

## BRIEF REPORT

# Emergency presentations by vulnerable road users: implications for injury prevention

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Most emergency presentations by vulnerable road users were the result of collisions that did not involve a motor vehicle. Many injuries occurred off-road without police attendance. Hence, reliance on official police records would underestimate the magnitude and scope of these injuries. Suggestions to provide a safer road environment are given.

By 2020, traffic crashes will be the third leading cause of death and disability worldwide.<sup>1</sup> Vulnerable road users—namely, pedestrians, cyclists and motorcyclists—account for a significant proportion of the morbidity and mortality.<sup>2,3</sup>

Traditionally, reports completed by police provide the primary source of information on events causing injury to road users. But such data are limited to motor vehicle related crashes that occur on public roads, leading to either injury or damages that exceed a certain value.<sup>4</sup> Police reports mostly exclude crashes occurring in non-roadway locations and non-collision events that do not involve a motor vehicle. Previous research suggests that the number of “missed” cases is substantial.<sup>5–7</sup> More motorcyclists and bicyclists could be identified through the hospital databases than police reports.<sup>8</sup> Moreover, pedestrian crashes are heavily underrepresented in the police crash statistics when compared with other sources.<sup>3</sup>

Although crash event data recorded in the hospital admission system may provide an additional source of injury information, they are generally restricted to hospitalisations and hence exclude individuals less severely injured. The purpose of this study was to ascertain the type and nature of injury of vulnerable road users by investigating their emergency presentations to hospitals as opposed to relying on police data.

## METHODS

A six month prospective study was undertaken at the emergency department of the four public tertiary hospitals in Perth, Western Australia. All pedestrians, bicyclists, and motorcyclists injured as a result of involvement in a crash or fall from a bicycle/motorcycle or non-motor vehicle collision were included. The data collection period began on 1 September 2004 and was completed on 28 February 2005, to coincide with the spring and summer seasons when cycling and walking are prevalent.

Vulnerable road users of all ages were eligible to participate in a structured interview. Individual or parental consent was sought. The interview was conducted in the presence of a parent for children aged 12 years or under. Approval was obtained from the human research ethics committee of the University of Western Australia and from each of the participating hospitals.

A registered nurse was responsible for recruitment and conducting the interviews. At each hospital, the clerical staff or triage nurse contacted the research nurse whenever an injured pedestrian, bicyclist, or motorcyclist presented to the emergency department. The structured questionnaire administered solicited information on demographic characteristics and description of events leading to the injury. Each interview took approximately 20 minutes to complete.

Injuries were classified according to body region and severity using the Abbreviated Injury Scale (AIS).<sup>9</sup> The AIS is a numerical score ranging from 1 (minor injury) to 6 (maximum injury). If casualties had more than one injury of equal severity to different body regions, the following hierarchy of the nine body regions was used for classification: head, spine, lower extremity, chest, abdomen, upper extremity, neck, face, and external.

## RESULTS

A total of 392 bicyclists, pedestrians, and motorcyclists presented to the four emergency departments with an injury during the study period, of whom 282 consented to be interviewed (response rate = 72%).

Bicyclists contributed the majority of presentations (n = 151, 53%), followed by motorcyclists (n = 104, 37%) and pedestrians (n = 27, 10%). Males represented 80% and dominated each road user type except pedestrians (44% males). The mean age for all participants was 27.5 (SD 17.2) years, with pedestrians being the oldest group (mean 40, SD 24.5). The mean age was 23 (SD 17.02) for bicyclists and 31 (SD 12.1) for motorcyclists.

## Severity and body region of injury

Overall, 147 subjects (52%) were treated and subsequently released. According to the AIS, moderate injuries accounted for 127 (45%), while minor, serious, and critical injuries accounted for 111 (39%), 40 (14%), and four (2%), respectively. A quarter of the motorcyclists had serious or critical injuries, compared to 19% for pedestrians and 8% for bicyclists.

Most of the emergency presentations involved the upper extremity (n = 105, 37.5%), followed by lower extremity (n = 74, 26%). Injuries to the spine accounted for all four critical injuries. A large proportion (32%) of minor injuries involved the head.

Only 68% of bicyclists and 91% of motorcyclists reported wearing a helmet at the time of the event. Of the 48 bicyclists who did not wear a helmet, 66% were between 10 and 24 years of age. Seven percent of motorcyclists and 23% of bicyclists reported not wearing their helmet “at all times”.

## Type of crash and roadway features

Crash events were classified as involvement with a motor vehicle; fall or non-motor vehicle collision; or collision with a

**Abbreviation:** AIS, Abbreviated Injury Scale.

**Table 1** Injury severity by type of crash

Injury severity	Motor vehicle, n (%)	Fall/non-motor vehicle collision, n (%)	Collision with animal/object/person, n (%)	Total, n (%)
Minor	42 (46)	53 (35)	16 (37)	111 (39)
Moderate	32 (35)	73 (49)	22 (51)	127 (45)
Serious	17 (19)	19 (13)	4 (10)	40 (14)
Critical	0 (0)	4 (3)	1 (2)	4 (2)
Total	91	149	43	282

fixed object, another person, or an animal. Motor vehicles were involved in only 32% (n = 91) of the events. However the type of crash appeared different among road users ( $\chi^2 = 61.26, p = 0.01$ ). All pedestrian injuries involved a motor vehicle, whereas most bicyclist injuries (64%) involved a fall or non-motor vehicle collision. In comparison, 49% (n = 51) of motorcyclists were involved in a fall or non-motor vehicle collision, 32% (n = 33) a collision with a motor vehicle, and 19% (n = 20) a collision with an animal, a fixed object, or another road user.

