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Original Research

Helmet wearing in Kenya: prevalence, knowledge, attitude, practice and implications☆

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ARTICLE INFO

Article history:
Received 17 August 2016
Received in revised form
30 November 2016
Accepted 1 December 2016

Keywords:
Road traffic injuries
Helmet
Kenya
Road safety
Low- and middle-income countries

ABSTRACT

Objectives: In light of the increasing prevalence of motorcycles on Kenyan roads, there is a need to address the safety of individuals using this mode of transport. Helmet use has been proven to be effective in preventing head injuries and fatalities in the event of a crash. This study aims to understand the prevalence of helmet use as well as knowledge, attitudes, and practices in two districts in Kenya over a 5-year period (2010–2014).

Study design: Observational studies on helmet use at randomly selected locations throughout each district were done every quarter to estimate the prevalence of helmet use. Roadside knowledge, attitude, and practice (KAP) surveys were done two times a year in each district.

Methods: Helmet use among motorcycle drivers and passengers in Thika and Naivasha was assessed through systematic observations at randomly selected locations in the two districts between August 2010 and December 2014. Roadside KAP surveys were administered in both sites to motorcyclists in areas where they stopped, including motorcycle bays, petrol stations and rest areas near the helmet observation sites. Secondary analysis of trauma registries was also used. Negative binomial regressions were used to assess trends of helmet wearing among motorcyclists over time, and logistic regressions were used to analyze associated risk factors as well as association with health outcomes among those admitted to the four hospitals.

Results: A total of 256,851 motorcycles were observed in the two target districts during the study period. Overall, prevalence of helmet use among motorcycle drivers in Thika and Naivasha across all periods was 35.12% (95% confidence interval [CI]: 34.87%–35.38%) and 37.42% (95% CI: 37.15%–37.69%) respectively. Prevalence of helmet wearing remained similar after the passage of a traffic amendment bill. These results were not statistically significant in either Thika or in Naivasha. Data from the KAP survey showed that respondents recognized the life-saving effect of wearing a helmet, but many did not always wear a helmet because they found it inconvenient/uncomfortable. Analysis of trauma

☆ Open Access provided for this article by the Johns Hopkins International Injury Research Unit through a grant from Bloomberg Philanthropies.

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http://dx.doi.org/10.1016/j.puhe.2016.12.005

registry data showed that helmet wearing was associated with a significant reduction in head injuries among motorcyclists (adjusted odds ratio: 0.472, 95% CI: 0.327–0.684).
Conclusions: This study highlights the low prevalence of helmet use and documents the potential reduction in the risk of head injuries to motorcyclists if this risk factor was addressed. The passage of a traffic amendment bill showed negligible impact on helmet use. This highlights the need for a multi-faceted strategy that includes media campaigns and widespread enforcement in addition to legislative change for improving helmet use.

Introduction

Kenya is a rapidly developing country in Eastern Sub-Saharan Africa that has and continues to experience increasing motorization. The total number of registered vehicles in the country grew from 750,000 in 2005 to 1,626,000 in 2011, with motorcycles being the largest contributors to this increase from 57,000 (7.6% of all registered vehicle) in 2005 to 514,000 (31.6% of all registered vehicles) in 2011.[1] This trend is similar to that observed in many other low- and middle-income countries around the world, where fatalities among motorcyclists and other motorized two-wheeled vehicles are rapidly increasing.[2,3]

Kenya has amongst the highest road traffic death rates in Africa, estimated at 11 deaths per 100,000 population in 2010.[4] Besides fatalities, road traffic injuries also contribute to a significant proportion of the burden of disability. In Kenya, road traffic injuries were the fifth leading cause of disability adjusted life years (DALYs) among males 15–49 years in 2010.[4] Several studies using hospital surveillance, mortuary, and verbal autopsy data from different regions of Kenya have also highlighted this burden.[5–7] One study from Kenyatta National Hospital, a national referral hospital, found that 61.7% of all trauma admissions were due to road traffic injuries, 7.7% of whom died.[7] The same study also found that motorcyclists were the third largest group of road users injured.[7]

