

# **Injuries Sustained By Riders and Pillion of Motorised Two-Wheelers in India**

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## **I. INTRODUCTION**

Motorised Two-Wheelers (M2Ws) are the most frequently affected road users in road traffic accidents (RTA) in India. M2W account for 73% of the vehicle population in India, as of March 2015[1]. The year 2016 recorded 480,652 RTA and 150,785 deaths. Of these, M2Ws accounted for the highest share in total number of road accidents, contributing 33.8%. Motorcyclists represent an increasing proportion of road crash casualties in India, contributing 34.8% (52,500) of total fatalities [2]. This study examines the injury severities and injury types sustained by the riders/pillions of M2W in several crash configurations colliding with various types of vehicle. All of the injuries are coded using the Abbreviated Injury Scale (AIS) 2008, and the data was collected by crash investigators from JP Research India Pvt. Ltd.

## **II. METHODS**

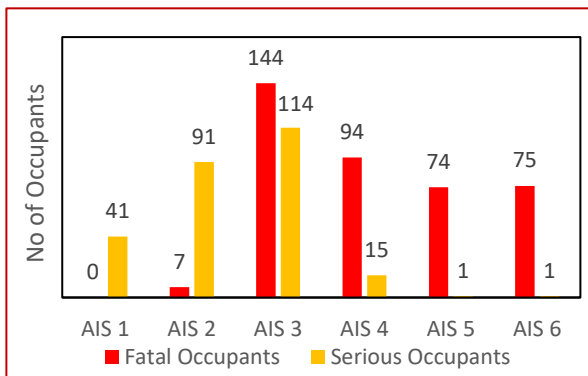
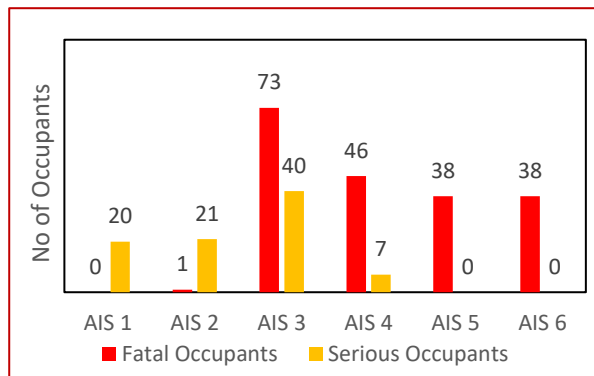
The Road Accident Sampling System – India (RASSI) data comprises 2,336 accidents recorded between April 2011 and March 2017 at five diverse locations across India [3]. This is an extension of a previous paper, ‘An in-Depth Study of Motorised Two-Wheeler Accidents in India’ [4]. Of the accidents recorded, 1,670 were analysed for this study and they all occurred at four locations: Coimbatore, Ahmedabad, Kolkata and Jaipur. Of these, 874 accidents involved at least one M2W (52%), and 810 (84%) of the total of 964 M2Ws involved at least one fatality or a seriously injured rider or pillion. Accidents with fatalities and seriously injured riders/pillions whose injury data were available were considered for further analysis. This study therefore includes accidents involving 657 riders/pillions belonging to 535 M2Ws and 522 accidents. Maximum AIS (MAIS) is considered for analysing injury types and affected body regions for this study. For occupants with multiple injuries and having one particular injury with unknown AIS severity, the maximum known AIS severity is considered.

## **III. INITIAL FINDINGS**

Of the 657 riders/pillions, 394 riders/pillions were killed and 263 riders/pillions sustained serious injuries. Those riders/pillions who died commonly suffered MAIS3–6 injuries, while seriously injured riders/pillions commonly sustained MAIS1–3 injuries. Fig. 1 shows a detailed distribution of MAIS for the 657 occupants. For fatal riders/pillions, the most commonly affected MAIS body regions are head (57%) and thorax (23%). Serious injuries sustained by riders/pillions most commonly affected the lower extremity (46%), head (21%) and face (11%). Riders/pillions died because of MAIS injuries like fractures (43%), contusions/haemorrhages (28%) and crush injuries (8%).