Table 1 presents a breakdown of injury severity by type of crash. Surprisingly, 46% of injuries due to collision with a motor vehicle were reported as minor, but about half the injuries due to fall/non-motor vehicle collision (n = 73) or collision with an animal/object/person (n = 22) were classified as moderate. As expected, collision with a motor vehicle led to the highest proportion (19%) of serious and critical injuries, compared to 16% for a fall/non-motor vehicle collision and 12% a collision with an animal/object/person.

Table 2 provides a breakdown of injury severity by road type for the three road user groups. Overall, 144 (51%) injury events occurred on a public road and 138 (49%) occurred off-road. Off-road refers to locations such as sidewalks, driveways, cycle paths, bike trails, and parking areas. Road users were significantly different in their injury presentations with respect to road type ( $\chi^2 = 21.36, p = 0.001$ ), with 58% (n = 88) of bicyclists, 45% (n = 47) of motorcyclists, and 11% (n = 3) of pedestrians injured off-road.

We also found that police attended only 76 (27%) of the total 282 injury events, the majority (n = 53, 70%) were due to involvement with a motor vehicle by motorcyclists (48%), while 13 (17%) cases attended by police involved a fall/non-motor vehicle collision by motorcyclists (77%). There were 10 (13%) police attended cases involving a collision with a person/object/animal, again predominantly incurred by motorcyclists (60%). Interestingly, 65% (n = 98) of bicyclists' injuries were not reported to police. Five (11%) of the 44 injuries classified as serious/critical by attending emergency physicians were not attended by police.

**DISCUSSION**

This study demonstrated that many bicyclists and motorcyclists were injured by a collision that did not involve a motor vehicle and/or occurred in off-road situations. The

findings are consistent with previous research that non-motor vehicle and off-road events pose a significant injury risk for these groups, and that reliance on official road statistics would underestimate the magnitude and scope of collisions and injury.<sup>4 10 11</sup> Indeed, police attended only 27% of all injury events of which 58% led to hospitalisations, while 11% of the serious/critical injuries were unattended by police.

Although many injuries due to non-motor vehicle collision were relatively minor or moderate when compared to those involving a motor vehicle,<sup>10 11</sup> it reinforces the need for continued and strengthened efforts towards creating a safer environment for cycling and walking.<sup>12</sup> Moreover, a substantial number of injuries were caused by collision with a fixed object. Poles and trees can be hazardous to these road users; proper positioning of roadside objects will prevent avoidable collisions and injuries.

Our investigation has highlighted several additional areas for attention: (1) children had a high prevalence of on- and off-road bicycle injuries; (2) male bicyclists and motorcyclists accounted for the majority of reported injuries; (3) injuries by bicyclists were seldom reported to police; (4) helmet use was low among injured bicyclists older than 10 years of age.

Limitations of the study include recall error and/or unwillingness to tell the truth during the interview. Parents who did not witness the event involving a child may affect the validity of their responses. Although response bias was unlikely, the potential for selection bias concerning those who sought medical care at the emergency departments could not be ruled out. Furthermore, individual exposure data were not collected to infer the level of risk associated with specific locations.

To improve the accuracy and representativeness of injury data, data linkage between emergency presentations, hospital admissions, and police records is recommended. The need to collect individual exposure data remains a priority in road safety research. Injury prevention programs targeting helmet wearing should be aimed at both motorcyclist and bicyclist, as well as increasing the acceptability of bicycle helmets beyond young children.

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**Table 2** Injury severity by type of road and road user

Injury severity	Pedestrians, n (%)		Bicyclists, n (%)		Motorcyclists, n (%)		Total, n (%)
	Public	Off-road	Public	Off-road	Public	Off-road	
Minor	14 (58)	2 (67)	30 (48)	33 (37)	21 (36)	11 (23)	111 (39)
Moderate	5 (21)	1 (33)	27 (42)	49 (56)	24 (43)	21 (45)	127 (45)
Serious	5 (21)	0 (0)	5 (8)	6 (7)	12 (21)	12 (26)	40 (14)
Critical	0 (0)	0 (0)	1 (2)	0 (0)	0 (0)	3 (6)	4 (2)
Total	24	3	63	88	57	47	282

## Key points

- Vulnerable road users account for a significant proportion of the injuries resulting from traffic crashes.
- Relying solely on official police records would underestimate the magnitude and scope of injury among vulnerable road users.
- The majority of their emergency presentations were the result of collisions that did not involve a motor vehicle and many injuries occurred off-road without police attendance.
- Injury events by bicyclists were seldom reported to police.
- A substantial number of bicyclists and motorcyclists still did not wear their helmet at the time of injury.
- Non-motor vehicle collisions, which were mostly moderate or minor, could be preventable by better positioning of roadside objects.

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## LACUNAE

### "Dumb, dumb, dumb drivers..."

The *Adelaide Advertiser* has reported on a survey of South Australian motorists which found that more than one in five drivers do not believe that speeding is dangerous. The survey, by a State insurance company, found that more than one in 10 do not think they need to take extra care while driving on wet roads, and half do not think they should use headlights in bad weather. Among the statements made by those surveyed were: "You're more alert driving fast", "I can multi-task (in relation to distractions such as text messaging while driving)", "I haven't had a problem (in relation to tailgating)". The Risk and Reality on the Road report also says 20 per cent of motorists believe being distracted while driving is not dangerous, even though it has been estimated that drivers who use text messages spend 12 seconds out of every 30 with their eyes off the road—55 per cent of drivers admit that text messages are their biggest distraction, followed by children, at 29 per cent. While one in 10 drivers questioned did not think taking extra care in wet weather would reduce the risk of crashing, the report points out that even a modern car with good brakes and tyres needs at least an extra 8 m to stop when travelling at 60km/h in wet weather. Of all collisions, 48 per cent are rear-end crashes, meaning many drivers do not allow themselves enough stopping distance.

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