The majority of deaths among motorcyclists involved in road traffic crashes are a result of head injuries, which are estimated to account for over 80% of the fatalities in low- and middle-income countries.[2] While motorcycle helmets have been consistently found to be effective in reducing the risk of death and head injury among motorcyclists in crashes,[8] their use in low- and middle-income countries such as Kenya has historically been low.[9] Amid this increasing burden, advocacy efforts through the Bloomberg Philanthropies Global Road Safety Program (BP-GRSP) and local non-governmental organizations and civil organizations, and a recognition of the need to act on road safety, legislators in Kenya passed an amendment to the traffic bill in November 2012, which among other things, reinforced the mandate of helmet use among all motorcyclists, including drivers and passengers, that was established in 2009.[2,10,11] The amendment in 2012 increased the penalty from 'a fine of five thousand shillings or, in default of payment, to imprisonment for a term not exceeding three months' in 2009,[10] to 'a fine not exceeding ten thousand shillings or, in default of payment, to imprisonment for a term not exceeding twelve months'. The traffic bill amendment was effective once it was signed in November 2012.[11]

This study was undertaken as part of the Bloomberg Philanthropies Global Road Safety Program (BP-GRSP) to evaluate efforts to improve helmet use in two sites—Thika and Naivasha, in Kenya. Specifically, we aim to assess the impact of this legislation in improving helmet use in Kenya. Through a multi-pronged approach, we estimated the prevalence of helmet use before and after this legislation, knowledge, attitudes and practices (KAP) surrounding helmet use, and road traffic crashes and injuries among motorcyclists.

Methods

Three methodologies were used for collecting data for this study: helmet observational studies, roadside KAP surveys and hospital injury surveillance. Each of these methodologies has been detailed previously[9,12] but are also briefly described below.

Helmet observational studies

Serial helmet observations were used to monitor the prevalence of helmet use among motorcycle drivers and passengers in Thika and Naivasha. Helmet use was documented as correct (defined as a standard helmet that was worn correctly and chin strap fastened), incorrect, none or unable to be determined. Systematic observations were done at six randomly selected locations in each of the two target districts as previously described.[9] Observation sites were locations near junctions/intersections and near motorcycle bays (up to 50 m away) where motorcyclists slowed down or stopped to allow helmet observation. A total of 16 rounds of observations were completed between August 2010 and December 2014, with each observation round conducted approximately three to four months apart.

As detailed elsewhere, observations were conducted during five different 90-min periods each day, with each location being observed for at least one weekday and one weekend day to account for variations in traffic patterns and build a representative picture of the prevalence of helmet use in the two sites.[9]

Data were entered in Epi Info version 7, then managed and analyzed using STATA 13 (StataCorp 2013)[13] and Microsoft Excel. Exploratory analyses were first conducted using tabulations and cross-tabulations to identify patterns in helmet use in each of the target sites and by round of observation. Chi-squared tests were used to assess whether the differences

between observation rounds were statistically significant. Negative binomial regression models were fit to assess trends over time and multivariate logistic regression models were fit to analyze factors associated with correct helmet use, clustered by observation site. For the analysis of trends in helmet use, a spline term was included to test for the change in trend with the passing of the traffic amendment bill in November 2012. Weather and observation period were controlled for in the constrained model. Separate models were run for each target district. Goodness of fit of each model was assessed using likelihood ratio tests.

Roadside KAP surveys on helmet use

Roadside KAP surveys of motorcycle riders were conducted in each of the two target districts to assess and monitor the changes in the knowledge, attitudes, and practices of helmet use.[9] These surveys were conducted twice a year, with a total of eight rounds of KAP surveys between August 2010 and December 2014. The surveys were administered to motorcyclists in areas where they stopped, such as motorcycle bays, petrol stations and rest areas near the helmet observation sites.[9] The six randomly selected KAP survey locations in each of the two target districts were selected based on a multi-stage sampling method previously described.[9]

Surveys were conducted throughout the week and at varying times of the day in between helmet observation intervals. As described previously, participants were selected based on convenience sampling. Verbal consent from participants was obtained before the initiation of the survey. A close-ended questionnaire was developed to capture information such as self-reported behavior of helmet use, helmet ownership, factors that affect the purchase of a helmet, perceptions on enforcement and reasons for use and non-use of helmets.[9,14] The study protocol was approved by the Johns Hopkins University Bloomberg School of Public Health Institutional Review Board.

Data were entered in Epi Info version 7. Data management and analyses were conducted using STATA 13 (StataCorp 2013) and Microsoft Excel. Exploratory analyses were conducted using tabulations and cross-tabulations of response by each target area and rounds of data collection. Chi-squared tests were used to assess the difference between KAP survey rounds.

