The increasing problem of motorcycle injuries in children and adolescents

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ABSTRACT

Objective: To quantify an anecdotally apparent increase in motorcycle-related injuries in children and adolescents across Victoria.

Design, setting and participants: Retrospective analysis of paediatric motorcycle injuries (1 July 2000 – 30 June 2004) from a statewide emergency department (ED) database (Victorian Emergency Minimum Dataset [VEMD]) and the Trauma Registry database at the Royal Children's Hospital (RCH), Melbourne.

Main outcome measures: Trends in paediatric motorcycle-related injuries over time; patient demographics, circumstances of accidents (on or off road), and injury characteristics, including severity markers.

Results: The VEMD recorded 3163 patients aged ⩽ 16 years presenting to EDs with motorcycle injuries during the study period; population-based rates of these injuries increased by an average of 9.6% per year (95% CI, 6.2%–13.1%; $P < 0.005$). In the same period, there was a total of 167 motorcycle-related admissions to the RCH, increasing annually in line with statewide ED presentations. About a quarter of paediatric motorcycle accidents occurred in children aged under 10 years (VEMD, 22%; RCH, 27%) and most occurred off road (VEMD,89%; RCH, 71%). At the RCH, median length of stay was 3 days (interquartile range [IQR], 1–7 days) and the median Injury Severity Score was 9 (IQR, 4–10); 41% of patients required an operation, 13% were admitted to an intensive care unit, and two died.

Conclusion: In Victoria, the incidence of motorcycle-related injuries is increasing in children and adolescents. Most of these injuries occur off road, outside of any legislative framework. There is an urgent need for coordinated legislative changes and educational efforts to decrease motorcycle injuries in children.

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Riding motorcycles (including mini bikes, quad bikes and trail bikes) is a popular sport among children and adolescents in Australia. At the Royal Children's Hospital (RCH), Melbourne (the only paediatric major trauma service in the state of Victoria), we noticed that more patients were presenting after motorcycle crashes, and that children as young as 5 years were being injured while riding these vehicles. Increasing presentations of motorcycle injuries in children and adolescents have been reported in Australia[1-4] and internationally.[5-11] In the United States and Canada, these trends have recently prompted recommendations for interventions, including legislative changes.[12,13] In Australia, it is not legal for children to ride motorcycles on public roads other than as pillion passengers. However, there is currently no legislation covering children and adolescents riding on private property or off road, and injury prevention efforts are limited.

We set out to quantify this anecdotal increase in motorcycle-related injuries by reviewing both emergency department (ED) presentations across Victoria, and detailed trauma registry data from its sole paediatric major trauma centre.

The overall aim was to provide epidemiological and burden of injury data in order to increase public awareness, inform injury prevention programs, and encourage legislative action.

METHODS

We conducted a retrospective analysis of motorcycle-associated injuries to identify paediatric patients (aged 16 years or younger) requiring ED treatment in Victoria or inpatient admission to the RCH between 1 July 2000 and 30 June 2004. Data for this study were collated from two prospective databases.

First, we queried the Victorian Emergency Minimum Dataset (VEMD),[14] which contains detailed injury records accounting for about 80% of all ED presentations statewide. Data from this database were provided by the Victorian Injury Surveillance Unit, a long-term project of the Monash University Accident Research Centre. The Unit also supplied information about the total number of motorcycle-related deaths (inhospital and prehospital) in Victoria from the Australian Bureau of Statistics.

Second, we reviewed the RCH Trauma Registry, which identifies all trauma admissions to the RCH. A single dedicated, trained data manager collects the information based on a review of clinical notes.

This study was approved as an audit by the RCH ethics committee.

Eligible patients were identified from the databases using keyword searches with the terms "motorbike", "motorcycle", "mini bike", "peewee", "quad bike", "trail bike", and "dirt bike", including spelling variations. Riders and passengers were included. Information was collected on basic demographics, incident location, and mechanism and details of injuries sustained. Incidents occurring outside the state road system, such as in forests or on farms on residential properties, were deemed to be "off road".

