An assessment of measures to reduce injuries and mortality among motorcyclists: A cross-sectional survey-based study

Hadi Fadaei, Elaheh Ainy¹, Roghayeh Paydar²

ABSTRACT

Background: Motorcyclists are one of the most vulnerable groups in road accidents. This study aimed to investigate the effective measures to reduce injuries and deaths in the most vulnerable road users’ motorcyclists in 2020.

Methods: The study was a cross-sectional study. In this study, 147 motorcycles were randomly selected from the list of all motor courier units in Tehran, which was prepared through an internet search. The required information was collected through questionnaires and interviews. The inclusion criteria had a minimum high school education and an age range of 18–65 years. The trained questioners referred to the selected courier offices and after obtaining consent to participate in the study, project questionnaire were completed.

Results: The mean age of subjects was 31.4 ± 8.0 years. All subjects were male. The purpose of the trip was going to work (84.4%). The highest percentage of leaving home time (94.6%) was observed in the morning. More than half of the subjects had a history of accidents (54.5%), and also more than half of the subjects (54.0%) had a history of an accident in their 2nd degree relatives’ families. Fourth-fifths of the studied motorcyclist (89.5%) wore helmets. Nearly half of the subjects (48.3%) always fastened their helmets strap. The highest action (72.0%) was suggested to separate the motorcycle lanes.

Conclusion: In the viewpoint of the motorcyclist, separating the motorcycle lines could be one of the most effective measurements to injury reduction. Hence, officials and planners need to pay more attention to the logical demands of motorcyclists.

Key Words: Accidental injuries, death, motorcycles, traffic accidents

INTRODUCTION

Motorcyclists are one of the most vulnerable groups in road accidents. The unsafe nature of this vehicle and its increasing use by young people were associated to an increase in road traffic accidents (RTAs).[1]

Studies show that almost all over the world, the risk of death due to RTA is higher for the vulnerable road user (motorcyclists, pedestrians, and cyclists) than car drivers.[2,3] In both high-income and low- and middle-income countries (LMIC), motorcycle users’ injuries are rising as a road safety problem.[4,5]
In Australia and New Zealand, the characteristics of fatal motorcycle accidents with roadside obstacles showed that behavioral factors such as speeding and alcohol consumption were associated to accidents.\(^6\)\(^7\) From 2000 to 2020, the highest increase in deaths due to RTA occurred in South Asia, which was more than 144%.\(^8\)

RTA-associated mortality is more than double for Colombian motorcyclists than for operators of other motorized vehicles.\(^9\) In Colombia, motorcycle casualties have become a serious public health issue. A 14-year study found that various social factors caused the deaths of more than 28,800 motorcyclists.\(^10\)

The law on compulsory use of helmets was approved by the Islamic Consultative Assembly of Iran in 1997.\(^11\) A study in Iran in 2012 showed that among motorcycle accidents, the highest number of motorcyclists were in the age range of 20–29 years, but the highest rate of death and injury was related to groups over 44 years and under 20 years. More than 82% of motorcyclists were unlicensed at the time of the accident.\(^12\) Among 320,000 injured in RTAs annually in Iran >100,000 involve motorcycle accidents, with the greatest number occurring in the capital city of Tehran. The share of motorcyclists is about five thousand, a high share of which is related to Tehran.\(^13\)

Moreover, according to Rahvar traffic police statistics in 2020, motorcyclists accounted for 46% of all RTA-associated mortality in Tehran; a fact supported by local forensic data.\(^14\)

This project surveyed motorcyclists to help identify opportunities for intervention to reduce motorcycle-associated RTAs.

**METHODS**

The study was a cross-sectional study. In this study, the subjects were randomly selected from motorcyclists’ address lists of all motor courier units in Tehran, prepared through internet search using list of Tehran motorized couriers keywords through Google search.\(^15\)\(^16\)

Considering the deaths due to traffic accidents which were extracted from 2017 World Road Safety Report for Iran, the share of motorcyclists was 23% (147 motorcycles) of all kinds of vehicles had to be studied.\(^17\)

The trained questioners referred to the selected courier offices, and after obtaining consent to participate in the study, project questionnaire was completed through questionnaires and interviews. Validity of initial items was evaluated after correction based on the panel suggestions, using content validity ratio and content validity index for quantitative content validity.

For reliability, test re-test was performed and internal consistency was calculated by Cronbach’s alpha coefficient that values >0.85 were considered admissible.

The inclusion criteria had a minimum high school education and an age range of 18–65 years. At first, demography, then the information of other designed questions such as “what measures” do you think are most effective in road injuries reduction? was completed. To accurately implement a briefing plan to get acquainted with how to complete the questionnaire were held for the questioners. Data were analyzed using SPSS, version 16 (IBM Corp., Armonk, USA).

