Helmet Wearing Behavior Where People Often Ride Motorcycle in Ethiopia: a Cross-sectional Study

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Abstract

Background: Road traffic accidents are a major global concern which affects all people regardless of their age, sex, wealth, among others. Injuries and deaths due to motorcycle are highly increasing, especially in developing countries. Wearing helmet has been shown to significantly reduce deaths and injuries due to motorcycle accidents.

Objectives: To assess magnitude of helmet wearing and its determinants among motorcycle riders in Sawula and Bulky towns, Gofa zone, Southern Ethiopia.

Methods: 422 motorcycle drivers were sampled in a cross-sectional study conducted from 15, April to 25, May, 2020 in Sawula and Bulky towns, where people often drive motorcycle. Stratified sampling technique was used to recruit the sampled drivers in a face to face interview. Data were entered into EPI-data version 3.1 and exported to Statistical Package for the Social Sciences (SPSS) version 23 to manage analysis. Descriptive analyses like frequency, percentage, mean and standard deviation were carried out as necessary. Logistic regression models were fitted to identify the predictors of helmet wearing. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were used to determine the presence and strength of association.

Results: A total of 403 motorcycle drivers participated in the study which gives a 95.5% response rate. Of the total of 403 motorcycle riders, only 12.4% (95% CI, 9.2 to 15.6%) of them wore a helmet while driving a motorcycle. Having license [AOR 3.51(95% C.I 1.56-7.89)], driving strips >10Km [AOR 2.53(95% C.I 1.08-5.91)], History of accident[AOR 2.71(95% C.I 1.32-5.55)], driving experience of >=10 years[AOR 2.98 (95% C.I 1.25-7.09)] and high perceived susceptibility to accident [AOR 3.10(95% C.I 1.29-7.46)] had statistically significant association with helmet wearing comparted to their counterpart.

Conclusion: This study highlighted that helmet wearing was very low. Having a license, driving strips, exposure to accident, driving experience, and accident risk perception were determinants of helmet wearing. These determinants imply that helmet wearing was directly or indirectly relies on motorcycle drivers' knowledge and perceptions about accident and helmet wearing. Therefore, we advise all stakeholders to conduct awareness creation campaigns and give focus on mandatory helmet wearing.

Background

Road traffic accidents (RTA) are among the leading causes of death, disabilities, and injuries around the world [1, 2]. Every year, as many as 50 million people are injured and nearly 1.3 million people lose their lives on the road[3]. Road injuries are the 8th leading cause of death globally, in developing countries and in sub-Saharan Africa. In contrast, they are the 17th leading cause of death in developed countries even though they have dramatically higher motorization rates[4, 5]. Despite the low number of the registered vehicles, the burden of RTA is disproportionally high in low- and middle-income countries, where over 90% of the world's fatalities on roads occur available in these regions[6, 7]. The road injury death rate in sub-Saharan Africa, 27.0 per 100,000 people, was 40% higher than the global road injury death rate. Four

countries (Nigeria, Ethiopia, South Africa, and Sudan) together account for half the road injury death toll of sub-Saharan Africa [4]. In Ethiopia, rates of injuries and fatalities secondary to RTAs are exceptionally high (contributed to 43.8% of all fatalities) and more than one-third of such accidents occur in vulnerable road users including motorcyclists, pedestrians, and cyclists[8].

Globally, motorcycles accounted for 23% of RTA-related death[2]. Motorcycle crashes are amongst the leading causes of traffic-related injuries and deaths in all age groups, especially in low- and middle-income countries [9–12]. This was due to many factors such as using motorcycles for commercial transport[2]. Evidence showed that motorcycle drivers are among the most vulnerable road users [1, 13]. In India, the prevalence of motorcycle injuries was 56.1%[13]. In Sub-Saharan Africa, motorcycle driver death contributes 13% of RTA-related death[14]. The problem was much higher in some countries. For instance, it constitutes 37.2% of all road traffic injuries in Tanzania[15], about 33% of fatalities associated with RTA in Ugandan, 24% in Kenya, and 18% in Ghana [1]. In Ethiopia, 21.0% of death from RTA causalities was motorcycle drivers [8]. Evidence from studies conducted in Ethiopia pointed that the rate of death due to a motorcycle crash in some areas was higher than the national death rate. For instance, studies from Arbaminch and Wolayita indicated that 40% and 31.2% of road traffic injuries resulted from motorcycle crashes, respectively [16, 17].

In addition to death and disabilities; motorcycle accident-related injuries can also result in loss economic of the individual, families, and the communities due to the requirement of specialized or long-term care, medical costs, loss of labor outputs, and funeral expenses [18–20]. Motorcycle crashes have a greater risk of serious injuries and death compared to other forms of transport because motorcycle users lack protection in the event of crashes, such as seat belts, helmets, airbags, and the body structure of the vehicle[21, 22]. These can be reduced if motorcycle drivers regularly and properly wear a helmet.

Evidence indicated that effective use of helmets has a pivotal role in preventing or reducing injuries during motorcycle accidents and its negative consequences [1, 23–25]. For instance, a systematic review showed that helmets are effective in reducing the risk of head injuries in motorcyclists by 69% and death by 42%, resulting in a significant reduction in the healthcare costs associated with a crash[26]. A study from Addis Ababa Ethiopia also showed the injury severity was high among motorbike riders or motorbike passengers without helmets [27]. Indeed, it also reduces the length of hospital stay and the medical costs of injured riders. Thus, helmet-wearing highly contributes to the achievement of sustainable development goal-3.