The main outcome measures of injury severity were the patient's Injury Severity Score (ISS),[15] length of stay (LOS), and whether they met the major injury criteria as used in the trauma services throughout Victoria. Major injury was defined as ISS greater than 15; intensive care unit (ICU) stay longer than 24 hours, including mechanical ventilation; "urgent" (within 48 hours) surgery for intracranial, intra-abdominal or intrathoracic injury, or fixation of pelvic or spinal fractures; or death.[16] The risk factors of age (< 10 years) and accident location (on or off road) were analysed for their influence on these injury outcome measures.

Statistical analysis

Data were analysed using Stata, version 10.0 (StataCorp, College Station, Tex, USA). Poisson regression was used to model the yearly presentation and admission rates against Victorian population data.[17] For all tests, values of P less than 0.05 were considered statistically significant.

1 Motorcycle injuries in children and adolescents recorded in the Royal Children's Hospital (RCH) Trauma Registry and the Victorian Emergency Minimum Dataset (VEMD), 1 July 2000 – 30 June 2004

Year*	No. of patients		Victorian population†	Rate per 100 000 (based on VEMD)
	RCH Trauma Registry	VEMD		
2000–01	32	677	1 090 697	62
2001–02	44	756	1 094 673	69
2002–03	37	826	1 097 773	75
2003–04	54	904	1 101 391	82
Total	167	3163	—	—

* Financial years, 1 July – 30 June. † Victorian population, 0–16 years of age.[17] ◆

2 Characteristics of children and adolescents with motorcycle-related injuries, recorded in different databases in Victoria, 1 July 2000 – 30 June 2004*

	Royal Children's Hospital Trauma Registry	Victorian Emergency Minimum Dataset
No. of patients	167	3163
Male	134 (80%)	2665 (84%)
Age (years)		
0–4	5 (3%)	130 (4%)
5–9	40 (24%)	568 (18%)
10–14	86 (51%)	1523 (48%)
⩾ 15	36 (22%)	942 (30%)
Median (IQR)	13 (10–15)	na
Range	2–18	na
Off-road location	118 (71%)	2832 (89%)
Rider (v pillion)	145 (87%)	na
Helmet-wearing	63 of 88 documented (72%)	na
Single-vehicle accident	116 (70%)	na
Injuries		
Fractures	113 (68%)	1093 (34%)
Head injuries	40 (24%)	98 (3%)
Intra-abdominal injuries	23 (14%)	21 (0.7%)
Lacerations	14 (8%)	809 (26%)
Injury severity markers		
Patients with multiple injuries	122 (73%)	na
Injury Severity Score		
Median (IQR)	9 (4–10)	na
Range	(0–50)	
Length of stay (days)		
Median (IQR)	3 (1–7)	na
Range	(0.03–58)	
Major injury	28 (17%)	na
Operation required	69 (41%)	na
Number of operations	95	
Intensive care unit admission	21 (13%)	na
Death	2	0

IQR = interquartile range. na = not available. * Data are no. (%) unless otherwise specified. ◆

RESULTS

VEMD data revealed that a total of 3163 children aged 16 years and younger with motorcycle-related injuries attended Victorian EDs in the 4-year study period. The number of ED presentations increased from 677 to 904 per year (Box 1). A Poisson regression model showed that population-based rates of motorcycle injury presentations across the state increased over the study period by an average of 9.6% per year (95% CI, 6.2%–13.1%; $P < 0.005$).

Similarly, RCH admissions increased over the study period from 32 to 54 per year (Box 1); Poisson regression showed a significant increase by an average of 14.9% per year (95% CI, 0.2%–31.7%; $P = 0.047$). The proportion of patients recorded in the VEMD admitted to the RCH did not change significantly over the study period ($P = 0.5$).

