among Motorcycle Riders in Nnewi, Southeast Nigeria".

Severity of injury sustained by the riders

Severity of the Injuries sustained by the motorcycle riders in the study were categorized into Minor, Moderate, Serious, Severe, and critical and later classified into Minor and Major injuries as shown in Table 2 below.

Table 2: Severity of injury sustained by the riders

Injury class	Frequency	
	Frequency	Percent
Minor	205	61.2
Major	130	38.8
Severity of Injury		
Minor	55	16.4
Moderate	150	44.8
Serious	70	20.9
severe	50	14.9



Critical	10	3
Total	335	100

The results in Table 2 indicates that 55 (16.4%) of the respondents were classified as having minor injuries, 150 (44.8%) were classified as having moderate injuries, 70 (20.9%) were classified as having serious injuries, 50 (14.9%) were classified as having severe injuries and 10 (3%) were classified as having critical injuries.

Minor injuries were more prevalent amongst the respondents compared to the major injuries.

Injury class

According to the result in Table 2, 205 (61.2%) of the respondents were classified as having minor injuries, while 130 (38.8%) were classified as having major injuries.

Use of PPE

The classification of cases for severity of injury (Injury class) and Utilization of PPE was done to ascertain the distribution of Injury type across Utilization of PPE at aggregate level and at individual utilization of PPE type i.e. Helmet, Jacket, Reflector, Heavy trousers, Boots and Gloves as presented in Table 3.

Table 3: Crosstab: Injury class vs PPE use

Crosstab		Injury_class		Total
Count		Minor	Major	
Helmet	Poor use	0	30	30
	Good use	205	100	305
Total		205	130	335
Jacket	Poor use	10	20	30
	Good use	195	110	305
Total		205	130	335
Reflector	Poor use	95	65	160
	Good use	110	65	175
Total		205	130	335
Heavy trousers	Poor use	10	40	50
	Good use	195	90	285
Total		205	130	335
Boots	Poor use	70	40	110
	Good use	135	90	225
Total		205	130	335
Gloves	Poor use	60	60	120
	Good use	145	70	215



Total		205	130	335
PPE use	Poor use	15	80	95
	Good use	190	50	240
Total		205	130	335

From the crosstab table, the frequency count of the two categorical variables in the study were displayed: Severity of the injuries sustained by the motorcycle riders (Injury class) and PPE use by the riders. The table presents the count of minor and major injuries that occurred under different levels of PPE use.

A relationship trail could be drawn from the information in the table but it is important to note that the data presented in this table was observational in nature and therefore, not possible to infer causality based on this alone. In order to determine the level of significance of the association between Individual and full PPE use and injury outcomes a chi square statistical tests was conducted with the results presented in Table 4.

Association between PPE use and Severity of Injury

Table 4. Association between PPE use and Severity of Injury

		Chi-Square Tests		Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
		Value	df			
Helmet	Pearson Chi-Square	51.961a	1	<.001		
	Continuity Correctionb	49.169	1	<.001		
	Likelihood Ratio	61.552	1	<.001	<.001	
	Fisher's Exact Test				<.001	<.001
	Linear-by-Linear Association	51.806	1	0		
Jacket	Pearson Chi-Square	10.771a	1	0.001		
	Continuity Correctionb	9.521	1	0.002		
	Likelihood Ratio	10.469	1	0.001		
	Fisher's Exact Test				0.001	0.001
	Linear-by-Linear Association	10.739	1	0.001		
Reflector	Pearson Chi-Square	.427a	1	0.514		
	Continuity Correctionb	0.293	1	0.588		
	Likelihood Ratio	0.427	1	0.514		
	Fisher's Exact Test				0.575	0.294
	Linear-by-Linear Association	0.426	1	0.514		
Heavy trousers	Pearson Chi-Square	41.998a	1	<.001		
	Continuity Correctionb	39.984	1	<.001		
	Likelihood Ratio	41.951	1	<.001		
	Fisher's Exact Test				<.001	<.001
	Linear-by-Linear Association	41.873	1	<.001		



Boots	Pearson Chi-Square	.411a	1	0.521		
	Continuity Correction ^b	0.273	1	0.602		
	Likelihood Ratio	0.413	1	0.52		
	Fisher's Exact Test				0.552	0.302
	Linear-by-Linear Association	0.41	1	0.522		
Gloves	Pearson Chi-Square	9.866a	1	0.002		
	Continuity Correction ^b	9.145	1	0.002		
	Likelihood Ratio	9.787	1	0.002		
	Fisher's Exact Test				0.002	0.001
	Linear-by-Linear Association	9.837	1	0.002		
Personal Protective Equipment Use	Pearson Chi-Square	115.119a	1	<.001		
	Continuity Correction ^b	112.466	1	<.001		
	Likelihood Ratio	118.968	1	<.001		
	Fisher's Exact Test				<.001	<.001
	Linear-by-Linear Association	114.776	1	<.001		
N of Valid Cases		335				

a 0 cells (0.0%) have expected count less than 5. The minimum expected count is 36.87.

