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DIRECTLY OBSERVED ROAD SAFETY COMPLIANCE BY MOTOR CYCLE RIDERS AFTER A 5- YEAR ROAD SAFETY CAMPAIGN IN NAIVASHA, KENYA

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ABSTRACT

Objective: To assess the extent of compliance with road safety regulations by motorcycle riders following a five year road safety campaign in Naivasha town, Kenya.

Design: A cross sectional study.

Setting: Naivasha town, Nakuru county, Kenya.

Results: A total of 9,280 MCs ferrying 13,733 people were observed. Less than 1% complied with all the four road safety requirements. The overall helmet wearing compliance was 31%. MC driver helmet compliance was 42% which was five times higher than passenger helmet compliance. Female passengers were twice less likely to wear helmet than males.

Conclusion: Despite the five-year road safety campaign, compliance among MC users remains low particularly among the passengers and more so female passengers. Does Kenya need to rethink the motor cycle road safety policy?

INTRODUCTION

Wearing a standard, good quality motorcycle helmet can reduce the risk of death by 40% and the risk of serious injury by over 70%, yet according to WHO global report on road safety 2013, only 69 countries have any type of data on rates of helmet wearing, these statistics show that helmet wearing rate range from below 10% in low income countries to 100% in some of the developed countries (1).

Centres for Disease control (CDC) analysis of data on fatalities and economic cost of MC crashes in the USA between 2008 and 2010 found that helmet use prevented an estimated 37% of fatalities among MC operators and 41% of fatalities among passengers. When compared to states with universal helmet laws, motorcyclists involved in crash were five to six times likely to die in states without or with partial helmet use law. Economic costs saved in states with a universal helmet law were, on average, four times greater than in states without such a law (2).

A study at the Mulago Hospital in Uganda, found that 75% of road traffic injury admissions were due to motor cycle crashes and that about 15% of the revenue allocated to healthcare at the hospital was utilised in taking care of the MC injury patients (3). While a study in Tanzania reported 23% helmet use among MC casualties, head injury rate of 55% and at least 64% of patients injured required surgery. The mortality rate reported in this 10-year study of MC crashes was 17% (4).

National helmet wearing rate in Kenya is unknown. Even though a law exists that require both motor cycle rider and passenger to wear helmets of a set standard, the latest WHO report ranks enforcement in Kenya at a poor four out of possible ten (5).

Motor cycle deaths rose from 1% of road crash deaths to 12% within a period of five years (3).

A recent study by Saidi and Mutiso on MC injuries seen at the Kenyatta National Hospital (KNH) reflects a worrying trend. Between 2004 and 2009, an increase of 29% in MC injuries was observed at the

KNH, and these injuries accounted for 22.3% of all injuries seen with the most affected age being 21 – 30 years. Fifty-two percent required surgery and they found a mean hospitalisation period of 24.3 days plus 9% mortality within two weeks (7).

Road safety studies have established that to be effective, helmet legislation require stric enforcement backed by powerful public advocacy and there is evidence that implementation of proven road safety measures reduces road traffic crash frequency, severity of injury and mortality (8,9).

The United Nations (UN) General Assembly adopted resolution 64/255, declaring 2011 – 2020 a Decade of Action for Road Safety and Kenya was identified as one of the priority countries in the WHO led intervention aimed at significantly bringing down the global road crash injuries and mortality, through a systematic road safety campaign (10). The campaign (RS10) targeted ten worst hit countries that between them accounted for about 50% of global road crash fatalities and included helmet wearing by motor cycle users as one of the key targets (11).

The Kenyan road safety campaign (RS-K) was piloted in the highway towns of Naivasha and Thika and involved a multi-sectorial approach, that utilised multiple strategies including; social marketing, enhanced enforcement of traffic regulations and improved trauma care (4).

Promotion of the use of helmet by motor cycle riders was among the road safety campaign strategies implemented in Naivasha and prior to the campaign onset, a baseline survey was conducted in Naivasha in the year 2010 (13,5).

This study examines the compliance with MC road safety regulations after a five year campaign in Naivasha town. The WHO sponsored pilot project has been on-going since the year 2010 in Naivasha and was initiated after an initial baseline study (5).

MATERIALS AND METHODS

Study Design: This was a cross sectional observational study of road safety compliance by MC riders through roadside observation in six selected centres in Naivasha. It was part of a broader study that included a survey on the Knowledge Attitude and Practice of MC riders on road safety, the findings of which are reported elsewhere.