Hospital-based injury surveillance

Hospital-based trauma registries are operating in four public hospitals in Kenya: Thika Level 5 Hospital, Naivasha District Hospital, Kenyatta National Hospital, and Machakos Level 5 Hospital. The process of establishing trauma registries and their structure in these hospitals has been described in detail previously.[12] Electronic data collection was implemented across the four hospitals in January 2014. For this analysis, we included trauma registry data between January 2014 and February 2015. Data were collected on a range of variables including demographics of the patient, type and mechanism of injury, date and time of injury, injury characteristics, type of treatment and treatment outcomes. Patients admitted due to road traffic injuries were asked about their mode of transport at the time of the crash. Self-reported helmet use at the time of the crash was included as a follow-up question for patients reporting to have been on a motorcycle or bicycle at the time of the crash.

Data were entered electronically on-site. Data quality assessment and analysis was done using STATA 13 (StataCorp 2013). Only data pertaining to motorcyclists were included in the analyses. Following exploratory data analysis using tabulations and cross-tabulations, logistic regression models were fit to examine the association between helmet use and head injury. Goodness of fit for the regression models was assessed using a likelihood ratio test.

Results

Helmet use prevalence

Motorcycle drivers

A total of 256,851 motorcycles were observed at the 12 observation sites in the two target districts during the study period. The overall prevalence of helmet use among motorcycle drivers in Thika and Naivasha was 35.12% and 37.42%, respectively. In total, 10.26% of all observed motorcycle drivers wore helmets incorrectly (Thika: 9.92%, Naivasha: 10.63%). Fig. 1 shows the overall trend of correct helmet use by motorcycle drivers over the 16 rounds of observation.

Negative binomial models were fit to assess trends in the prevalence of correct helmet use over time. Bivariate analysis showed a very slight increase in the prevalence of correct helmet wearing by round of observation in both districts. While this increase was not statistically significant for Thika (Incidence rate ratio [IRR]: 1.007, $P = 0.40$), it was for Naivasha, where correct helmet used increased by 3% (IRR: 1.030, $P < 0.05$) with each subsequent round of observation (Table 1).

Following the inclusion of a spline term with one knot to assess trends before and after the passage of the traffic amendment bill in November 2012, a slight difference in trends before and after this time point was seen among drivers in Thika, controlling for observation time, weather condition and observation location but changes were not statistically significant (Table 1). In Thika, the prevalence of correct helmet wearing among drivers was on a downward trend (aIRR per observation round: 0.977, $P = 0.41$) prior to the passing of the traffic amendment bill, but reversed slightly after November 2012 (aIRR per observation round: 1.033, $P = 0.39$). While a small statistically significant increase in correct helmet wearing among drivers (aIRR per observation round 1.030, $P < 0.001$) and passengers (aIRR: 1.043, $P < 0.05$) was observed in Naivasha between 2010 and 2014, we did not find a change in trends before vs after the passage of the traffic amendment bill in November 2012 in Naivasha. A slight increasing trend was observed prior to the passing of the traffic amendment bill (aIRR: 1.049, $P = 0.08$), and remained so after the passage of the bill (aIRR: 1.017, $P = 0.49$). Comparing any changes in correct helmet wearing level before and after passage of the traffic amendment bill in November 2012 also found no statistically significant difference (Table 1). Controlling for the trends, there were no statistically significant changes on correct helmet use level among drivers and passengers comparing after the traffic amendment with before the amendment in both Thika and Naivasha (results not shown).

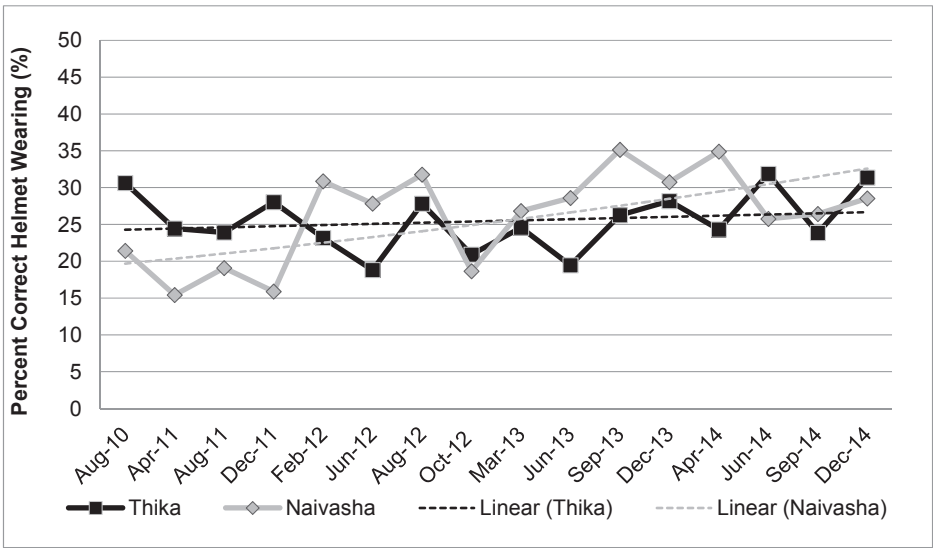

Fig. 1 – Prevalence of correct helmet wearing among motorcycle drivers in Thika and Naivasha (n = 256,830).

