Baraton Interdisciplinary Research Journal (2018), 8(Special Issue), pp 1-9

OBSERVATIONAL SURVEY OF SELECTED SAFETY INDICATORS AMONG COMMERCIAL MOTORCYCLISTS IN KISUMU CITY

Amulla O. Walter
University of Eastern Africa, Baraton, P. O. Box 2500-30100, Eldoret, Kenya
Email addresses: amulla.walter@ueab.ac.ke , walteramulla@yahoo.com

Abstract

Motorcyclists are among the most vulnerable road users (VRUs) globally, accounting for nearly a quarter of global road traffic mortality annually. In Kenya injuries to motorcyclists have been documented to increase at an annual rate of approximately 29%, with Kisumu reporting accident rates of up to 60%. Key safety interventions include utilization of personal protective equipment (PPE)—specifically helmets and reflective jackets, and restriction on the number of pillion riders. Though clearly legislated, the enforcement of these interventions remains a major challenge in Kenya. This study sought to document rider practice regarding use of helmets, reflective jackets and passenger loading among commercial motorcyclists in Kisumu city. Data was collected using structured observation guides administered at strategic locations around the City's CBD and analyzed descriptively on SPSS version 23. The study established that majority (72.1%) of the motorcyclists did not have helmets, a few (5.8%) had helmets but did not wear them, and only 22% wore reflective jackets. Nearly one fifth of the motorcyclists carried two or more pillion riders and over 99% of the pillion did not have helmets. Compliance with traffic regulations is poor and action needs be taken to reverse the trend.

Keywords: Commercial, motorcyclists, helmets, pillion, reflective jackets

Introduction

Traffic accidents are among the leading causes of disease burden around the world and has been on the rise despite improvements in safety and technological standards (Ryder et al., 2017). Road traffic injuries are currently the ninth leading cause of death globally, claiming more than 1.2 million lives each year beside millions of nonfatal injuries (WHO, 2015).

The greater burden is borne by low and middle-income countries with sub-Saharan Africa being among the worst hit (Vissoci et al., 2017). In Kenya, traffic accidents claim between 3000 and 13000 lives every year, majority of whom are vulnerable road users (Manyara, 2016; WHO, 2018).

Motorcyclists are among the most vulnerable road users (VRUs) globally (Shinar, 2012), accounting for nearly a quarter of global road traffic deaths annually (WHO, 2015; Araujo, Illanes, Chapman, & Rodrigues, 2017). These fatalities seem to correlate linearly with the prevalence of motorcycle use. Expansion in motorcycle use has been associated with increase in related traffic fatalities in a number of countries (Vasconcellos, 2013; WHO, 2015).

In Kenya injuries to motorcyclists have been documented to increase at an annual rate of approximately 29 percent, with fatalities equally rising (Bachani et al., 2017; Kiteywo, 2017). However, estimates are cofounded by the fact that most injuries are not reported to Kenya police from whom data is often retrieved thus the figures could be much higher. A study in Thika town found that only 8.5% of motorcycle riders reported incidences of injury to the police (Matheka, Omar, Kipsaina, & Witte, 2015).

In Kisumu, motorcycle accidents have been on the rise over the years despite the road safety interventions underscored in the Kisumu's First County Integrated Development Plan (2013 – 2017). A study conducted by Nyachieo (2015), reported that slightly over 40% of motorcyclists had been involved in an accident and Wilberforce and Olela (2016) reported an incidence of injuries of over 60% among motorcyclist in Kisumu.

Factors contributing to the vulnerability of motorcyclists include sharing traffic space with fast-moving vehicles, relatively low visibility, lack of physical protection as well as negative behavioral conducts (WHO, 2015; Lwin, Win, Aung, & Lwin, 2016). It is reported that motorcyclists are generally reckless, disrespectful of other road users and often over-speed and over load their motorcycles to maximize returns (Odiwuor, Nyamusi, & Odero, 2015; Karau, Ogeng'o,

Okoro, Muia, & Saumu, 2015).