Of the 657 riders/pillions, 562 (86%) were not wearing a helmet. Only 80 (12%) riders/pillions were wearing a helmet. 10 (13%) out of 80 riders/pillions didn't strap their helmet. 41 (51%) out of 80 riders/pillions were wearing ISI standard helmets and 23 (56%) of them sustained head and face injuries. It is not known whether the remaining 15 (2%) riders/pillions were helmeted or not. It was found that 284 (51%) of 562 non-helmeted riders/pillions and 34 (49%) of 70 properly helmeted riders/pillions sustained head and face MAIS injuries. A detailed distribution of MAIS injuries for non-helmeted riders/pillions is shown in Fig. 2. It is seen that 76 (14%) riders/pillions have suffered MAIS5–6 injuries to head and face and were fatal. The helmet is an effective way of reducing head injuries and fatalities for M2W riders/pillions if used properly, otherwise it is not a reliable prevention measure.

The collision partners for 535 M2Ws were also analysed, with a close study being made of those cases that resulted in a fatality or a serious injury. Of 535 collision partners, trucks (29%), cars (27%) and buses (13%) were the top three vehicle types involved. MAIS injuries were studied for the top two crash configurations for these three collision partners.

**Fig. 1. Distribution by MAIS for 657 occupants.****Fig. 2. Distribution of head and face MAIS injuries for non-helmeted riders/pillions.**

There were 105 M2Ws (137 riders/pillions) involved in head-on (43%) and side-angle impacts (31%) with cars. In this type of collision, 82% of riders/pillions sustained MAIS2–4 injuries. The most commonly affected MAIS body regions are the lower extremity (41%) and head (34%). The most common MAIS injury types found for such crash configurations with cars are fractures (51%) and contusions/haemorrhages (24%).

A total of 91 M2Ws (120 riders/pillions) were involved in run-over (40%) and head-on (19%) events with trucks. For run-overs, 39% of the riders/pillions sustained MAIS6 injuries and for head-on impacts 45% of riders/pillions sustained MAIS3 injuries. The most frequently affected MAIS body regions for run-overs are head (39%), thorax (35%) and lower extremity (13%). The most frequently affected body region in head-on impact is the head (39%). The most common MAIS injury type for run-over events is crush injuries (41%) and fractures (23%), while for head-on impact it is fractures (45%).

There are 44 M2Ws (52 riders/pillions) involved in head-on (37%) and run-over (26%) events with buses. For head-on impact, 59% of the riders/pillions suffered MAIS3 injuries, while for run-over events 70% of the riders/pillions suffered MAIS6 injuries. The most frequently affected MAIS body regions are head (41%) and lower extremity (26%) for head-on impacts with buses. The most commonly affected MAIS body regions for run-over impacts are thorax (45%) and head (38%). Likewise, riders/pillions have a 40% chance of sustaining head injuries in impacts with a bus. The most common MAIS injury type for head-on impact is fractures (46%) and contusions/ haemorrhages (35%), while for run-over events it is crush injuries (52%).

#### IV. DISCUSSION

The increasing number of fatalities among M2W riders/pillions indicates that in-depth accident investigations and injury research are necessary in order to identify the most effective measures to mitigate injuries as a result of RTAs in India. The analysis shows that only 51% of the riders/pillions use helmets of ISI or equivalent standards. The analysis suggests that even those wearing helmets have died as a result of head and facial injuries. Rigid rules and regulations will have to come from the relevant authorities if helmets are to be worn in a manner that will protect riders/pillions from sustaining head and face injuries. It will also be necessary to educate Indian road users about the benefits of wearing a helmet and fitting it on correctly. Considering the high percentage of run-over events which are of commonly untreatable AIS6 injuries, heavy vehicles should be equipped with run-over protection device. Given the high number of M2W users in India, the government should also focus on developing M2W-friendly road infrastructure. A separate lane for M2Ws would help as it will prevent conflicts of M2Ws with other road users. This could prove a substantial help in mitigating injuries caused in road traffic accidents.

#### V. REFERENCES

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