b Computed only for a 2x2 table

The results of the study indicate that the use of a helmet and jacket is significantly associated with the type of injury sustained by motorcycle riders in case of a road traffic accident. The use of a reflector, however, was not significantly associated with the type of injury sustained. Table 4 shows that the use of a helmet was significantly associated with the type of injury sustained by the motorcycle riders (Helmet: $X^2 = 51.961$, $df = 1$, $p = <.001 < .05$). The results also indicate that the use of a jacket was significantly associated with the type of injury sustained by the motorcycle riders (Jacket: $X^2 = 10.771$, $df = 1$, $p = 0.001 < .05$). However, the use of a reflector was not significantly associated with the type of injury sustained by the motorcycle riders (Reflector: $X^2 = .427$, $df = 1$, $p = 0.514 > .05$).

The results also indicated that the use of heavy trousers and gloves was significantly associated with the type of injury sustained by motorcycle riders. The use of boots, however, was not significantly associated with the type of injury sustained. The use of the full personal protective equipment (PPE) in general was also significantly associated with the type of injury sustained by motorcycle riders (PPE Use: $X^2 = 115.119$, $df = 1$, $p = <.001 < .05$). These findings suggest that the use of helmet, jacket, heavy trousers, gloves, and PPE in general play a protective role in reducing the injury impact from accidents involving motorcycle riders. The use of reflectors and boots may not have a significant impact on the type of injury sustained by motorcycle riders in case of a road traffic accident.

Effect size of PPE utilization on Injury class

Table 5 presents the results of symmetric measures, specifically the values of Phi and Cramer's V, for the effect size on the association between the use of various forms of personal protective equipment (PPE) and the severity of the injury sustained by the motorcycle riders in the study



Table 5: Effect size of PPE utilization on Injury class

Symmetric Measures		Value	Approx. Sig.
Helmet	Phi	-0.394	<0.001
	Cramer's V	0.394	<0.001
Jacket	Phi	-0.179	0.001
	Cramer's V	0.179	0.001
Reflector	Phi	-0.036	0.514
	Cramer's V	0.036	0.514
Heavy trousers	Phi	-0.354	<0.001
	Cramer's V	0.354	<0.001
Boots	Phi	0.035	0.521
	Cramer's V	0.035	0.521
Gloves	Phi	-0.172	0.002
	Cramer's V	0.172	0.002
Full PPE use	Phi	-0.586	<0.001
	Cramer's V	0.586	<0.001
N of Valid Cases		335	

Table 5 showed that the effect size of the association between, the use of helmets, jackets, heavy trousers and gloves are negatively correlated with the severity of the injuries sustained by the motorcycle riders (Helmet: $X^2 = -0.394$, $p = <.001 < .05$, Jacket: $X^2 = -0.179$, $p = .001 < .05$, Heavy trousers: $X^2 = -0.354$, $p = <.001 < .05$ and Gloves: $X^2 = -0.172$, $p = 0.002 < .05$ respectively.). Reflectors and boots, on the other hand, had no significant relationship with the severity of the injury sustained from the motorcycle accidents (Reflector: $X^2 = -0.036$, $p = 0.514 > .05$ and Boots: $X^2 = 0.035$, $p = 0.521 > .05$ respectively.) . The full use of PPE had the strongest negative relationship with severity of the injuries sustained by the motorcycle riders, with an effect size of Full PPE use: $X^2 = -0.586$, $p = <.001 < .05$, which is considered a large effect.

DISCUSSION

The results of this study suggested that motorcycle-related injuries were a significant public health concern, with a high prevalence of injuries among riders. The most common injuries recorded were skin abrasions, lower limb injuries, head injuries, and upper limb injuries. This is consistent with previous studies, such as "Prevalence of Road Traffic Injuries among Motorcycle Riders in Nnewi, Southeast Nigeria" by Chukwuonye et al., (2019) which found that the most common injuries among motorcycle riders were fractures and head injuries.

In terms of the severity of injuries sustained, the study found that moderate injuries were the most prevalent, with 205 minor and moderate injuries recorded compared to 130 serious, severe, and critical injuries. This suggests that the majority of injuries sustained by motorcycle riders are minor in nature. A study by Amoako Johnson et al. (2019) on Prevalence and risk factors of road traffic injuries among motorcycle riders in a peri-urban area of Ghana also found a high prevalence of minor injuries among motorcycle riders.

The results of the study suggested that the use of certain types of personal protective equipment (PPE) can play a protective role in reducing the impact of injuries sustained in the event of a motorcycle accident. The use of a helmet, jacket, gloves and heavy trousers may help to reduce the severity of injuries sustained in the event of a crash. However, not all types of PPE appear to have a significant impact on injury outcomes, such as the use of boots and reflectors. PPE use in general is significantly associated with the type of injury sustained by motorcycle riders, suggesting that the use of PPE in general may play a protective role in reducing the severity of injury sustained by the motorcycle riders



It is important to note that the results of the study may be specific to the population and region studied and may not be generalizable to other populations or regions.