Safety regulations have been shown to improve safety practices among motorcyclists and is among the key interventions for road safety (Karuppanagounder & Vijayan, 2016; Sharma & Verma, 2017). In Kenya, the Traffic Act Cap 403 stipulates the use of helmets and reflective jackets and restricts the number of pillion riders to only one at a time. Nonetheless, enforcement of these regulations remains a challenge in many parts of the country (Odiwuor et al., 2015; Manyara, 2016; Singoro et al., 2016).

According to Matheka et al. (2015), one of the leading challenges to enforcement is lack of enough data to inform prevention strategies—a sentiment earlier underpinned by Bachani et al. (2012). On a global scale, this deficiency in data makes comparisons over time and between regions impossible and the WHO (2015) recommends that countries need to collect regular data to curb the problem. Though studies of this nature have been conducted in certain parts of the country (Bachani et al., 2012; Nasongo, 2015; Matheka et al., 2015; Karau et al., 2015; Odhiambo, Hasan, Mock, Oyugi, & Kagereki, 2017; Singoro, Wakhungu, Obiri, & Were, 2016; Obey & Njagi., 2015) few are observational and virtually none is extant for Kisumu city.

Against this backdrop, the present study aimed to assess the incidence of selected safety indicators (including helmet, reflective jacket, and number of pillion riders) among commercial motorcyclists in Kisumu. It was anticipated that the outcome of this study will contribute to bridging the existing knowledge gap, and informing public policy on road safety in Kenya.

Methods

Study Area and Study Design

Employing a descriptive cross-sectional design, the study was conducted in Kisumu city—the third largest city in Kenya located on the shores of Lake Victoria. Initially called Port Florence, the city has grown to a population in excess of 400, 000 according to the 2009 census with motorcycles being among the most common means of transport linking the suburbs to the CBD.

Study Population and Sample Size

The study population comprised all commercial motorcyclist servicing Kisumu city and its environs. Eligibility criteria was all motorcyclists riding on selected roads during the study period and carrying at least one pillion rider. Due to difficulty in obtaining a record of all motorcyclists plying a particular route so as to calculate a sample size (Ledesma & Peltzer, 2008; Matheka et al., 2015), a convenient sample of 174 motorcyclists were sampled at each of the selected routes yielding a total of 1044 units.

Data Collection and Analysis

Data was collected using observation guides administered by the researcher at six (6) purposively selected sites within the outskirts of Kisumu City CBD. The sites comprised strategic locations on the major feeder routes of the city namely: Nairobi road, Kondele roundabout, Busia road, Ring road and Achieng Oneko Street.

Six (6) observation guides were filled for every route with the exception of Nairobi road where twelve (12) observation guides were filled due to its high traffic. Since each observation guide had 29 slots, the total number of motorcycles observed per street was 174. This technique is not uncommon in such studies (Fong et al., 2015; Karuppanagounder & Vijayan, 2016; Bachani et al., 2017).

Observations lasted between 30-50mins on each route and data was collected over a period of three days in the month of December 2017. Observations on Nairobi road occurred in the mid-morning hours while observations on *Ring road, Busia road, Kondele roundabout* and *Achieng Oneko Street* occurred in the afternoons. Only motorcyclists with pillion riders were included in the study to minimize chances of observing non-commercial motorcyclists. To increase feasibility, the researcher limited the variables observed to comprise whether or not the riders had helmets, reflective jackets and the number of pillion carried (Fong et al., 2015). When approaching motorcycles were more than one, the observer picked the first in his gaze and recorded the requisite data then proceeded to the next in his sight upon lifting his gaze (Lunnen et al., 2015). Chances of observing the same motorcyclist was controlled by limiting observation time per site and including only motorcycles with pillion. Obtained data was analyzed descriptively on SPSS version 23 using percentages, frequencies, summations, cross-tabs and chi-square and the results presented on charts and tables.

Ethical Considerations

None of the motorcyclist were identified by name or otherwise in the study. No identifying information on the motorcycles were recorded. As the data collected comprise observations of public behavior informed consent was waved (Fong et al., 2015). The ensuing information will be disseminated to facilitate action on recommendations for the benefit of key stakeholders.