Sampling Method: Systematic multi-step process and stratified random sampling technique of representative roads was done. Randomisation took into consideration MC traffic volume and different road types and locations from which convenient and safe observation sites were selected.

Study Setting and population: Direct observation of helmet use by rider and passenger, wearing of reflective clothing and MC riding with running daytime headlights was recorded from six randomly

selected sites as described above. The number of passengers carried on each MC was also recorded. Safety of the observers was taken into account and to ensure they were not at risk of being hit by the vehicles all the observers wore reflective clothing and kept a safe distance from the road. Areas close to junctions where traffic slowed down were selected. The following six observation sites were selected using the above criteria;

Karagita, Kinungi, Sera Centre, Bata kihoto, Nakuru stage and Delta

Daily observations were done for seven days from Monday to Sunday. Observations were in time blocks of 2 hours with each day having three time blocks; 7am to 9am, 12noon to 2pm and 4pm to 6pm. yielding a total of 21 observation sessions. Helmet use was recorded for both riders and passengers. The use of reflective clothing and daytime running light was also recorded for the MCs that rode through the observation points in either direction. There were two observers per observation station and a predesigned data collection form was used.

Study population: All the motor cyclists spotted riding past the designated observation station during the observation hours constituted the study population.

Stationary MCs were excluded from this part of the study.

Research Question and study objectives: Following the WHO initiated RS-K intervention in Naivasha town in the year 2010, has there been change over the five year period in the observable compliance with road safety regulations by the motor cycle drivers and passengers? Compliance was measured in terms of percentage use of helmets and wearing of visibility enhancing attires by both rider and passenger, ferrying not more than one passenger per MC at any given time and driving with MC headlights switched on. The main objective of this study was to therefore, to determine the rate of road safety compliance by MC drivers and passengers in Naivasha town and determine the various factors that may influence compliance.

Ethical Considerations: The study was approved by the Ethics and Research Committee of the Kenyatta National Hospital and the University of Nairobi.

RESULTS

A total of 9,280 Motor cycles (MCs) ferrying 13,733 people (riders and passengers) were observed from the six selected observation sites in Naivasha during seven consecutive days of the study. Only 73 (0.79%) MCs complied with all the four road safety requirements of MC not carrying more than one passenger, both driver and passenger wearing helmets, both driver and passenger wearing reflective clothing and MC head lamp switched on.

Complete compliance by individuals required the use of both helmet and reflective jacket; based on these criteria 3316 (24.1%) people were compliant. The overall helmet wearing compliance was 31% (4252 out of 13,733). A total of 3850 (42%) MC drivers wore helmet which was five times higher than passenger helmet compliance rate of 8% (402 out of 5041). Female passengers at helmet wearing rate of 5% were twice less likely to wear helmet than their male counterparts at 10%.

Out of the 9280 MC observed, 4,453 (48%) carried at least one passenger and of the MC that carried a passengers, 3897 (87.5%) riders carried one passenger, 525 (11.8%) riders had two and 31 (0.7%) had three passengers.

Table 1 shows the distribution of MC by observation centre and number of passengers. There were 27 female drivers observed out of whom 7 (26%) wore helmet compared to 3843 (42%) out of 9221 male drivers.

Of the drivers 4453 (48%) transporting passengers, 557 (13.2%) had two or more passengers, 8.1% (360 out of 4453) of the first passenger wore a helmet, 8.0% (42 out of 525) of the second passenger had helmet while none of the 33 third passengers had a helmet. One hundred and eighty three (3.7%) passengers out of 4808 wore reflective clothing. Table 2 is a summary of MC driver compliance with various road safety measures.

Table 1
Distribution of MCs by number of riders and observation station in Naivasha town (N=9264)

Number of Riders	Observation station							Total
	Karagita	Kinungi	S e r a Centre	Bata Kihoto	Ki-Nakuru	Delta stage	Delta	
Driver only	709	968	1082	969	667	418	4813(52%)	
Rider & 1 passenger	888	304	810	625	764	503	3894(42%)	
Rider & 2 passenger	170	57	36	85	84	93	525(6%)	
Rider & 3 passenger	4	18	1	6	1	1	31(0.3%)	
5 passengers	0	1	0	0	0	0	1	
Total	1771(19%)	1348 (15%)	1929 (21%)	1685 (18%)	1516 (16%)	1015 (11%)	9264	

Table 2.
MC driver Compliance with Motor Cycle Road safety Measures (N=9280)

Safety Measure observed	Missing data	Yes	No
	N(%)	N(%)	N(%)
Wearing Helmet	31(0.3%)	3,850(41.5%)	5,399(58.2%)
Reflective attire	35(0.4%)	7,044(75.9%)	2201(23.7%)
Headlights ON	12(0.1%)	351(3.8%)	8917(96.1%)

Status of MC headlights: There were 351 (3.78%) MCs observed riding with lights turned on and MC were twice more likely to have lights on between 4 – 6pm (6%) than 12 – 2pm (2%), table 3 shows compliance with headlights on and time of observation.