Several other studies have also found similar results, with motorcycle riders who use personal protective equipment having a lower risk of injury. A study by Langworth, S. et al. 2002 found that motorcycle helmet use was associated with a significant reduction in the risk of head injury and death among motorcycle riders involved in crashes. A similar study by Sagberg, F. et al. 2011 found that personal protective equipment use among motorcycle riders is associated with a lower risk of injury.

Consistent use of personal protective equipment (PPE) by motorcycle riders was associated with less severe injuries in the event of an accident. Specifically, the use of helmets, jackets, heavy trousers, and gloves was found to be negatively correlated with the severity of injuries sustained, meaning that as the use of these PPE increases, the severity of injuries decreases. The use of reflectors and boots, however, was found to have no significant relationship with the severity of injuries sustained. The strongest relationship was found between the full use of PPE and the severity of injuries sustained. These findings are consistent with previous studies on PPE use among motorcycle riders, such as "Assessment of Personal Protective Equipment Use Among Motorcycle Riders in Urban Nigeria" by Olugbenga Adedokun et al. 2018, and "Assessment of Personal Protective Equipment Use Among Motorcycle Riders in India" by S. S. Tiwari et al. These findings have important implications for motorcycle safety, as they suggest that promoting the use of PPE among riders may be an effective way to reduce the severity of injuries sustained in motorcycle accidents. The study also noted that these findings may be influenced by other factors such as the type of accident, road conditions, traffic laws, and rider behavior and therefore further research is needed to fully understand the relationship between PPE use and the severity of injuries sustained in motorcycle accidents.

CONCLUSIONS

The high prevalence of road traffic injuries (RTIs) among motorcycle riders in Kibera constituency can be attributed to a variety of factors, including lack of employment, poor road intelligence, high speeding, underlying injuries from previous motorcycle crashes, and not attaining riding training from a certified driving school. Unemployment in the area is a major issue, and many residents turn to motorcycle riding as a source of income. However, without proper training or a valid driver's license, these riders may not have the necessary skills to safely operate a motorcycle. Additionally, poor road intelligence amongst the riders can make it difficult for them to safely navigate through modern roads safely. High speeding, which is often a result of riders trying to make more trips in a shorter amount of time, increases the risk of accidents. Furthermore, underlying injuries from previous motorcycle crashes can make riders more susceptible to accidents and injuries. Finally, not attaining riding training from a certified driving school can also contribute to the high prevalence of RTIs, as riders may not have the proper knowledge and skills to operate a motorcycle safely. Overall, the high prevalence of RTIs among motorcycle riders in Kibera constituency highlights the importance of addressing the underlying socio-economic and infrastructural issues in the area, as well as promoting rider education and training programs to improve safety.

Utilization of personal protective equipment (PPE) amongst motorcycle riders in Kibera constituency has greatly improved due to the joint efforts of the national government and international automobile organizations such as the FIA (Fédération Internationale de l'Automobile) a global organization that promotes road safety and works to improve the safety of all road users. The WRC organized by the FIA in 2021 partnered with the national government and other than bring entertainment and people together, the government maximized on the opportunity by taking the chance to create awareness and educate the entire population on the importance of PPE and the ways in which it can protect them from injuries. Tell a friend to tell a friend strategy must have had an impact with reference to mediums used to campaign for proper use of PPE. The radio, television, and social media reached a wide audience. Involvement in previous accidents amongst the riders in Kibera constituency made them become more cautious and aware of the importance of proper PPE use. The code of conduct provided by the local Bodaboda saccos (motorcycle taxi cooperatives) guides the motorcycle riders on how to go about their day to day activities. The saccos may have also collaborated with the local authorities in order to enforce strict traffic laws to ensure the safety of both riders and passengers. Another contributor to the good use of PPE amongst motorcycle riders is the introduction of online apps for transportation like Uber and Bolt that set minimum requirements for PPE utilization both for the riders and their passengers. Other than being affordable than a sole rider, the applications also highlight the maximum number of passengers to be conveyed at one point in time. Attending an NTSA accredited driving school for motorcycle riding training equips the riders with all the knowledge on the traffic laws and the required set standard



of conduct by the authorities from the motorcycle riders. This knowledge is key with reference to road safety for both self and others in general.

Good personal protective equipment (PPE) use amongst motorcycle riders effectively reduces the severity of the injuries sustained by motorcycle riders in the event of a crash. The importance of good PPE use cannot be overstated, as it can make the difference between a minor injury and a severe one, or even between life and death. By promoting good PPE use among motorcycle riders, we can help to reduce the severity of injuries and save lives.

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