Results

Observed Motorcyclists

As presented in table 1, observations were made on all the main feeder streets of the City's CBD, each contributing a convenience sample of 174 motorcycles. A total of 1044 commercial motorcyclists carrying 1270 disproportionately distributed pillion passengers were observed. The variance in number between motorcyclists and pillion (+226) was due to the fact that some of the motorcyclists carried more than one passenger.

Table 1

Sample Matrix

Street		Observed Motorcyclists					
		Frequency (n)		Percent (%)		Cumulative Frequency	
		Operators	Pillion	Operators	Pillion	Operators	Pillion
1	Nairobi1	174	203	16.7	16.0	174	203
2	Nairobi2	174	226	16.7	17.8	348	429
3	Busia	174	204	16.7	16.1	522	633
4	Kondele-Roundabout	174	207	16.7	16.3	696	840
5	Ring Road	174	214	16.7	16.9	870	1054
6	Achieng Oneko	174	216	16.7	17.0	**1044**	**1270**

Helmet Use/Non-Use

Slightly over a quarter (27.9%) of the operators had helmets and of these approximately 21% (61/291) did not wear them while riding. Overall, helmet use among observed operators was 22% with the rest either not having helmets or not wearing them. This means only about 3 in 10 commercial motorcyclists in Kisumu city wear helmets. The best performing street in terms of helmet possession was Achieng Oneko (66/174) while the best performing street in terms of helmet use was Busia (42/174).

Table 2

Helmet Possession and Use by Motorcyclists And Passengers

Cyclist Category	Helmet Possession				Helmet Use			
	Present		Absent		Worn		Not Worn	
	n	%	n	%	n	%	n	%
Rider/Operator	291	27.9	753	72.1	230	22	61	5.8
Pillion	4	0.3	1266	99.7	4	0.3	1266	99.7

Helmet use among pillion riders was very low with less than 1% of observed passengers wearing helmets. Overall helmet use (operators and pillion) was 10.1%. Operators with helmets were very likely to wear them (X2 (2, N=1044) =1044.000, p < 0.001, V= 1.000).

Reflective Jacket Use/Non-Use

Observations on reflective jacket use were made only for motorcycle operators. This was necessary to reduce the variables in order to increase feasibility of data collection. As illustrated below, reflective jacket use was equally poor with only 22% of the observed motorcyclists wearing them. Cross-tabulation showed that Achieng Oneko was the best performing street (63/174) while Ring road was the worst-performing street (23/174).