Among the 351 riders with day headlights on, 218 (62%) wore helmets which was 5.7% of the 3,846 helmet wearing riders compared to 2.5% (133) who had lights-on in the non-helmet wearing cohort.

Helmet wearing by time: Table 4 is a summary of the distribution of rider wearing helmet by observation time

Table 3
MC headlight status by observation time (N=9235, missing =45)

MC headlights status			Observation time			Total
			7am - 9am	12 - 2pm	4pm - 6pm	
ON	N		113	61	175	349
	%		3.5%	2.1%	6.1%	3.8%
OFF	N		3270	2920	2696	8886
	%		96.5%	97.9%	93.9%	96.2%
Total	N		3383(37%)	2981(32%)	2871(31%)	9235(100%)

Table 4
MC driver wearing a helmet by day of the week and observation time N= 9216

Observation time	Day of the Week						Total
		Monday	Tuesday	Wednesday	Thursday	Friday	
No. MC Riders							
Monday		1263					1373
Tuesday			1335				
7am - 9am	Helmet	241 45%	223 43%	178 42%	205 41%	168 46%	2004 48%
	No helmet	291 55%	297 57%	249 58%	296 59%	197 54%	2135 52%
12 - 2pm	Helmet	196 46%	137 43%	136 33%	243 46%	197 49%	1313 11%
	No helmet	229 54%	184 57%	271 67%	287 54%	202 51%	2886 9%
4pm - 6pm	Helmet	211 51%	180 36%	171 40%	126 33%	196 48%	2155 1%
	No helmet	205 49%	314 64%	258 60%	258 67%	210 52%	2044 9%
Total observed/day							
	Helmet	648 47%	540 40%	485 38%	574 41%	477 34%	561 48%
	No Helmet	725 53%	795 60%	778 68%	841 59%	932 66%	609 52%
		705 56%	538 58%				

The lowest rider helmet wearing rate at a particular block observation time was 31% on Sunday 12 – 2pm and the highest wearing rate was 51% at 4pm – 6pm on Monday and at a similar time on Sunday. Saturday had the highest observed helmet wearing rate 48% and lowest was 34% on Friday.

Of the passengers carried by riders who wore helmet 264 out of 1804 (14.6%) had helmet compared to only 96 passengers with helmet transported among the 2621 (3.7%) riders who did not wear. While 30 out of 263 (11.4%) ferried by riders who wore helmet had a helmet as compared to 12 helmet wearing passengers

out of 292 (4.1%) who did not have.

Passenger helmet wearing rates: Females passengers were less likely to wear helmet than their male counterparts, the distribution of the passenger helmet wearing rate by gender is summarised in Table 5. Of the 402 passengers observed wearing helmet 273 (67.9%) were sighted at Karagita 78 (19.4%) at Delta. No passenger was sighted wearing a helmet at Sera Centre. All 3rd passengers did not wear helmet and 21(62%) out the 34 were sighted at Kinungi centre. (Table 6)

Table 5
Distribution of MC passengers by gender and helmet wearing status

Passenger category	Total (N)	Helmet wearing		P value
		Yes – N(%)	No- N(%)	
1stpassenger N	4,416	360(8.2%)	4,056(91.8%)	<0.05
Male	2,358(53.4%)	248(10.5%)	2,110(89.5%)	
Female	2,055(46.5%)	112(5.5%)	1943(94.5%)	
Can't tell	3 (0.1%)	0(0%)	3(100%)	
2ndPassenger N	553	42(7.6%)	551(92.4%)	<0.05
Male	292(52.8%)	31(10.6%)	261(89.4%)	
Female	257(46.5%)	11(4.3%)	246(95.7%)	
Can't tell	4(0.7%)	0(0%)	4(100%)	
3rd Passenger. N	33	0(0%)	33(100%)	
Male	25(75.8%)	0(0%)	25(100%)	
Female	7(21.2%)	0(0%)	7(100%)	
Can't tell	1(0.3%)	0(0%)	1(100%)	
Total passengers	5,000	402(8.0%)	4,598(92%)	
Male	2,673(53.4%)	279(10.4%)	2,398(89.6%)	
Female	2,319(46.3%)	123(5.3%)	2,189(94.7%)	
Can't tell	8(0.3%)	0(0%)	8(100%)	