**RESULTS**

Demographic data are presented in Table 1. The mean age of the subjects was 31.4 ± 8.0 years. All subjects were male, and the mean family size was 4.3 ± 1.1 persons, with 84 (57.3%) being married, 60 (41.3%) single, and 3 (1.4%) classified as “other.” Ninety five (66.4%) were the primary sources of household income (i.e., breadwinners), and the majority were self-employed 97 (67.8%). The greatest number of participants had an education level of 12 years – 85 (59.4%), and the lowest percentage was in high school (<12 years) – 28 (19.6%).

Monthly income ranged from 5 to 15-million Iranian rials (IRR). Nearly half of participants reported having a private home (69, 48.3%), whereas the remainder were tenants or did not report having a home [Table 2].

The purpose of the travel at the time of the RTA was greatest for going to work, and least for entertainment or leisure, and occurred more frequently in the morning [Table 2]. More than half of participants had a personal or family (to 2nd degree relatives) history of RTA [Table 3], with 30.3% resulting in patient hospitalization.

Only 13.3% of participants had governmentally medical insurance, with 68.5% of the people had nongovernmentally medical (supplementary) insurance [Table 3]. The majority of participants wore helmets [89.5%; Table 4], but only 48.3% fastened the helmet straps.

**Table 1: Demographic information of studied motorcyclist**

| Variables         | Mean ± SD | Minimum | Maximum | Mode |
|-------------------|-----------|---------|---------|------|
| Age               | 31.4 ± 8.0| 19      | 50      | 29   |
| Family size       | 4.31 ± 1.1| 2       | 8       | 5    |
| Gender, n (%)     |           |         |         |      |
| Male              | 147 (100) |         |         |      |
| Female            | 0         |         |         |      |
| Marital status, n (%) |     |         |         |      |
| Married           | 61 (41.3) |         |         |      |
| Single            | 84 (57.3) |         |         |      |
| Others            | 2 (1.4)   |         |         |      |

SD: Standard deviation
Risk reduction measures are presented in Table 5. The most effective measures were (1) making separate motorcycle lanes, followed by (2) making separate pedestrian lanes, (3) widening the road, and (4) separate the bicycle lanes. The least effective measures were building pedestrian bridges and underpasses.

### DISCUSSION

The study showed that in the viewpoint of motorcyclists separating the motorcycle lanes could be one of the most effective measures to injury reduction, a finding supported by similar studies. Our finding was in line with mentioned studies.

This study found that the highest percentage of the purpose of the trip was going to work among the subjects. In Latin American cities, motorcycles had a low cost compared to other means of transportation. The vulnerability of motorcyclists to traffic injuries and death showed the need to make motorcycle travel safer, and improving public transportation was essential. Motorcycles are considered the main means of transportation in Nigeria where its use for commercial purposes has significantly affected the economy and society. The speed of urbanization in the country is one of the effective factors in increasing the use of motorcycles. In our country, the motorcycle is mostly used for work and was considered a high-risk job. Therefore, to reduce RTA as a health priority, it is necessary to consider effective measures to reduce accidents. In this study, the highest percentage of leaving home time was observed in the morning. The highest percentage of return home time was observed at night and midnight. Heydari et al. reported that due to the rush hours of the morning, whether on the way back from night work or when leaving home to work, this rush hour increases traffic congestion and increases the speed of driving on the roads and the possibility of an accident increased. Shajith reported that >57% of RTAs occurred at night. Young motorcyclists are involved in accidents, and the risk of death increased with their age. Prior studies have reported that RTAs are more frequent during the summer months, and on weekends, with rates being lower on the holidays. In this study, more than half of participants had a personal or family history of RTAs, which is consistent with other published reports.

Konlan et al. reported that more than two-thirds of motorcyclists in the Central Tongu District, Ghana, had a history of accidents in the past year before the study. Among all RTAs, 30.3% needed to be hospitalized. About forth-fifths of studying motorcyclist wore helmets. Nearly half of the subjects always fastened their helmets strap. Liang et al. study showed that mortality rates, length of hospital stay, or intensive care unit admission was not significantly different between adolescents and adults. A significant percentage of adolescents did not wear helmets compared to adults. Among motorcyclists that did not wear helmets, the Glasgow Coma Scale score was significantly lower. Shavaleh et al. reported that most road traffic injuries occurred in motorcyclists and has the most head injuries in the body. Therefore, to reduce motorcycle RTAs and prevent head injuries among them, helmet using and promote safety behaviors among motorcyclists should be strictly enforced. 13.3% of the studied people had insurance. More than two-thirds of the people had supplementary

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**Table 2:** Purpose of daily travel, leave, and return home time of studied motorcyclist

| Variables                  | n (%)       |
|----------------------------|-------------|
| The purpose of the trip Work | 124 (84.4)  |
|                            Study     | 10 (6.8)    |
|                            Other     | 13 (8.8)    |