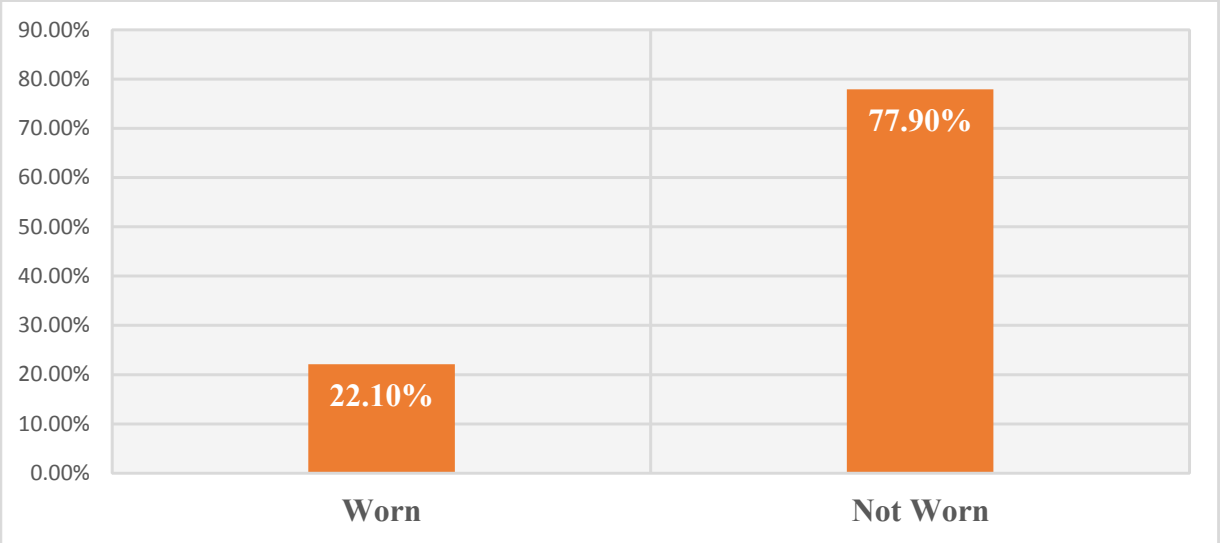

Figure 1. Utilization of reflective jackets by motorcycle operators.

Passenger Loading

As illustrated in table 3, most of the motorcyclists ferried one pillion at a time. Of all the four safety requirements this was the most commonly complied with. Nonetheless, nearly one fifth of the motorcyclists carried two or more passengers. The excess (226) passengers were disproportionately distributed across the streets with Ringroad having the highest number of violating motorcyclists.

Table 3

Number of Pillion Riders per Motorcycle

Passenger Loading Category	**Observed Prevalence**	
	Frequency (n)	Percentage (%)
One Pillion	850	81.4
Two Pillion	169	16.2
More than Two Pillion	25	2.4

Overall Compliance with Traffic Act cap 403

Approximately 7.8% (n=81) of the operators wore both reflective jackets and helmets. Much less (6.6%, n=69) complied with three of the four safety requirements assessed — having helmets, reflective jackets and carrying only one passenger. But only 2 out of the 1044 motorcyclists (0.19%) complied with all the four safety requirements assessed in this survey.

The most frequently complied with requirement was passenger loading (81.4%) while the least frequently complied with requirement was pillion helmet use (0.3%). There was significant relationship between possession of helmet and possession of reflective jacket (X2 (1, N=1044) =37.065, $p < 0.001$, V = 0.188).

Table 4

*Operator Helmet Use * Operator's Jacket Use * Number of Pillion Riders Cross-tabulation*

Number of Pillion Riders			**Operator's Jacket Use**		
			Worn	Absent	Total
One Pillion rider	Operator Helmet Use	Helmet Not Worn	19	36	55
		Helmet Worn	**69**	118	187
		Not Applicable	103	505	608
	Total		191	659	850
Two Pillion riders	Operator Helmet Use	Helmet Not Worn	1	5	6
		Helmet Worn	10	26	36
		Not Applicable	24	103	127
	Total		35	134	169
More than 2 Pillion riders	Operator Helmet Use	Helmet Worn	2	5	7
		Not Applicable	3	15	18
	Total		5	20	25
Total	Operator Helmet Use	Helmet Not Worn	20	41	61
		Helmet Worn	**81**	149	230
		Not Applicable	130	623	753
	Total		231	813	1044

Discussion

Among other interventions, utilization of personal protective equipment (PPE) and restrictions on passenger loading have been shown to significantly reduce the risk and severity of crash-related injuries and hospitalization among motorcyclists (de Rome et al., 2011; de Rome et al., 2012; Oluwadiya, Ojo, Adegbehingbe, Mock, & Popoola, 2016). Thus helmets, reflective jackets and the number of pillion passengers ferried at a time are among the most critical indices of safety for motorcyclists.

In terms of PPE helmets are by far the most important for motorcyclists as injuries to the head and neck are the leading cause of morbidity and mortality among motorcyclists. It is estimated that wearing helmets can reduce the risk of death by almost 40% and the risk of severe injury by roughly 70% (Araujo et al., 2017; WHO, 2015). In order to confer maximum protection, helmets should be of standardized quality, be worn by all riders regardless of age and at all times and places during the ride (Araujo et al., 2017).