Table 6
Distribution of MC passenger helmet wearing status by observation station

Helmet		Observation station						Total
		Karagita	Kinungi	Sera C	Bata K	Nakuru S	Delta	
Yes	N	273	14	0	22	15	78	402
		22,2%	3,1%	,0%	2,7%	1,6%	11,4%	8,1%
No	N	958	437	880	779	916	606	4576
		77,2%	96,9%	100,0%	97,3%	98,4%	88,6%	91,9%
Total	N	1231	451	880	801	931	684	4978
		24.7%	9.1%	17.7%	16.1%	18.7%	13.7%	100%

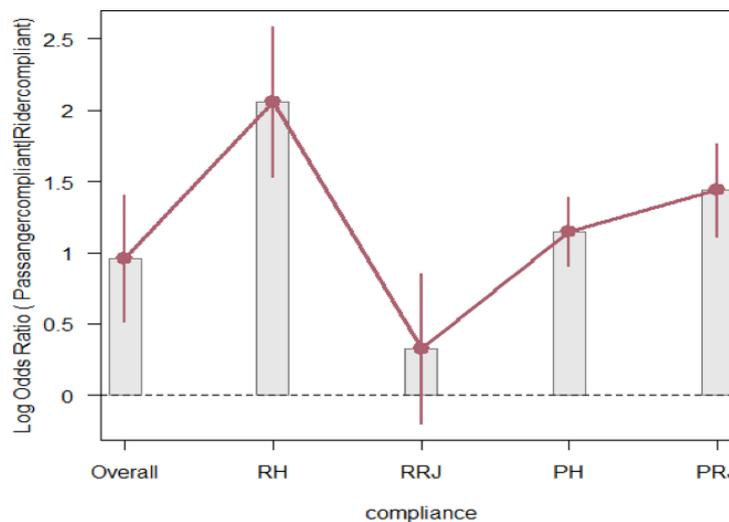
Of the 360 first passengers who wore helmets 73%(264) were transported by helmet wearing riders. The passenger helmet wearing rate among 1804 riders with helmet was 14.6%(264), while among the 2621 riders who did not have helmet, the first passenger helmet wearing rate was 3.7%(96).

Out of the 42 second passengers who had helmet, 30(71%) were transported by helmet wearing riders

and the 2nd passenger helmet rate among helmet wearing riders was 11%(30 out of 263) compared to 4.1% (12 out of 292) among non-helmet wearing riders who had a second passenger.

The interplay of various road safety compliance factors on overall compliance is illustrated in figure 1.

figure 1
Log odds ratios for passenger and driver by compliance



Most cases of non-compliance were associated with the driver's non-compliance (P-value=0). The aspect of non-compliance that was mostly associated with this was the lack of wearing the reflective jacket (P-value= 0). The passenger's non-compliance was however associated with both the lack of wearing the helmet (P-value= 0) and the lack of wearing the reflective jacket (P-value= 0).

There was an influence of the driver's compliance on various aspect of the passengers compliance. The odds of passenger compliance doubled given that the rider wore a helmet even without the reflective jacket, OR=2.05, 95% CI[1.53,2.58] and reduced by 68% if the rider wore a jacket only, OR=0.32, 95% CI[-0.19,0.85]. Further if the passenger wore a reflective jacket, this increased the odds of the overall compliance by 40%, OR=1.43, 95% CI [1.11,1.76]

DISCUSSION

Studies have shown that wearing motor cycle helmet correctly reduces crash fatalities by about 40% and severe injuries by about 70% (14) This high level of evidence in support of wearing helmets should give credence to the campaign to promote the wearing as

well as mitigate for strict enforcement to save lives and support economies. According to the recently published global status of road safety by WHO, helmet wearing rate by MC riders in Kenya is unknown and though national helmet laws require both rider and passenger to wear helmet, the level of enforcement is rated at four out of ten.

Anecdotal observation on Kenyan roads confirm lack of both active and passive enforcement of helmet wearing among MC passengers as motor cyclists ferrying passengers are often observed going through the traffic police stops carrying non-helmet wearing passengers without being stopped.

Compared to a study done in Naivasha in the year 2010 in which 3,143 MC users were observed, MC drivers helmet wearing rate doubled from 21% in 2010 to 42% in 2015 while passenger helmet wearing rate though remaining low had increased from 3 to 9%.