**Table 3:** Having a history of accidents in the individual and in the family, the need for hospitalization and having various types of insurance in the motorcyclist

| Variables                        | Yes, n (%) | No, n (%) |
|----------------------------------|------------|-----------|
| Accident history                 | 86 (54.5)  | 61 (37.8) |
| Family accident history          | 80 (54.0)  | 67 (46.0) |
| Need to be hospitalized*         | 45 (30.3)  | 102 (69.7) |
| Having insurance                 | 20 (13.3)  | 127 (86.7) |
| Having supplemental insurance    | 101 (68.5) | 46 (41.5)  |

*Need to be hospitalized: To take someone who is injured by traffic accident to hospital and keep them there for treatment at least 1 day or more

**Table 4:** Status of the use of seat belt in the studied motorcyclists

| Variables                  | n (%)  |
|----------------------------|--------|
| Use a helmet               |        |
| Yes                        | 132 (89.5) |
| No                         | 13 (10.5)   |
| Fasten his helmet strap    |        |
| Always                     | 71 (48.3)   |
| Sometimes                  | 57 (38.8)   |
| Rarely and never           | 19 (12.9)   |

**Table 5:** Percent of the opinion of motorcyclist about which actions would reduce the injury risk

| Reduce the risk of death through         | Ever | A little | Medium | Much | Very much |
|-----------------------------------------|------|----------|--------|------|-----------|
| The separation of bicycle lanes          | 0.7  | 5.6      | 18.2   | 53.1 | 22.4      |
| The separation of pedestrian lanes      | 0.0  | 0.7      | 4.9    | 46.2 | 48.2      |
| The separation of motorcycle lines      | 0.0  | 0.7      | 1.4    | 25.9 | 72.0      |
| Widen the way                            | 0.0  | 0.0      | 12.5   | 39.9 | 47.6      |
| Build more pedestrian bridges            | 0.0  | 4.9      | 26.6   | 52.4 | 16.1      |
| Increasing the number of public buses    | 0.8  | 7.9      | 25.9   | 49.1 | 16.3      |
| Increase pedestrian underpass            | 0.0  | 7.0      | 30.1   | 46.8 | 16.1      |
insurance. Chumpawadee et al. reported that among motorcycles, 72.3% had a motorcycle driving license, and 83.0% had accident insurance. Prevalence of the nonuse of helmets was 23.3%. Their findings show the need to strengthen accident prevention programs for northeastern Thailand.[31]

In the study of Manan et al. with the aim of reducing multivehicle crashes on motorcycles, they recommend that motorcyclists should be separated from main traffic through the exclusive motorcycle lane or motorcycle lane on high-speed roads, as it has been proven to significantly reduce motorcycle crashes. If complete separation is not possible, the introduction of a road shoulder alongside rural roads can also be effective in creating a space for safe motorcycle movement.[32]

Sivasankaran et al. studied that motorcycles be separated from the main traffic by an exclusive motorcycle lane to decrease RTAs. A more accurate understanding of the accident pattern can guide decision-makers to take effective countermeasures to reduce the number of fatalities and injuries.[33]

According to the findings of Jones et al. study, possible measures to improve the safety of motorcycles could be the precise control of high-risk behaviors and speeding of motorcyclists, the establishment of dedicated motorcycle lanes, and especially the training of female passengers.[34]

Our findings were in line with other studies. To show the importance of having insurance, ways to adapt and tailor training opportunities that focus on health insurance literacy, more studies should be done for a wide range of road users such as motorcyclists.

Motorcycles seem to be an integral part of the transportation system in LMICs countries. To reduce the number and severity of injuries among motorcyclists, variables related to motorcyclists, such as the behavior of road users and the road environment, emergency preaccident care should be effectively considered.

In this study, respondents felt that the greatest potential improvement for road safety would be the institution for separate motorcycle lanes. Hence, officials and planners should pay more attention to road design and separation of motorcycle lanes as a solution.

Studying the viewpoint of the main stakeholders (motorcyclists) for the first time in Iran could be one of the strengths of the study. The small sample size could affect the generalizability of the results which could be considered a weakness of the study.

**CONCLUSION**

In the viewpoint of the motorcyclist, separating the motorcycle lanes could be one of the most effective measurements to injury reduction. Hence, officials and planners need to pay more attention to the logical demands of motorcyclists.

**Research quality and ethics statement**

This study was approved by the Institutional Review Board/Ethics Committee at Shahid Beheshti University of Medical Sciences (Approval #IR.SBMU.RETECH.REC.2021.077; Approval date May 2, 2021). The authors followed the applicable EQUATOR Network (http://www.equator-network.org/) guidelines, specifically the STROBE Guidelines, during the conduct of this research project.

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**Conflicts of interest**

There are no conflicts of interest.

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