In this study, it was established that slightly one fifth (22%) of the operators wore helmets and nearly all (99.7%) pillion riders did not wear helmets. Low rates of helmet use have been observed in other parts of the country (Karua et al., 2015; Bachani et al., 2017; Bachani et al., 2012; Odhiambo et al., 2017) as well as abroad (Karuppanagounder & Vijayan, 2016). Nefariously, non-use of helmets is observed even among riders aware of its legal implications (Khan, Khan, Aziz, Islam, & Shafqat, 2008) and pillion riders often do not wear helmets despite its well-established protective benefit (Siddiqui et al., 2016; Yadukul, Devadass, & Gururaj, 2016).

According to WHO (2015), failure to use motorcycle helmets is among the key behavioral risk factors for road traffic injuries. The use of helmets has been documented to reduce the severity of traumatic head injuries including epidural hematoma, skull fractures, intracranial hemorrhage and loss of consciousness (Gupta et al., 2018). With Kisumu reporting accident rates of up to 60% (Wilberforce & Olela, 2016), this laxity on helmet use is a serious concern.

Other than helmets, wearing reflective jackets is an equally important safety indicator since conspicuity is a key factor in motorcycle accident risk (Ranchet, Cavallo, Dang, & Vienne, 2016; de Craen, Doumen, & Van Norden, 2014). A population-based case control study by Wells et al (2004) found that drivers wearing any reflective or fluorescent clothing had a 37% lower risk of crash related injury than other drivers. Sinisterly, in this study majority (77.9%) of the motorcyclists did not wear reflective jackets. These findings contrasts that of Obey and Njagi (2015) in which 84.6% of the motorcyclists had reflective jackets.

PPEs aside, passenger loading also influence the severity of accident outcome. According to Oluwadiya, et al. (2016), carrying more than one pillion significantly increases the risk of sustaining injuries in the event of an accident. Although in the present study majority of the motorcyclists (81.4%) carried only one pillion, the proportion carrying more than one passenger (18.6%, n = 194) is still unacceptably high. By contrast a study in Bungoma County reported that over 70% of motorcyclists carried more than one pillion at a time (Singoro et al., 2016). The reason behind this impressive performance remains to be established.

According to the Kenya's Traffic Act Cap 403, which was revised in 2015, any person, including a passenger, riding on a motorcycle of any kind or description must wear a helmet and a reflective jacket. The responsibility to provide these protective gear for pillion passengers is incumbent on the rider/operator of the motorcycle, who also must carry only one pillion at a time.

Despite these regulations, the present study established that less than 1% of the motorcyclists complied with all the four safety requirements assessed. Sinisterly, this is not uncommon in Kenya. A similar rate of non-compliance was reported by Odhiambo et al (2017). However, this is not merely a Kenyan challenge but one which is common in many low and middle income countries across the world (King, 2015).

Generally, factors influencing noncompliance include ergonomic, attitudinal, socio-economic, environmental and physiological barriers (Orsi et al., 2012; Haqverdi, Seyedabrishami, & Groeger 2015; Onawumi, Oyawale, Dunmade, Ajayi, & Obasanya, 2016; Maghsoudi, Boostani, & Rafeiee, 2018; Hung, Stevenson, & Ivers, 2008; Obey & Njagi., 2015), but context-specific correlates need investigation. Nonetheless, as there was a strong association between helmet possession and use among the motorcycle operators ($p < 0.001$, $V = 1.000$), it is probable that cost is a critical barrier to compliance for majority of the motorcyclists in this population.

Strict and consistent enforcement of safety regulations has been found to increase compliance

among motorcyclist (Karuppanagounder & Vijayan, 2016) and should be leveraged by the Kenyan government. But with NTSA bemoaning lack of implementation workforce, alternative and complementary interventions should be explored.