Despite, the effectiveness of helmet wearing in reducing death, disabilities, injuries, and economic and societal impact due to motorcycle accident; to the best of authors' knowledge, the status of helmet wearing was unknown in Ethiopia. Therefore, this study aimed to assess Helmet wearing and its determinants among motorcycle drivers in Sawula and Bulky town, Gofa zone, Southern Ethiopia 2020.

Methods

Study Design and setting

A cross-sectional study was conducted from 15, April to 25, May 2020 in Sawula and Bulky towns. Sawula and Bulky towns are found 514 kilometers and 531 kilometers away from Addis Ababa (the capital city of Ethiopia), respectively. Based on the 2020 report obtained from the Sawula and Bulky towns' health offices, Sawula town has ten kebele (the smallest administrative unit next to district) and Bulky town has five kebele. Sawula and Bulky towns had a total population of 46,957 and 25,000; and households 9,582 and 5,201 respectively [28, 29]. Sawula town has one government general hospital, one health center, twelve private clinics[28]. The bulky town has one health center and four private clinics[29]. A motorcycle is the common mode of transportation both in Sawula and Bulky towns. The towns were purposely selected considering factors like researchers' familiarity with the study area and resource issues. Both towns are rapidly increasing in population size and economic growth among the towns of Gofa Zone, Southern Ethiopia.

Population and sampling

The source populations were all motorcycle drivers in Sawula and Bulky towns. Study populations were all randomly selected motorcycle drivers who were driving a motorcycle in the past three months before the study period. All motorcycle drivers who drive a motorcycle in the past three months before the study period were included in the study. Whereas, motorcycle drivers who were unable to communicate or severely ill during the data collection period and those who live in the study areas for less than six months were excluded.

The sample size was calculated using a single population proportion formula with the assumption of 50% proportion of helmet wearing (since the were no studies in Ethiopia that can address these objectives), 1.96 standard normal distribution curve value for 95% level of confidence, and 5% margin of error between the sample and the population. Finally, considering a non-response rate of 10%, the total sample size was calculated to be 422.

The participants of the study were selected as follows: First, the list of owners of motorcycles, their phone number, and motorcycles' plate numbers were obtained from the registration books of Sawula and Bulky towns' road and transportation offices to construct the sampling frame. Accordingly, 500 and 250 owners of motorcycles were identified in Sawula and Bulky town respectively. Then, the sample size was proportionally allocated to the two towns. Finally, computer-generated simple random sampling was used to identify the study participants. Their phone numbers were used to contact the participants. For those whose phone call was not working, their usual place of residence and working area was identified in collaboration with health extension workers. Since the possibility that a motorcycle may not be ridden by the owner and/or the existence of more than one rider for a single motorcycle; individuals who commonly drive the motorcycle during the last three months before data collection were selected after information from the owner of the motorcycle. In case when difficult to know who commonly drives the motorcycle, a lottery method was used to select them.

Data collection tools and procedures

An interviewer-administered structured questionnaire was adapted from different related literature [30-33]. It was initially prepared in English language and then translated to the local language (Gophigna and Amharic) and back-translated to English language by an independent translator to check for consistency of meaning. The questionnaire comprised of socio-demographic and economic characteristics, driving-related factors, substance use, and knowledge about helmet, perceived susceptibility, perceived severity, social pressure, and helmet wearing related questions. Perceived susceptibility, perceived severity, and social pressure were assessed using a five-scale response format, where: 1= strongly disagree, 2= Disagree, 3 = Neutral, 4= Agree, 5= strongly agree). Accordingly, perceived susceptibility and perceived severity were assessed by four items, and social pressure related to helmet wearing was assessed by five items. Knowledge about helmet was assessed by three items in 'Yes or No' format. A correct answer was coded as "1" and an incorrect answer was coded as "0". Helmet wearing was assessed by two questions: One yes or No question (Have you used helmet prepared for motorcycle drivers in the past three months during driving?) and for those who answered "yes" to the first question, they were asked one additional three Likert scale question (How often do you wear?) with the response options of 1= Rarely, 2= Sometimes and 3= Always. A pretest was conducted on 5% of the total sample size in shefite town and some modifications were done based on the findings. The internal consistency of the items was checked using Cronbach's alpha (α).   Accordingly, the alpha of perceived susceptibility α = 0.98, perceived severity α = 0.85 and social pressure α = 0.91.

Six data collectors (four BSc Nurses and two diploma Nurses) and two supervisors (Health Officers) were involved in the study. One day intensive training was given to data collectors and supervisors on the aim of the study, data collection instruments, research ethics, and approaches to study participants. Data collection was conducted at the workplaces, main parking areas, and the area where traffic police monitor the drivers (police stations). Close supervision during data collection, daily feedback, and proper cleaning before and after entry, was made seriously. In addition to supervisors, the authors coordinated the data collection, made site visits, and oversaw the whole process and then if any inconsistency and errors were checked and solved immediately.

Operational Definitions and Measurements

In this study, motorcycle riders were considered as "wear helmet" if they were always wearing helmet for the sake of reducing motorcycle injuries while they drive in the last three months before the study period. That means, respondents who *"hadn't worn, wear rarely and wear sometimes"* were considered as "Not wearing helmet" and those who *"wear always"* were considered as "Wearing helmet".