Logistic regression analysis was used to assess factors associated with correct helmet use. Time of observation and weather condition were associated with correct helmet wearing (Table 2). Controlling for the round of observation before and after the passage of traffic amendment bill and observation location, light rain was found to be associated with higher odds of correct helmet use among motorcycle drivers in Naivasha as compared to no rain (odds ratio [OR]: 1.377, $P < 0.01$) (Table 2). However, the same association was not observed in Thika (OR: 1.046, $P = 0.16$) (Table 2). Time of day was associated with helmet wearing in both sites. Motorcyclists were less likely to wear helmets later in the morning, at mid-day and in the afternoon as compared to early morning in Thika (Table 2).

Motorcycle passengers

In both districts, over half of the motorcycles did not have any passengers (Thika: 51.68%, Naivasha: 56.92%), while close to a tenth of motorcycles observed in Thika and approximately 5% of motorcycles observed in Naivasha had two passengers or more. Overall helmet wearing (including correct and incorrect helmet wearing) was significantly lower among passengers as compared to drivers (Figs. 1 and 2). Overall helmet wearing among motorcycle passengers was 2.77% in Thika and 2.43% in Naivasha. Overall, 2.11% of the passengers wore a helmet correctly in Thika and 1.95% in Naivasha.

Negative binomial regression analysis of correct helmet wearing among passengers shows a declining trend in Thika (IRR: 0.952, $P < 0.1$) and a slight increase in Naivasha over the

Table 1 – Incidence rate ratio (IRR) of correct helmet wearing among drivers (n = 132,243) and passengers (n = 76,830) in Thika and drivers (n = 1,22,873) and passengers (n = 58,058) in Naivasha.

Location	Type of occupant	Period	IRR (SE)	
			Bivariate	Multivariate
Thika	Drivers	Overall (per round)	1.007 (0.013)	1.008 (0.014)
		Before November 2012 (per round)	0.983 (0.020)	0.977 (0.027)
		After November 2012 (per round)	1.036 (0.039)	1.033 (0.039)
		After November 2012 (vs before November 2012)	0.910 (0.137)	0.907 (0.135)
	Passengers	Overall (per round)	0.952* (0.026)	0.957 (0.028)
		Before November 2012 (per round)	0.953 (0.091)	0.963 (0.092)
		After November 2012 (per round)	0.951 (0.087)	0.953 (0.085)
		After November 2012 (vs before November 2012)	0.638 (0.402)	0.666 (0.295)
Naivasha	Drivers	Overall (per round)	1.030*** (0.004)	1.030*** (0.005)
		Before November 2012 (per round)	1.050* (0.030)	1.048* (0.029)
		After November 2012 (per round)	1.016 (0.024)	1.017 (0.024)
		After November 2012 (vs before November 2012)	0.994 (0.289)	1.003 (0.290)
	Passengers	Overall (per round)	1.035** (0.018)	1.043** (0.017)
		Before November 2012 (per round)	1.016 (0.068)	1.037 (0.082)
		After November 2012 (per round)	1.048 (0.055)	1.047 (0.057)
		After November 2012 (vs before November 2012)	1.162 (0.414)	1.202 (0.443)

Multivariate models controlled for weather conditions observation time.
* $P < 0.1$; ** $P < 0.05$; ***, $P < 0.001$.

Table 2 – Results from multivariate logistic regression model on correct helmet wearing among drivers (n = 1,32,243) and passengers (n = 76,830) in Thika and drivers (n = 1,22,873) and passengers (n = 58,058) in Naivasha.