Foremost among these are health promotion campaigns which was identified in one umbrella review as among the most effective transport interventions respecting helmet use and other safety practices (Morrison, Petticrew, & Thomson, 2003). The overarching advantage of this intervention is that the NTSA can augment its implementation capacity by leveraging resources from other sectors such and the MOH, Private and NGOs. Other than this intervention, a moral-based compliance in which people comply with regulations from a sense of moral duty rather than fear of repercussion may as well be explored (King, 2015). Such intervention would make use of the moral centers of society, further augmenting the often meager law enforcement workforce in developing countries.

Conclusions and Recommendations

This study established that overall compliance with safety regulations was very poor among commercial motorcyclist in Kisumu city though specific provisions were disproportionately complied with. Further research to establish factors influencing non-compliance is necessary as is a more comprehensive study monitoring compliance over a longer period.

As strict and consistent enforcement of safety regulations has been found to increase compliance among motorcyclist (Karuppanagounder & Vijayan, 2016) it is recommended that local authorities should adopt the modality. Together with consistent law enforcement public education and information campaigns should be leveraged as the combination of these modalities have been shown to yield better outcome (Sharma & Verma, 2017).

Study Limitations

This was a convenience cross-sectional study conducted at a single town in Kenya and therefore the results may not be generalized to the rest of the country. Nevertheless, the concurrence of the findings of this study with a number of others done elsewhere does suggest a general trend among commercial motorcyclists in the country.

References

Araujo, M., Illanes, E., Chapman, E., & Rodrigues, E. (2017). Effectiveness of interventions to prevent motorcycle injuries: Systematic review of the literature. *International Journal of Injury Control and Safety Promotion, 24*(3), 406-422.

Bachani, A. M., Hung, Y. W., Mogere, S., Akunga, D., Nyamari, J., & Hyder, A. A. (2017). Helmet wearing in Kenya: Prevalence, knowledge, attitude, practice and implications. *Public Health, 144*, S23-S31.

Bachani, A. M., Koradia, P., Herbert, H. K., Mogere, S., Akungah, D., Nyamari, J., ... & Stevens, K. A. (2012). Road traffic injuries in Kenya: the health burden and risk factors in two districts. *Traffic Injury Prevention, 13*(sup1), 24-30.

de Craen, S., Doumen, M. J., & Van Norden, Y. (2014). A different perspective on conspicuity related motorcycle crashes. *Accident Analysis & Prevention, 63*, 133-137.

de Rome, L., Ivers, R., Fitzharris, M., Du, W., Haworth, N., Heritier, S., & Richardson, D. (2011). Motorcycle protective clothing: protection from injury or just the weather?. *Accident Analysis & Prevention, 43*(6), 1893-1900.

de Rome, L., Ivers, R., Fitzharris, M., Haworth, N., Heritier, S., & Richardson, D. (2012). Effectiveness of motorcycle protective clothing: Riders' health outcomes in the six months following a crash. *Injury, 43*(12), 2035-2045.

de Rome, L., Ivers, R., Haworth, N., Heritier, S., Du, W., & Fitzharris, M. (2011). Novice riders and the predictors of riding without motorcycle protective clothing. *Accident Analysis & Prevention, 43*(3), 1095-1103.

Fong, M. C., Measelle, J. R., Dwyer, J. L., Taylor, Y. K., Mobasser, A., Strong, T. M., ... & Sittiphone, D. (2015). Rates of motorcycle helmet use and reasons for non-use among adults and children in Luang Prabang, Lao People's Democratic Republic. *BMC Public Health, 15*(1), 970.

Gupta, S., Klaric, K., Sam, N., Din, V., Juschkewitz, T., Iv, V., ... & Park, K. B. (2018). Impact of helmet use on traumatic brain injury from road traffic accidents in Cambodia. *Traffic Injury Prevention, 19*(1), 66-70.

Haqverdi, M. Q., Seyedabrishami, S., & Groeger, J. A. (2015). Identifying psychological and socio-economic factors affecting motorcycle helmet use. *Accident Analysis & Prevention, 85*, 102-110.

Hung, D. V., Stevenson, M. R., & Ivers, R. Q. (2008). Barriers to, and factors associated, with ob served motorcycle helmet use in Vietnam. *Accident Analysis & Prevention, 40*(4), 1627-1633.