 To measure perceived susceptibility, perceived severity, and social pressure; subscale scores were computed by summing item scores and dividing by the total number of items. Then, dichotomization was made by taking mean as a cut of point. Scores above or equal to the mean scores were considered as "high" and scores below the mean score were considered as "low". Knowledge about helmet was measured by computing a total score after summing up all three items together. Then, respondents were

considered as "knowledgeable" if they scored above or equal to the mean value otherwise considered as "less knowledgeable".

Social pressure: Any influence made on the motorcycle drivers from his friends and/or families and/or community to wear helmet.

Data analysis

The collected data were entered into Epidata version 3.1 and then exported to SPSS version 23 for analyses. Descriptive statistics like frequencies, proportions, means and standard deviations were done for different variables. Binary logistic regression analysis was carried out to select variables for multivariable regression analysis. Accordingly, variables with a p-value < 0.25 in the binary logistic regression analysis were taken as candidates for multivariable regression analysis. Finally, multivariable logistic regression analyses were performed to control for the possible confounding effect of the selected variables. Crude and adjusted odds ratio, and 95% CI were used to determine the magnitude of the association. Variables with a p-value of < 0.05 were taken as statistically significant determinants for wearing helmet. Model fitness was checked using Hosmer and Lemeshow goodness of a fit test and the model test P-value was found to be 0.10. Finally, results were presented in the form of tables, figures and narratives.

Ethical Approval

Ethical clearance was obtained from the Research and Ethical Review Committee of Jimma University. Permission letter was secured from Sawula and Bulky towns Health Offices, and road and transportation offices. Written informed consent was taken from each study participant. For participants under 18 years old, the written consent was obtained from their parents. All participants were informed about the purposes and benefits of the study. They were informed that participation in the study is voluntary and that they can refuse to participate or withdraw from the study without any penalties. Moreover, the participants were reassured that their responses were kept confidential.

Results

Socio-demographic and economic characteristics of respondents

A total of 403 motorcycle drivers participated in the study which gives a response rate of 95.5%. A majority, 246(61.0%) of the respondents were in the age range of 18-35 years. More than half, 226(56.1%) were single by marital status. Nearly half, 203(50.4%) of the participants were commercial motorcycle drivers. Of the total 403 respondents, 373 (92.6%), of them attended formal education (Table 1).

Table 1: Socio-demographic and economic characteristics of motorcycle drivers in Sawula and Bulky towns, Gofa zone, Southern Ethiopia, 2020.

Variable	Category	Frequency	Percentage
Age (yrs)	<18	54	13.4
	18-35	246	61.0
	>35	103	25.6
Marital status	Single	226	56.1
	Married	148	36.7
	Divorced	17	4.2
	Widowed	12	3.0
Educational status	No formal education	30	7.4
	Primary (1-8)	133	33.0
	Secondary (9-12)	81	20.1
	Technical/vocational	48	11.9
	Degree and above	111	27.5
The main occupation of the respondents	Commercial motorcycle driver	203	50.4
	Farmer	44	10.9
	Merchant	66	16.4
	Government employee	73	18.1
	NGOs	17	4.2
Monthly income	<1000 ETB	22	5.5
	1000-2000	66	16.4
	2000-3000	96	23.8
	3000-4000	80	19.9
	>4000	139	34.5

Driving and substance use-related factors

Of a total of 403 motorcycle drivers, Half, 202(50.1%) of them had motorcycle driving license. The majority of them, 251(62.3%) and 280(69.5%) had a history of driving experience of less than five years and drive commonly more than ten kilometers, respectively. More than one-fourth, 110(27.3%) of the respondents had a history of a motorcycle injury. More than three fourth, 306(75.9%) of the participants

had a history of alcohol drinking and the majority, 228(56.6%) of them driver within four hours after drinking an alcoholic beverage (Table 2).

Table 2: Driving and substance use-related factors among motorcycle drivers in Sawula and Bulky towns, Gofa zone, Southern Ethiopia, 2020

Variable	Category	Frequency	Percentage
Had license	Yes	202	50.1
	No	201	49.9
Driving experience (yrs.)	<5	251	62.3
	5-10	99	24.6
	≥10	53	13.2
Driving distance	<5 Km	38	9.4
	5-10 Km	85	21.1
	>10 Km	280	69.5
Driving frequency	Daily	181	44.9
	Sometimes	149	37.0
	Rarely	73	18.1
Ever had a motorcycle accident	Yes	110	27.3
	No	293	72.7
History of alcohol drinking	Yes	306	75.9
	No	97	24.1
Drink driving	Yes	228	56.6
	No	175	43.4
History of khat chewing	Yes	297	73.7
	No	106	26.3

Perceptions, knowledge of motorcycle drivers and social pressure

The mean scores for perceived susceptibility, perceived severity, knowledge about helmet and social pressures related to helmet wearing were summarized in table 3.

Table 3: Perceptions and knowledge of motorcycle drivers and social pressure on motorcycle drivers in Sawula and Bulky towns, Gofa zone, Southern Ethiopia, 2020.

Variable	Minimum	Maximum	Range	Mean[Std. deviation]
Perceived susceptibility	7	20	13	15.59[±2.21]
Perceived severity	4	20	16	14.96[±2.20]
Knowledge	1	3	2	2.10 [± 0.33]
Social pressure	8	25	17	15.77[±4.13]

Prevalence of Helmet Wearing

Findings of this study indicated among a total of 403 motorcycle riders, only 50(12.4%) of them wore helmet while driving a motorcycle (Figure 1).