	Thika		Naivasha	
	Drivers	Passengers	Drivers	Passengers
	OR (SE)	OR (SE)	OR (SE)	OR (SE)
Weather condition				
Dry/no rain	Ref	Ref	Ref	Ref
Light rain	1.046 (0.034)	1.697*** (0.153)	1.377*** (0.046)	1.755*** (0.210)
Heavy rain	0.981 (0.134)	1.317 (0.606)	0.961 (0.069)	1.381 (0.433)
other	1.613* (0.457)	NA	0.972 (0.093)	2.862*** (0.818)
Observation time				
7.30–9 am	Ref		Ref	
10–11.30 am	0.768*** (0.015)	0.710*** (0.060)	0.910*** (0.019)	0.894 (0.089)
12.30–2 pm	0.703*** (0.014)	0.763*** (0.063)	0.820*** (0.017)	0.843* (0.087)
3–4.30 pm	0.743*** (0.015)	0.881 (0.070)	0.912*** (0.019)	1.071 (0.103)
5.30–7 pm	0.903*** (0.018)	1.106 (0.080)	1.05** (0.021)	1.174* (0.106)
Observations	1,32,243	76,830	1,22,873	58,058
AIC	146301.7	14898.92	135443.8	10706.97
BIC	146448.6	15028.41	135609	10859.44

OR = odds ratio.
Controlled for round of observation before and after passage of traffic amendment bill and observation location.
* $P < 0.1$; ** $P < 0.05$; ***, $P < 0.001$.
AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion.

study period (IRR: 1.035, $P < 0.05$). The inclusion of a spline term with a knot in November 2012 to represent the passing of the traffic bill and an indicator variable after November 2012 did not indicate changes in trends nor levels in both Thika and Naivasha (Table 1). Controlling for weather condition and time of observation, similar trends of correct helmet remained in Thika among motorcycle passengers before (IRR: 1.024, $P > 0.1$) and after the traffic bill amendment (IRR: 0.982, $P > 0.1$), and in Naivasha before the traffic bill amendment (IRR: 0.993, $P > 0.1$) and after the traffic bill amendment (IRR: 1.033, $P > 0.1$).

Similar to motorcycle drivers, correct helmet use among passengers was associated with weather conditions and time of the day but stronger association with weather when compared to motorcycle drivers (Table 2). Controlling for the round of observation, time period of observation and observation location, motorcycle passengers were more likely to correctly wear a helmet during periods of light rain in both Thika (OR: 1.697, $P < 0.01$) and Naivasha (OR: 1.755, $P < 0.01$) as compared to dry periods. The odds of correct helmet use was slightly higher in Naivasha in the evening (OR: 1.174, $P < 0.1$) as compared to the early morning, while no statistically significant difference was observed in Thika comparing the same period (Table 2).

Knowledge, attitudes, and practices (KAP)

A total of 8889 motorcyclists were approached (4628 in Thika and 4261 in Naivasha) over the eight rounds of data collection during the study period. Of those, 7071 motorcyclists (79.6%) (3970, 85.8% in Thika; 3101, 72.8% in Naivasha) accepted the interview. Response rate per round of data collection ranged between 79.6% and 92.0% in Thika and 67.1% and 78.4% in

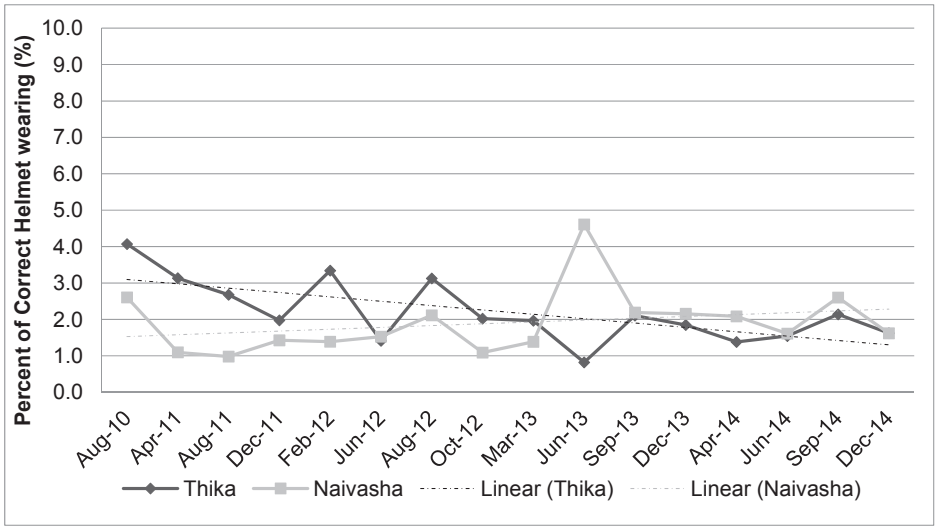

Fig. 2 – Prevalence of correct helmet wearing among motorcycle passengers in Thika and Naivasha (n = 144,133).