Karau, P. B., Ogeng'o, J. A., Okoro, D., Muia, M., & Saumu, M. W. (2015). Risk factor profile of motorcycle crash victims in rural Kenya. *Annals of African surgery, 12*(1), 4-8.

Karuppanagounder, K., & Vijayan, A. V. (2016). Motorcycle helmet use in Calicut, India: User behaviors, attitudes, and perceptions. *Traffic Injury Prevention, 17*(3), 292-296.

Khan, I., Khan, A., Aziz, F., Islam, M., & Shafqat, S. (2008). Factors associated with helmet use among motorcycle users in Karachi, Pakistan. *Academic Emergency Medicine, 15*(4), 384-387.

King, M. (2015). *Traffic behaviour and compliance with the law in low and middle income countries: Are we observing "pragmatic driving"?*. In proceedings of the 2015 Australasian Road Safety Conference.

Kiteywo, S. P. (2017). *Crash characteristics and injury patterns among commercial motorcycle users attending Kitale County Referral Hospital, Kenya 2013*. JKUAT Digital Repository. Accessed Jan, 13, 2018 at http://ir.jkuat.ac.ke/handle/123456789/2432.

Ledesma, R. D., & Peltzer, R. I. (2008). Helmet use among motorcyclists: observational study in the city of Mar del Plata, Argentina. *Revista de Saúde Pública, 42*(1), 143-145.

Lunnen, J. C., Pérez-Núñez, R., Hidalgo-Solórzano, E., Chandran, A., Híjar, M., & Hyder, A. A. (2015). The prevalence of motorcycle helmet use from serial observations in three Mexican cities. *International Journal of Injury Control And Safety Promotion, 22*(4), 368-376.

Lwin, A. M. M., Win, Y. Y., Aung, T., & Lwin, T. (2016). 514 Factors influencing motorcycle accidents in Nay Pyi Taw, Myanmar. I*njury Prevention, 22*(Suppl. 2), A185-A186.

Maghsoudi, A., Boostani, D., & Rafeiee, M. (2018). Investigation of the reasons for not using helmet among motorcyclists in Kerman, Iran. *International Journal of Injury Control and Safety Promotion, 25*(1), 58-64.

Manyara, C. G. (2016). Combating road traffic accidents in Kenya: A challenge for an emerging economy. In M. M. Koster, M. M. Kithinji, & J. P. Rotich (Eds.), *Kenya After 50* (pp. 101-122). New York: Palgrave Macmillan.

Matheka, D. M., Omar, F. A., Kipsaina, C., & Witte, J. (2015). Road traffic injuries in Kenya: A survey of commercial motorcycle drivers. *Pan African Medical Journal, 21*(1). doi: 10.11604/pamj.2015.21.17.5646

Morrison, D. S., Petticrew, M., & Thomson, H. (2003). What are the most effective ways of improving population health through transport interventions? Evidence from systematic reviews. *Journal of Epidemiology & Community Health, 57*(5), 327-333.

Nasong'o, W. M. (2015). Motorcycle public transport services in Kenya: A study of their compliance with road safety regulations in Kitale municipality (Unpublished master's thesis). University of Nairobi, Kenya.

Nyachieo, G. M. M. (2015). *Socio-cultural and economic determinants of boda boda motorcycle transport safety in Kisumu County, Kenya* (Unpublished doctoral dissertation). Kenyatta University, Kenya.

Obey, J. K., & Njagi, E. (2015). Establishing possible risk factors associated with motorcycle use and safety between Baraton and Chepterit, Nandi County, Kenya. *Baraton Interdisciplinary Research Journal, 5*(Special Issue).

Odhiambo, W. A., Hasan, S., Mock, C., Oyugi, J., & Kagereki, E. (2017). Directly observed road safety compliance by motor cycle riders after a 5-year road safety campaign in Naivasha, Kenya. *East African Medical Journal, 94*(1), 25-32.