Factors associated with motorcycle drivers helmet wearing

As shown in table 4, a total of eleven variables: Age, having license, driving distance, driving area, history of motorcycle accident, history of alcohol drinking, driving experience, knowledge about personal protective equipment, social pressure, perceived Susceptibility and perceived Severity had a significant association with helmet wearing at p-value <0.25 in binary logistic regression analysis. After adjusting for potential confounders in multiple variable logistic regression analysis, having license, driving distance, history of motorcycle accident, driving experience and perceived Susceptibility were found to be statistically significant predictors of motorcycle drivers' helmet wearing.

Findings showed that the likelihood of wearing helmet were nearly 3.5 times [AOR 3.51(95% C.I 1.56-7.89)] higher among motorcycle drivers who had license compared to their counterparts. Driving distance also determined helmet wearing. The odd of wearing helmet was nearly 2.5 times [AOR 2.53(95% C.I 1.08-5.91)] higher among those who drive a distance of greater than 10Km compared to those who drive distance of <=10Km. Motorcycle drivers who had a history of motorcycle accident were nearly 2.7 times [AOR 2.71(95% C.I 1.32-5.55)] more likely to wear helmet compared to those who hadn't a history of motorcycle accident. The findings of this study also showed the existence of an association between driving experience and helmet wearing. The odd of wearing helmet was nearly three times [AOR 2.98 (95% C.I 1.25-7.09)] higher among motorcycle drives who had a driving experience of >=10 years compared to those who had a driving experience of <5 years. Motorcycle drivers who had high perceived Susceptibility to accident were nearly three times [AOR 3.10(95% C.I 1.29-7.46)] more likely to wear helmet compared to their counterpart (Table 4).

Table 4: Logistic regression analyses of factor associated with helmet use among motorcycles drivers in Sawula and Bulky towns, Gofa zone, Southern Ethiopia, 2020

Variable	Helmet wearing Status		COR (95%CI)	AOR (95% CI)
	Wear	Not wear		
Age (yrs.)				
<18	1	53	1	1
18-35	28	218	6.81[.91-51.17]	2.97[0.37-24.17]
>=35	21	82	13.57[1.77- 103.93] *	4.56[0.52-39.69]
Have license				
Yes	41	161	5.43[2.56-11.52] **	3.51[1.56-7.89] *
No	9	192	1	1
Driving Distance				
<=10Km	8	115	1	1
>10Km	42	238	2.54[1.15-5.58] *	2.53[1.08-5.91] *
Common driving area				
Outside main road	15	164	1	1
On main road	35	189	2.03[1.07-3.84] *	1.55[0.76-3.16]
History of Accident				
Yes	26	84	3.47[1.89-6.36] **	2.71[1.32-5.55] *
No	24	269	1	1
History of alcohol drinking				
Yes	42	264	1	1
No	8	89	0.57[0.26-1.25]	0.45[0.19-1.08]
Driving experience				
<5 yrs.	20	231	1	1
5-10 yrs.	17	82	2.40[1.20-4.79] *	1.78[0.83-3.83]
>=10 yrs.	13	40	3.75[1.73-8.15] *	2.98[1.25-7.09] *
Knowledge				
Poor	17	160	1	1
Good	33	193	1.61[.86-3.00]	1.29[0.63-2.67]
Social pressure				

Low	13	146	1	1
High	37	207	2.01[1.03-3.91] *	1.32[0.61-2.85]
Perceived susceptibility				
Low	7	130	1	1
High	43	223	3.58[1.57-8.19] *	3.10[1.29-7.46] *
Perceived severity				
Low	6	115	1	1
High	44	238	3.54[1.47-8.56] *	1.69[0.56-5.11]

*Statistically significant at P-value <0.05, ** statistically significant at P-value <0.001

Discussion

Road traffic accidents have been highly increasing both in developed and developing countries. Motorcycle is among the main contributors for road traffic accidents especially in low and middle income countries where motorcycles are a primary mode of transportation. Wearing personal protective devices especially helmet is the most cost-effective and has the potential to substantially reduce road traffic injuries, deaths and the associated personal and societal costs.

Findings of our study showed that only 12.4% of the study participants were wearing a helmet. This finding was by far lower than studies conducted in high-income countries like the united states (68.4%) [34]and Australia (89%)[35]. This might be due to the study population difference. The current study was conducted among all types of riders. However, a study from the United States was conducted among recent graduates of a motorcycle training course and a study from Australia was conducted among cyclists who faced crashes in transport-related areas. Attending training increases knowledge, perceived benefit of the desired behavior, positive attitude and finally help individuals to engage in the intended behavior/helmet wearing. The previous history of accidents might also enable people to engage in the recommended behavior. The discrepancy might also be due to the difference in legislation on helmet utilization.

The finding of our study was also lower than studies conducted in upper-middle-income countries like Mexico (73.8%)[36], India (64.7%)[37], Thailand (55.8%)[38], China (43.2%) [39] and Argentina (40%)[40]. The discrepancy might be due to legislation related to helmet wearing. Helmet use is mandatory for both motorcycle drivers and pillion riders in these countries unlike in Ethiopia and law enforcement strictly has been on penalties for motorcyclists who do not obey helmet use and even seizing their vehicles. The existence of such legislation enforces the riders to wear personal protective equipment and helps to reduce road traffic accidents. The discrepancy might also be due to strong operationalization of the behavior (helmet wearing) in terms of frequency, duration and purpose in our study. That means riders who always wore helmet in the last three months before study period for the sake of reducing injuries and

other consequences of road traffic accident. Indeed, the difference might also be due to sample size difference. However, the finding of the current study was comparable with studies conducted Iran where (10%) [41]and (10.7%) [42] of motorcyclists wore a standard helmet while riding.