Naivasha. Respondents were predominantly males (Thika: 97.9%, Naivasha: 97.1%). Approximately half of the respondents (Thika: 52.1%, Naivasha: 42.2%) had secondary or high school education.

Table 3 summarizes findings on helmet use and reasons for use and non-use of helmets in Thika and Naivasha. On average, 63.1% of respondents in Thika and 66.2% of respondents in Naivasha reported that they always wore a helmet when riding a motorcycle. The majority of respondents who always wore a helmet indicated they did so because it could save their lives (Thika: 90.3% [SD: 5.2%], Naivasha: 91.3% [SD: 3.4%]), while a significantly lower proportion said they did so because it was required by law (Thika: 37.0% [SD: 7.1%], Naivasha: 22.0% [SD: 12.6%]). The most commonly cited reason for not always wearing a helmet was that respondents found them to be inconvenient or uncomfortable in both districts (Thika: 47.6% [SD: 8.3%], Naivasha: 45.8% [SD: 10.5%]).

Except in the first round of the survey, more than two-thirds of respondents in both districts indicated they owned a helmet, and the majority bought their helmets at motorcycle/helmet specific shops (Thika: 65.2% [SD: 13.9%], Naivasha: 63.5% [SD: 9.7%]). Approximately half of the respondents in Thika and two-thirds in Naivasha paid between US$10 and $20 for their helmets. Quality was the most important factor in the decision on what helmet to purchase, and price was the second most important factor among respondents in both districts. Results from KAP survey also suggested no major change on police enforcement on helmet use over time and before and after passing the helmet law (Fig. 3).

Head injuries and helmet use

Data from trauma registries at four hospitals in Kenya (including hospitals in Thika and Naivasha) show that approximately a quarter of road traffic patients (26%) were motorcyclists. Among the motorcycle drivers who were injured and admitted to these hospitals, just over a third reported wearing a helmet at the time of the crash (38.9%), while less than half this proportion (14.2%) of motorcycle passengers reported wearing a helmet.

The bivariate analysis suggested a significant reduction in the likelihood of head injuries among motorcyclists who were wearing a helmet at the time of the crash among patients injured from motorcycle crash (OR: 0.576, 95% confidence

Table 3 – Results from roadside KAP survey on helmet wearing in Thika (n = 3970) and Naivasha (n = 3101).

	Thika		Naivasha	
	Average (%)	(SD, %)	Average (%)	(SD, %)
Always wear a helmet	63.1	(9.2)	66.19	(8.0)
Reason(s) always wearing a helmet				
It's required by law	37.0	(7.1)	22.04	(12.6)
Police can fine me if I don't	17.8	(5.0)	13.9	(12.0)
It can save my life	90.3	(5.2)	91.30	(3.4)
Others	13.0	(9.1)	11.05	(8.7)
Reason(s) not always wearing a helmet				
It is inconvenient/uncomfortable	47.6	(8.3)	45.79	(10.5)
I forget sometimes	19.9	(5.7)	20.70	(7.3)
The helmet is broken	10.3	(2.7)	5.71	(3.3)
I do not have a helmet	18.3	(6.4)	14.13	(4.9)
Depending on where I drive or ride (e.g. highway vs local road)	31.0	(8.4)	26.93	(6.9)
I am a highly skilled driver and helmet is unnecessary	1.3	(1.0)	1.58	(1.3)
Others	14.2	(5.6)	18.83	(14.5)
Respondent owns a helmet	74.8	(10.5)	83.8	(9.3)
Where respondent obtain helmet (if own)				
Motorcycle/helmet specific shop	65.2	(13.9)	63.5	(9.7)
General shopping center/mall	7.1	(3.6)	16.0	(9.6)
Street market/seller	2.9	(1.9)	2.2	(1.3)
Bought from friend, colleague, acquaintance	3.1	(1.6)	3.1	(2.1)
Given the helmet	10.5	(4.8)	4.0	(2.8)
Found the helmet	4.3	(6.3)	3.1	(7.3)
Other	7.8	(11.8)	12.7	(12.7)
Important factors in purchasing the helmet				
Color	11.5	(6.4)	10.4	(7.2)
Price	26.6	(11.9)	26.7	(17.3)
Style/look	8.9	(4.5)	15.1	(8.4)
Quality	42.9	(9.8)	49.3	(10.0)
Certified as 'standard' helmet	5.0	(2.4)	9.5	(7.7)
Brand/company name	6.2	(3.8)	15.2	(10.3)
Other	5.6	(5.3)	3.1	(2.7)
No relevant factors in purchasing a helmet	12.3	(7.9)	12.8	(12.9)