Odiwuor, C. W., Nyamusi, E., & Odero, W. (2015). Incidence of road traffic crashes and pattern of injuries among commercial motorcyclists in Naivasha Town. *International Journal of Applied Research, 1*(11), 541-549.

Oluwadiya, K. S., Ojo, O. D., Adegbehingbe, O. O., Mock, C., & Popoola, O. S. (2016).

Vulnerability of motorcycle riders and co-riders to injuries in multi-occupant crashes. *International Journal of Injury Control and Safety Promotion, 23*(2), 189-196.

Onawumi, A. S., Oyawale, F. A., Dunmade, I. S., Ajayi, O. O., & Obasanya, O. O. (2016). Comfort analysis of commercial motorcyclists using protective helmets operating in Ogbomoso, Oyo State Nigeria. 3rd International Conference on African Development.

Orsi, C., Stendardo, A., Marinoni, A., Gilchrist, M. D., Otte, D., Chliaoutakis, J., ... & Morandi, A. (2012). Motorcycle riders' perception of helmet use: Complaints and dissatisfaction. *Accident Analysis & Prevention, 44*(1), 111-117.

Ranchet, M., Cavallo, V., Dang, N. T., & Vienne, F. (2016). Improving motorcycle conspicuity through innovative headlight configurations. *Accident Analysis & Prevention, 94*, 119-126.

Ryder, B., Gahr, B., Egolf, P., Dahlinger, A., & Wortmann, F. (2017). Preventing traffic accidents with in-vehicle decision support systems-The impact of accident hotspot warnings on driver behaviour. *Decision Support Systems, 99*, 64-74.

Sharma, V., & Verma, V. (2017). The role of law in preventing accidents. *Journal of Bone and Joint Diseases, 32*(2), 1-4.

Shinar, D. (2012). Safety and mobility of vulnerable road users: Pedestrians, bicyclists, and motorcyclists. *Accident Analysis and Prevention, 44*, 1-2.

Siddiqui, S. M., Sagar, S., Misra, M. C., Gupta, A., Crandall, M., & Swaroop, M. (2016). Patterns of injury among motorized two-wheeler pillion riders in New Delhi, India. *Journal of Surgical Research, 205*(1), 142-146.

Singoro, B. W., Wakhungu, J., Obiri, J., & Were, E. (2016). Causes and trends of public transport motorcycle accidents in Bungoma County, Kenya. *International Journal of Multidisciplinary Academic Research, 4*(1), 37-42.

Vasconcellos, E. A. D. (2013). Road safety impacts of the motorcycle in Brazil. International *Journal of Injury Control and Safety Promotion, 20*(2), 144-151.

Vissoci, J. R. N., Shogilev, D. J., Krebs, E., Andrade, L. D., Vieira, I. F., Toomey, N., ... & Staton, C. A. (2017). Road traffic injury in Sub-Saharan African countries: A systematic review and summary of observational studies. *Traffic Injury Prevention, 18*(7), 767-773. doi: 10.1080/15389588.2017.1314470

Wells, S., Mullin, B., Norton, R., Langley, J., Connor, J., Lay-Yee, R., & Jackson, R. (2004). Motor cycle rider conspicuity and crash related injury: Case-control study. *BMJ, 328*(7444), 857. doi: 10.1136/bmj.37984.574757.EE

Wilberforce, C., & Olela, S. (2016) Pattern and risk factors for bicycle and motorcycle related injuries in Kisumu city: An implication for prevention. *International Journal of Academic Research and Development, 1*(12), 13-23.

World Health Organization (WHO). (2015). *Global status report on road safety 2015*. Geneva: Author.

World Health Organization (WHO). (2018). *Road safety in Kenya*. Accessed Jan 11, 2018. http://www.who.int/violence_injury_prevention/road_traffic/countrywork/ken/en/

Yadukul, S., Devadass, P. K., & Gururaj, G. (2016). Role of Helmet in Preventing Head Injury among Two Wheeler Occupants in Fatal Road Traffic Injuries. *Indian Journal of Forensic Medicine & Toxicology, 10*(1), 6-10.