The findings of our study was lower than studies conducted in low-middle income countries such as Cameroon (65%)[43], Pakistan (56%)[44], Myanmar (51.5%)[45], India (44.5%)[46], Vietnam (23%)[47], Ghana (47%)[48], Tanzania (42.3%)[49], Kenya (28%)[50], and study from low income country like Uganda where 30.8% of drivers were wearing helmets[33]. This might be probably due to relatively strong legislation of helmet use in these countries compared to Ethiopia. In Ethiopia, wearing helmet is not mandatory and people as per their interests. However, the finding of our study was higher than a study from Nigeria, where only 2.7% of participant wore helmet regularly[51] and study from Malawi which showed that of the 1900 cyclists observed, no cyclist was identified as wearing a helmet[52]. This might be due to difference of study population. Study conducted in Malawi was conducted among bicycle riders while our study was conducted among motorcycle riders. The discrepancy might also be due to gaps of study period between the previous studies and current study.

This study also identified determinants of helmet wearing among motorcycle riders. The findings showed that the likelihood of wearing helmet were nearly 3.5 times higher among motorcycle drivers who had license compared to their counterparts. This was similar to studies conducted in the United Kingdom[53], Southern Iran[54] and Ghana[48, 55]. This might be due to the fact that license owners took training about the traffic rules and ways of reducing road traffic accidents and the benefits of using personal protective equipments like helmet. Hence training helps to increase knowledge about helmet wearing, attitude towards helmet wearing, and practice/wearing of helmet. Studies from Thailand[38] and Uganda[56] pointed the association between training and road safety compliance/helmet use. The current study also showed the association between riding distance and helmet wearing. Motorcycle riders who usually drive a distance of greater than ten kilometers were more likely to wear helmet compared to those who drive a distance of less than or equal to ten kilometers. This finding was in congruent with studies done in Vietnam[47] and Batu Pahat, Johor[57], which showed higher compliance to safety helmet usage among motorcyclists who travel a longer distance. The higher usage of safety helmets for longer distance trips might be due to be due to higher accident risk perception. Driving longer distances may increase the chance of facing road traffic accidents. This may increase the drivers' risk perception which may in turn increases the utilization of personal protective equipments like helmet.

Similar to a study conducted in Vietnam[47], our study also showed that motorcycle drivers who had a history of motorcycle accident were more likely to wear helmet compared to those who hadn't a history of the motorcycle accident. This was probably due to the previous exposure to an accident can increase individuals' perception about the risks and seriousness of accident. In addition, exposure to accident may also increase the perceived benefits of using personal protective devices, which may help riders to wear helmet. The findings of the current study also indicated the association between helmet wearing and driving experience. Motorcycle drivers who had longer driving experiences (>=10 years) had higher odd of wearing helmet compared to those who had a driving experience of <5 years. This finding was supported

by studies conducted in Iran[54], Batu Pahat, Johor[57], and Nigeria[58]. The possible explanation was due to the fact that as the experience increase the chance of obtaining right information also increases, which may motivate individuals and engage them in wearing helmet. Our study also showed a statistically significant association between risk perceptions and helmet wearing. Motorcycle drivers who had high perceived susceptibility to accident were more likely to wear helmet compared to those who had low perceived susceptibility. This was due to the fact that acceptable risk perception can help individuals to take protective measures. However, highly increased risk perception may cause fear, tension, and depression which lead to ignorance of the desired behavior. A study from United Kingdom also showed the association of risk perceptions and motorcycle drivers' personal protective equipment wearing[53].

This study has strengths. One of the strengths of this study was that the authors well defined the behavior (helmet wearing) in terms of frequency, duration, and purpose. That means motorcycle riders were considered as wear helmet if they were always wearing helmet for the sake of reducing motorcycle injuries while they drive in the last three months before the study period. To the best of the authors' knowledge, this was the first study to elicit responses related to helmet wearing in Ethiopia. Thus, this study contributes to the limited literature. This study has several limitations. Hence, the findings of the study should be interpreted in light of the following limitations. First, As sampling frames of motorcycle drivers were prepared based on the registered motorcycle, those who drive unregistered motorcycles were not included in this study. Thus, it was difficult to generalize the findings of this study to all motorcycle drivers of Sawula and Bulky towns. Second, Due to the nature of the study, there might be interviewee bias as some respondents were interviewed at their workplace and busy with their work. However, to reduce this, participants were well informed about the purpose of the study and data collectors scheduled the time of interview after discussing the study participants. Third, Recall bias might occur for some variables. Fourth, there might be social desirability bias for interviews conducted at police station. However, to reduce, this training was given for data collectors and supervisors to keep distances from crowded areas and influential people like traffic police during interviews with the study participants.