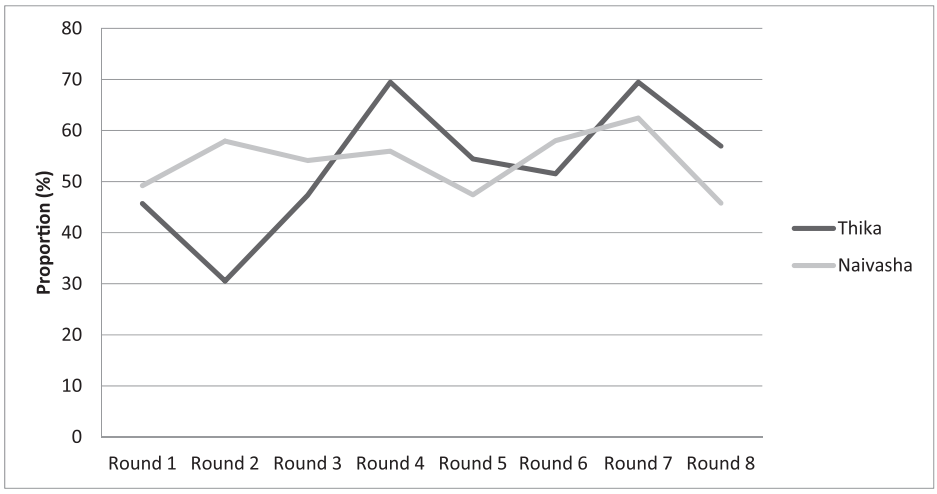

Fig. 3 – Proportion of respondents reported having been stopped by police for helmet wearing in the past three months in Thika and Naivasha (n = 6584).

interval [CI]: 0.407–0.816). This association was even stronger when controlling for type of road user, injury occurrence time and age in the multivariate logistic regression model (OR: 0.472, 95% CI: 0.328–0.687) (Table 4, model 2).

Among all trauma registry patients injured from motorcycle crash, motorcycle passengers had lower odds of head injuries compared to drivers (OR: 0.524, 95% CI: 0.373–0.737), and crashes that occurred during the day was associated

Table 4 – Results from multivariate logistic regression model on head injury in four hospitals.

Head injury	Model 1		Model 2		Model 3	
	Odds ratio	S.E.	Odds ratio	S.E.	Odds ratio	S.E.
Helmet wearing	0.478***	(0.090)	0.472***	(0.089)	0.478***	(0.091)
Type of road user						
Driver	Ref	NA	Ref	NA	Ref	NA
Passenger	0.591**	(0.113)	0.581**	(0.112)	0.577***	(0.113)
Other	1.546	(1.098)	1.580	(1.128)	1.528	(1.090)
Age in years						
Under 5	2.177	(1.248)	2.482	(1.431)	2.18	(1.375)
5–17	0.301**	(0.125)	0.322**	(0.134)	0.286**	(0.139)
18–29	Ref	NA	Ref	NA	Ref	NA
30–44	0.729*	(0.122)	0.738*	(0.124)	0.750*	(0.131)
45–59	0.427**	(0.145)	0.438**	(0.149)	0.440**	(0.153)
60 and above	0.851	(0.354)	0.901	(0.376)	1.140	(0.517)
Injury at night			Ref	NA	Ref	NA
Injury during day			0.614**	(0.099)	0.610**	(0.099)
Occupation						
Casual laborer					1.193	(0.308)
Self-employed					1.252	(0.321)
Salary worker					Ref	NA
Student/child					1.432	(0.561)
Housewife					2.247	(1.176)
Unemployed					0.887	(0.407)
Retired					NA	NA
Other					2.256*	(1.068)
Observations	1185		1185		1175	
df	10		11		17	
AIC	1120.816		1113.845		1115.371	
BIC	1171.591		1169.697		1201.544	

S.E. = standard error.
Models controlled for sex.
* $P < 0.1$; ** $P < 0.05$; ***, $P < 0.001$.
AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion.

with reduced odds of having a head injury (OR: 0.606, 95% CI: 0.443–0.831), controlling for the age of patients (Table 4, model 2).