Characteristics of patients recorded in the VEMD and in the RCH Trauma Registry are shown in Box 2. In both databases, most patients were male; roughly half were aged between 10 and 14 years, one-quarter were younger than 10 years, and some children were even younger than 5 years. In the RCH group, there were 11 patients aged 6 years or less, only three of whom were riding pillion. The vast majority of injuries in both data sources occurred off road. Of all relevant Victorian ED presentations, admission was required for 826 patients (26%). The RCH received 167 of these patients over the 4-year study period for inpatient care, including the patients who died.

Patients admitted to the RCH were in single-vehicle accidents (70%), mainly after a fall (53%) or collision with a stationary object (23%), with only 13% caused by collision with another vehicle.

Helmet-wearing status was recorded in 53% of the patients, and where recorded, 28% were not wearing a helmet. These patients sustained a total of 390 injuries (excluding 107 skin abrasions), and 122 patients (73%) sustained multiple injuries (Box 2). Fractures were the most common injuries and about half of the patients with fractures required surgery. Forty (24%) patients sustained head injuries. Of these, 45% required ICU admission, and 15% required a neurosurgical procedure. Of the patients with head injuries, most of those whose helmet-wearing status was known were not wearing a helmet (60%). A total of 95 operations were performed on 69 patients, most of which were orthopaedic (59%).

Markers of severity of injury are shown in Box 2. Most (94%) patients were discharged home. Two patients died, both due to severe head injury (ISS, > 40); neither was wearing a helmet and one accident was off road.

During the study period, there were another nine adolescent motorcycle-related deaths in Victoria not managed at the RCH.

DISCUSSION

This study showed that the incidence of motorcycle-related injuries requiring ED treatment in children and adolescents in Victoria has been increasing by almost 10% per year. Concordantly, increasing numbers require inpatient admission to the paediatric major trauma centre. Increases in paediatric motorcycle injuries have also been seen in other countries, such as the US.[11,18,19] In Australia, motorcycles are recognised as the principal cause of non-traffic-related motor vehicle-related injuries in both children and adults.[20,21]

In our study of motorcycle-related injuries, one-quarter of the patients were younger than 10 years; some even 5 years or less. Young people and novice riders are over-represented in all types of motorcycle accidents.[22] It is very doubtful if children under 10 years, and certainly those under 6 years, have the developmental and cognitive ability to control the power and torque of motorcycles, nor the required capacity for hazard perception. A study analysing the causes of motorcycle accidents had similar findings to ours in that most were attributed to young age and unsafe riding practices, rather than another vehicle.[4]

Most injuries in children and adolescents in our study occurred off road. No legislation exists in Victoria on the wearing of helmets or protective clothing for off-road riding. In our series, helmet-wearing status was documented in only 53% of patients and, of these, 28% were not wearing a helmet. This included both patients who died and 60% of those who sustained head injuries. Among several preventive measures, helmet wearing in particular has been shown to protect against more serious injuries and head injuries, and to be cost effective.[23-25]

The need to target young riders and off-road use has been recognised previously. A Victorian health report produced by the Monash University Accident Research Centre in 1994 revealed that most hospitalised motorcyclists were under licensing age, with most of their accidents occurring off road.[26] Among a number of recommendations, the report suggested that "an appropriate government authority . . . take authority for off-road motorcycle safety". The report also highlighted the need for guidelines on minimum heights and weight-to-bike ratios of motorcycle riders, and strongly suggested the mandatory use of helmets for off-road riding. Our data strongly support these recommendations.

A limitation of this study is that VEMD data cover only 80% of EDs in Victoria, and include only injuries necessitating a visit to an ED. Many injuries are probably treated locally by general practitioners, especially in rural areas. Additionally, accident-related information, such as type of vehicle, helmet use or location of the event, depended on accurate recollection and reporting by parents and patients and recording by ED staff. Protective equipment use in particular may be over-reported by patients and parents.

CONCLUSION

In Victoria, the incidence of motorcycle-related injuries is increasing in children and adolescents. These injuries can be serious or even fatal. Most occur off road and, as such, outside any legislative framework. There is an urgent need for coordinated legislative changes and educational efforts to decrease motorcycle injuries in children and adolescents.

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COMPETING INTERESTS

None identified.

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