Conclusion

This study highlighted that helmet wearing was very low. Having license, driving strips, exposure to accident, driving experience and accident risk perception were determinants of helmet wearing. These determinants imply that helmet wearing was directly or indirectly relies on motorcycle drivers' knowledge and perceptions about accidents and helmet wearing. Therefore, we advise all stakeholders to conduct public education like awareness creation campaigns and via media, promote motorcycle rider training programs, routine sensitization on safe riding and give attention to road safety measures to improve helmet wearing among motorcyclists. Concerned bodies were also recommended to prepare and distribute advocacy messages about the risks of head injury and other consequences of motorcycle accidents. The study highlights the importance of setting and enforcing stringent legislative measures / mandatory universal helmet legislation. In addition, periodic police checks also help to improve helmet wearing. We also advise the relevant key authorities like traffic police to allow only riders with a motorcycle license to ride in order to encourage others to apply for a license. We also recommend

researchers to conduct observational studies. Indeed, researchers are advised to measure helmet wearing status of Pillions/ passengers.

Abbreviations

AOR: Adjusted odds ratio; CI: Confidence interval; COR: Crude odds ratio; RTA: Road traffic accidents; SPSS: Statistical Package for the social sciences

Declarations

Ethics approval and consent to participate:

A letter of ethical approval was received from the Institutional Review Board of Jimma University. In addition, the official letter of cooperation was obtained from the Sawula and Bulky towns' health office, and road and transportation office. All the study participants were informed about the purpose of the study, their right to refuse, and assured about the confidentiality of the information they provided. Written informed consent was obtained from all participants. For participants under 18 years old, the written consent was obtained from their parents.

Consent for publication:

Not applicable

Availability of data and material:

The data of the study are available from the corresponding author upon reasonable request.

Competing interests:

The authors declare that they have no competing interests.

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Authors' contributions:

DB participated in the conception, design, data collection, analyses, report writing, interpretation, critically reviewed the draft of the manuscript. FT participated in the conception, design, analyses; report writing, wrote the first draft of the manuscript, interpretation, critically reviewed the draft of the manuscript. YK participated in the conception, design, analyses; report writing, interpretation, critically reviewed the draft of the manuscript. ZB participated in the conception, design, analyses; report writing, interpretation, critically reviewed the draft of the manuscript. All authors read and approved the final manuscript and agreed for submission.

References

1. World Health Organization: Global status report on road safety 2018: Summary. In.: World Health Organization; 2018.

2. World Health Organization: Global status report on road safety 2013: supporting a decade of action: summary. In.: World Health Organization; 2013.

3. Sleet DA, Baldwin G, Dellinger A, Dinh-Zarr B: The decade of action for global road safety. Journal of safety research 2011, 42(2):147-148.

4. Bhalla K, Harrison J, Shahraz S, Abrahama J, Bartels D, Yeh P: The views expressed in this report are those of the authors. Burden of road Injuries in Sub-Saharan Africa, Global Road Safety Facility, Harvard School of Public Health 2014.

5. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, Abraham J, Adair T, Aggarwal R, Ahn SY: Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. The lancet 2012, 380(9859):2095-2128.

6. Jafarpour S, Rahimi-Movaghar V: Determinants of risky driving behavior: a narrative review. Medical journal of the Islamic Republic of Iran 2014, 28:142.

7. WHOD V, Prevention I, Violence W, Prevention I: Organization WH. Global status report on road safety: time for action: World Health Organization 2009.

8. Abegaz T, Gebremedhin S: Magnitude of road traffic accident related injuries and fatalities in Ethiopia. PLoS one 2019, 14(1):e0202240.

9. Krug EG, Sharma GK, Lozano R: The global burden of injuries. American journal of public health 2000, 90(4):523.

10. Wong E, Leong MK, Anantharaman V, Raman L, Wee KP, Chao TC: Road traffic accident mortality in Singapore. The Journal of emergency medicine 2002, 22(2):139-146.

11. Orsi C, Marchetti P, Marinoni A, Morandi A: Risk factors for road traffic accidents severity in the province of Milan, Italy. Biomedical statistics and clinical epidemiology 2009, 3(3):141-152.

12. Bachani AM, Koradia P, Herbert HK, Mogere S, Akungah D, Nyamari J, Osoro E, Maina W, Stevens KA: Road traffic injuries in Kenya: the health burden and risk factors in two districts. Traffic injury prevention 2012, 13(sup1):24-30.

13. Fitzharris M, Dandona R, Kumar GA, Dandona L: Crash characteristics and patterns of injury among hospitalized motorised two-wheeled vehicle users in urban India. BMC public health 2009, 9(1):1-12.

14. Bhalla K, Harrison J, Shahraz S, Abraham J, Bartels D: Burden of road injuries in sub-Saharan Africa. Boston: Department of global health and population, Harvard School of Public Health 2013.

15. Chalya PL, Mabula JB, Ngayomela IH, Kanumba ES, Chandika AB, Giiti G, Mawala B, Balamuka D: Motorcycle injuries as an emerging public health problem in Mwanza City, Tanzania: A call for urgent intervention. Tanzania Journal of Health Research 2010, 12(4):214-221.

16. Misker D, Tunje A, Mengistu A, Abera F, Yalelet M, Gebrie M, Yimam M, Ayalew S, Anemaw S: Magnitude and factors associated with road traffic accident among traumatized patients in Arba Minch General hospital. Int J Public Health Saf 2017, 2(3):1-5.

17. Hailemichael F, Suleiman M, Pauolos W: Magnitude and outcomes of road traffic accidents at Hospitals in Wolaita Zone, SNNPR, Ethiopia. BMC research notes 2015, 8(1):135.

18. Blincoe L, Miller TR, Zaloshnja E, Lawrence BA: The economic and societal impact of motor vehicle crashes, 2010 (Revised). In.; 2015.