Discussion

This study highlights the low prevalence of helmet use in Kenya and the urgent need for sustained efforts to improve this burden and reduce the risk of head injuries and their consequences among motorcyclists. This is especially true given the rapid increase in the number of motorcycles on Kenyan roads in recent years. The proportion of new motorcycle registrations increased from less than a tenth of the all new vehicle registrations in 2005, to approximately a third in 2011.[1] However, based on our findings, only approximately one-third of motorcycle drivers wear a helmet, with helmet use being particularly low among motorcycle passengers.

While the introduction of helmet laws have been shown to be effective in increasing helmet use and reducing head injuries in a number of countries,[3,15–19] establishing legislation alone is usually not enough.[20] In Kenya, the Traffic Amendment Bill that included mandatory helmet use for all motorcyclists, drivers and passengers, was passed in 2009 and penalties were increased in the Traffic Amendment Act in 2012.[10,11] However, based on our study, only minor improvements have been observed in helmet use among motorcycle drivers and passengers in Naivasha throughout this period, and no effect was observed among motorcyclists in Thika.

It is imperative to better understand the reasons underlying the low prevalence of helmet use, in order to develop targeted approaches to improve the situation. Data from the KAP survey suggested low police enforcement of the motorcycle helmet legislation. Additionally, while these surveys showed high awareness of the life-saving potential of helmets, a low proportion of respondents indicated that they used helmets because it was required by law. This presents an opportunity to further increase both awareness as well as enforcement of the legislation to improve helmet use and ultimately outcomes among motorcyclists.

One of the most common reasons cited for not wearing a helmet, especially among passengers was that helmets were inconvenient or uncomfortable, and those that had been used by others were considered unhygienic. Given that motorcycles are commonly used as taxis, there is a need to develop appropriate strategies to address this issue. Interventions such as the provision of hair nets, or use of disinfecting spray by motorcycle taxis and mass media campaigns addressing these specific issues need to be considered in addition to enhanced enforcement of the legislation.[20]

Helmet non-use continues to be a major risk factor for road traffic injuries in Kenya. A previous study using police data showed that injuries to motorcyclists more than doubled between 2004 and 2009 in Kenya, with an annual rate of increase of 29%.[9] Using data from four hospitals, we found motorcycles were involved in a quarter of all road traffic injuries presenting to the hospitals. Also, similar to findings from our observational studies, slightly over a third of motorcyclists involved in road traffic crashes and subsequently presenting at the hospitals wore a helmet at the time of crash.

Results from hospital surveillance confirmed that helmet use at the time of the crash prevented head injuries among motorcyclists. While these findings may be subject to the bias associated with hospital data—which only include individuals who managed to survive the crash and make it to the hospital—the protective effect of helmets for head injuries has long been known and well documented in the literature. A meta-analysis, for example, found helmets being protective against death, with a 42% reduction in odds of death associated with helmet use, and significantly protective against head injury with a 59% reduction in the odds of head injury.[8]

This study has a number of limitations. First, the observed prevalence of correct helmet wearing may include helmets that are substandard as the inspection of helmet quality was not feasible during the observations since they did not involve stopping the motorcyclists. Second, both use and quality of helmet being used could not be ascertained for patients presenting at the hospital. We relied on self-report, but as mentioned above, our findings revealed about a third of motorcycle drivers wearing a helmet at the time of the crash, which is consistent with what we observed. Third, hospital surveillance data were not available for the entire study period, which limited analyses of injuries related to motorcyclists over the entire study period, including changes associated with the amendment of the traffic bill.

Despite these limitations, the study highlights that in addition to the improved legislation on motorcycle helmets, there needs to be a concurrent focus on other areas that could bring about the desired behavioral change to prevent injuries and reduce deaths among motorcyclists. Our study reveals that there is a need for better and more visible enforcement of the legislation; developing strategies to improve helmet use among motorcycle taxi passengers; and media campaigns to raise awareness of the legislation as well as the consequences of not complying with it.

Author statements

Acknowledgments

The authors would like to thank the study participants and research staff for contributing to the research.

Ethical approval

Institutional Review Board at the Johns Hopkins Bloomberg School of Public Health (JHSPH) and the Kenya Ministry of Public Health and Sanitation.

Funding

This work was conducted as part of the Road Safety in 10 Countries project funded by the Bloomberg Philanthropies. Publication of this paper was supported by Bloomberg Philanthropies through a grant to the Johns Hopkins International Injury Research Unit at the Johns Hopkins Bloomberg School of Public Health, USA.

Competing interests

None declared.

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