Of concern however is that passenger helmet wearing rate remained below 4% in four of the six centres with only significant increase observed in two centres of Karagita and Delta at 22 and 13% respectively. More than 65% of passengers spotted wearing helmet were from Karagita centre and together with Delta they contributed 90% of the

passengers sighted wearing helmet while the Sera centre had 0% helmet wearing rate among passengers observed.

Therefore, helmet wearing generally remains very low among passengers who were five to ten times less likely to wear helmet than the MC drivers.

Further inquiry revealed that most MC sighted at Karagita were ferrying passengers to the flower farms where factory rules denied entry of the non-helmet wearing MC drivers and passengers to the premises. This appears to have been a case of an effective internal helmet wearing enforcement through employer intervention that should be piloted elsewhere.

Female passengers are less likely to wear helmet than their male counterparts, this has been attributed to helmet interference with their elaborate hairstyle and makeup as well as greater concern for hygiene by females. Given the body of evidence that helmets reduce mortality and severity of head injury in motor cycle crashes, it is likely that a higher proportion of females suffer higher mortality and severer head injuries.

Helmet wearing was low at 12 -2pm among all rider categories, most likely due to heat of the midday sun.

Helmet wearing by a rider appears to have some influence on the passenger helmet wearing behaviour. Passengers transported by helmet wearing riders are three times more likely to wear helmet than those transported by non-helmet wearing riders.

Six percent (556) of the riders carried one or more extra passengers thus breaking the law that limits each MC to one passenger.

Helmet wearing in LMIC remain very low especially among passengers. In these countries unlike in high income countries MC is used in commercial passenger transport, hence the problem of helmet availability and sharing. Private riders are likely to have an extra helmet for the pillion rider and issues of hygiene are not of concern as is the case in sharing of helmets used in public transport.

The low rate of helmet use observed in this study is similar to that observed in Cambodia of 44.3% and likewise the use of helmet among passengers was found to be exceptionally low among passengers at 6.4% with a tenfold difference in helmet wearing rate between riders and passengers. However, the law in Cambodia then only applied to riders and not passengers (15).

A study conducted among youths in Mexico comparing the impact of three types of road safety interventions on attitude change found that educational interventions were the most effective followed by law enforcement activity and though wide reaching, social marketing campaign was found to be the least effective intervention (16).

The rate of MC riding with headlights on at daytime dropped from 17% in 2010 to 3.8% in this

study (2015). Running headlights is considered important in enhancing the visibility of the MCs and it is possible that this aspect of safety was ignored in the campaign or is not prioritised by the traffic law enforcers.

Study limitations: Observations were limited to seven days in one week which may not be representative of the actual pattern of behaviour in the entirety as this could be influenced by periodic changes.

The observation did not take into account the proper wearing of helmet or helmet quality.

Determination of the gender of the rider and passenger was subject to some errors as this was based on the kind of dressing.

In conclusion, although the helmet wearing rate among the MC drivers doubled within the five years, compliance with MC road safety measures remains poor among the MC users in Naivasha, especially among passengers.

The general helmet use is low at 30% among all MC users; Less than a half of the MC drivers wore a helmet but this was still more than five times better than the observed passenger wearing rate of 8%. Female passengers were twice less likely to wear helmets than their male counterparts. Luminous clothing was used by more than two-thirds of the MC drivers but there was hardly any use of daytime riding light by motor cyclists.

It is encouraging to note that helmet wearing by riders had some positive influence on passengers, thus concerted campaign that target the MC riders is likely to have a trickle down benefit on passenger helmet wearing. We also note that local enforcement by non-traffic police agencies had a significant positive influence on helmet wearing rate (The Karigita phenomena)

In a second part of our study on motor cycle road safety reported elsewhere, we share our findings on the knowledge attitude and practice of the riders

We recommend, new methods should be explored that will make more MC users especially passengers wear helmets. Education and law enforcement need more emphasis as research has shown that they achieve more attitude change.

Research is necessary to determine why helmet wearing among passengers and particularly females remain extremely low. Road safety researchers need to explore alternatives to helmets or at least improve the comfort, hygiene and acceptability especially in the hot tropical climate. There is also need to establish if female passengers involved in MC crash have a higher proportion of severe head injury and mortality than the male counterparts due to comparatively poor helmet wearing compliance.

The Karagita phenomena- Passengers riding

past the Karigita stage to or from the flower farms were ten times more likely to wear helmets. This non-police/non-government road safety awareness and enforcement should be piloted with other industries and employers to support road safety compliance.

CONFLICT OF INTEREST

The authors declare no conflict of interest in the study

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