19. Allen Ingabire J, Petroze R, Calland F, Okiria J, Byiringiro J: Profie and Economic Impact of Motorcycle Injuries Treated at a University Referral Hospital in Kigali, Rwanda. Rwanda Medical Journal 2015, 72(4):5-11.

20. Kudebong M, Wurapa F, Nonvignon J, Norman I, Awoonor-Williams J, Aikins M: Economic burden of motorcycle accidents in Northern Ghana. Ghana medical journal 2011, 45(4).

21. Shinar D: Safety and mobility of vulnerable road users: pedestrians, bicyclists, and motorcyclists. In.: Elsevier; 2012.

22. Orsi C, Stendardo A, Marinoni A, Gilchrist MD, Otte D, Chliaoutakis J, Lajunen T, Özkan T, Pereira JD, Tzamalouka G: Motorcycle riders' perception of helmet use: Complaints and dissatisfaction. Accident Analysis & Prevention 2012, 44(1):111-117.

23. Stiles R, Benge C, Stiles P, Dong F, Ward J, Ablah E, Haan JM: Evaluation of protective equipment used among motorbike riders. Kansas journal of medicine 2018, 11(2):44.

24. Solagberu B, Ofoegbu C, Nasir A, Ogundipe O, Adekanye A, Abdur-Rahman LO: Motorcycle injuries in a developing country and the vulnerability of riders, passengers, and pedestrians. Injury prevention 2006, 12(4):266-268.

25. Keng S-H: Helmet use and motorcycle fatalities in Taiwan. Accident Analysis & Prevention 2005, 37(2):349-355.

26. Liu BC, Ivers R, Norton R, Boufous S, Blows S, Lo SK: Helmets for preventing injury in motorcycle riders. Cochrane database of systematic reviews 2008(1).

27. Baru A, Azazh A, Beza L: Injury severity levels and associated factors among road traffic collision victims referred to emergency departments of selected public hospitals in Addis Ababa, Ethiopia: the study based on the Haddon matrix. BMC emergency medicine 2019, 19(1):1-10.

28. Sawula town Health office: annual plan. In.; 2020.

29. Bulky town Health office: annual plan. In.; 2020.

30. Haqverdi MQ, Seyedabrishami S, Groeger JA: Identifying psychological and socio-economic factors affecting motorcycle helmet use. Accident Analysis & Prevention 2015, 85:102-110.

31. Pitaktong U, Manopaiboon C, Kilmarx PH, Jeeyapant S, Jenkins R, Tappero J, Uthaivoravit W, van Griensven F: Motorcycle helmet use and related risk behaviors among adolescents and young adults in Northern Thailand. Southeast Asian journal of tropical medicine and public health 2004, 35:232-241.

32. Lawal N, Oche M, Isah B, Yakubu A, Raji M: Knowledge, Attitude and Compliance with Safety Protective Measures and Devices among Commercial Motorcyclists in Sokoto Metropolis, Northwestern Nigeria. Journal of Advances in Medical and Pharmaceutical Sciences 2018:1-9.

33. Roehler DR, Naumann RB, Mutatina B, Nakitto M, Mwanje B, Brondum L, Blanchard C, Baldwin GT, Dellinger AM: Using baseline and formative evaluation data to inform the Uganda Helmet Vaccine Initiative. Global health promotion 2013, 20(4_suppl):37-44.

34. Ranney ML, Mello MJ, Baird JB, Chai PR, Clark MA: Correlates of motorcycle helmet use among recent graduates of a motorcycle training course. Accident Analysis & Prevention 2010, 42(6):2057-2062.

35. de Rome L, Boufous S, Georgeson T, Senserrick T, Ivers R: Cyclists' clothing and reduced risk of injury in crashes. Accident Analysis & Prevention 2014, 73:392-398.

36. Lunnen JC, Pérez-Núñez R, Hidalgo-Solórzano E, Chandran A, Híjar M, Hyder AA: The prevalence of motorcycle helmet use from serial observations in three Mexican cities. International journal of injury control and safety promotion 2015, 22(4):368-376.

37. Wadhwaniya S, Gupta S, Tetali S, Josyula LK, Gururaj G, Hyder AA: The validity of self-reported helmet use among motorcyclists in India. WHO South-East Asia journal of public health 2015, 4(1):38-44.

38. Siviroj P, Peltzer K, Pengpid S, Morarit S: Helmet use and associated factors among Thai motorcyclists during Songkran festival. International journal of environmental research and public health 2012, 9(9):3286-3297.

39. Xuequn Y, Ke L, Ivers R, Du W, Senserrick T: Prevalence rates of helmet use among motorcycle riders in a developed region in China. Accident Analysis & Prevention 2011, 43(1):214-219.

40. Ledesma RD, Peltzer RI: Helmet use among motorcyclists: observational study in the city of Mar del Plata, Argentina. Revista de Saúde Pública 2008, 42:143-145.

41. Zamani-Alavijeh F, Bazargan M, Shafiei A, Bazargan-Hejazi S: The frequency and predictors of helmet use among Iranian motorcyclists: A quantitative and qualitative study. Accident Analysis & Prevention 2011, 43(4):1562-1569.

42. Ali M, Saeed MMS, Ali MM, Haidar N: Determinants of helmet use behaviour among employed motorcycle riders in Yazd, Iran based on theory of planned behaviour. Injury 2011, 42(9):864-869.

43. Abia WA, Tache NC: Commercial Motorcycle Riders' Knowledge of Road Safety and Effective Use of Personal Protective Equipment in Cameroon. Journal of Public Health in Developing Countries 2017, 3(1):299-305.

44. Khan I, Khan A, Aziz F, Islam M, Shafqat S: Factors associated with helmet use among motorcycle users in Karachi, Pakistan. Academic emergency medicine 2008, 15(4):384-387.

45. Siebert FW, Albers D, Naing UA, Perego P, Santikarn C: Patterns of motorcycle helmet use–A naturalistic observation study in Myanmar. Accident Analysis & Prevention 2019, 124:146-150.

46. Wadhwaniya S, Gupta S, Mitra S, Tetali S, Josyula L, Gururaj G, Hyder AA: A comparison of observed and self-reported helmet use and associated factors among motorcyclists in Hyderabad city, India. Public health 2017, 144:S62-S69.

47. Hung DV, Stevenson MR, Ivers RQ: Barriers to, and factors associated, with observed motorcycle helmet use in Vietnam. Accident Analysis & Prevention 2008, 40(4):1627-1633.

48. Nimako Aidoo E, Bawa S, Amoako-Yirenkyi C: Prevalence rate of helmet use among motorcycle riders in Kumasi, Ghana. Traffic injury prevention 2018, 19(8):856-859.

49. Moshy JR, Msemakweli BS, Owibingire SS, Sohal KS: Pattern of mandibular fractures and helmet use among motorcycle crash victims in Tanzania. African health sciences 2020, 20(2):789-797.

50. Sisimwo PK, Onchiri GM: Epidemiology of head injuries and helmet use among motorcycle crash injury: a quantitative analysis from a local hospital in Western Kenya. The Pan African Medical Journal 2018, 31.

51. Adewoye KR, Aremu SK, Olomofe CO, Adeniyi AM, Agbana RD, Abioye OO, Issa YF: The prevalence and determinants of helmet use amongst commercial motorcyclists in Ido-Osi local government area. Archives of environmental & occupational health 2020, 75(6):358-364.

52. Kraemer JD, Honermann BJ, Roffenbender JS: Cyclists' helmet usage and characteristics in central and southern Malawi: a cross-sectional study. International journal of injury control and safety promotion 2012, 19(4):373-377.

53. Norris E, Myers L: Determinants of Personal Protective Equipment (PPE) use in UK motorcyclists: Exploratory research applying an extended theory of planned behaviour. Accident Analysis & Prevention 2013, 60:219-230.

54. Heydari ST, Lankarani KB, Vossoughi M, Javanmardi K, Sarikhani Y, Mahjoor K, Mahmoodi M, Shirazi MK, Akbari M: The prevalence and effective factors of crash helmet usage among motorcyclists in Iran. Journal of injury and violence research 2016, 8(1):1.

55. Akaateba MA, Yakubu I, Akanbang BAA: Correlates and barriers associated with motorcycle helmet use in Wa, Ghana. Traffic injury prevention 2015, 16(8):809-817.

56. Ndagire M, Kiwanuka S, Paichadze N, Kobusingye O: Road safety compliance among motorcyclists in Kawempe Division, Kampala, Uganda: a cross-sectional study. International journal of injury control and safety promotion 2019, 26(3):315-321.

57. Ambak K, Hashim H, Yusoff I, David B: An Evaluation on the compliance to safety helmet usage among motorcyclists in Batu Pahat, Johor. International Journal of Integrated Engineering 2010, 2(2).

58. Amoran O, Eme O, Giwa O, Gbolahan O: Road safety practices among commercial motorcyclists in a rural town in Nigeria: implications for health education. International quarterly of community health education 2004, 24(1):55-64.
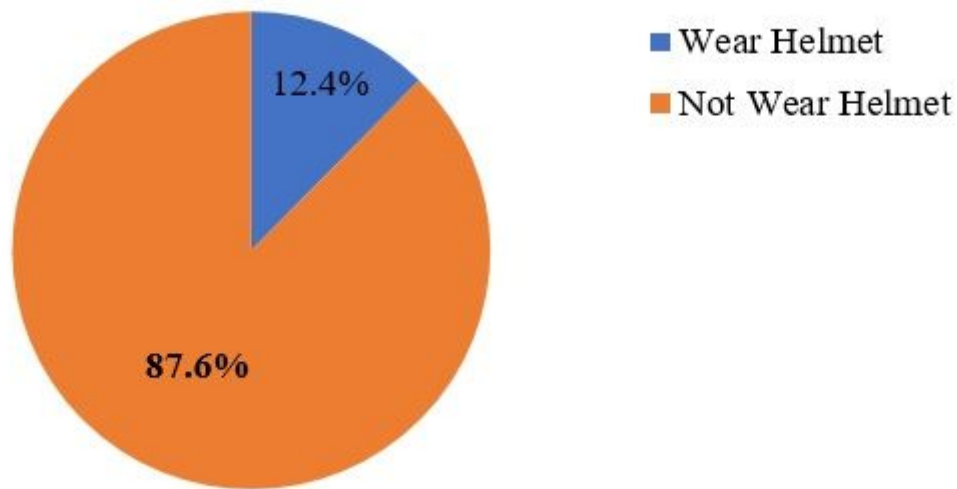
Figures

Figure 1

Prevalence of helmet wearing among motorcycle riders in Sawula and Bulky towns, Gofa zone, Southern Ethiopia