

Road Traffic Injuries in Children: findings from WA's Childhood Injury Surveillance System

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Abstract

Introduction:

Road traffic injuries are the leading cause of death for children aged between one and fourteen years in Australia. While recent trends show that child road death is decreasing, the numbers of injuries from road traffic accidents are not.

Methods:

The Western Australian Childhood Injury Surveillance System collects data from cases presenting to the Emergency Department of Western Australia's Princess Margaret Hospital for Children.

Kidsafe WA analyses data collected through the ISS and produces quarterly information bulletins for dissemination to key injury prevention stakeholders. Road Traffic injury presentations between January 2000 and December 2007 were analysed and the findings presented in the January 2008 bulletin.

Results:

During the eight year period 1,580 presentations were made to PMH ED by children suffering a road traffic injury. Of these, 5 were announced dead on arrival or died while in the ED. Males were 1.3 times more likely to sustain a road traffic injury, and while there was no notable difference in presentations between days of the week, most injuries occurred 4.00-5.59pm.

The majority (70%) of injuries were sustained in Motor Vehicle Accidents. However, few MVAs resulted in serious injuries. Pedestrians, bicyclists and wheeled pedestrians were at greater risk of injuries requiring hospital admission.

Conclusions: Safety equipment usage has a significant impact on the occurrence and severity of road traffic injuries. The lack of suitable safety equipment, especially by bicyclists and wheeled pedestrians, is of great concern. Increased use of safety equipment, coupled with supervision and child education would have a positive effect on child road safety.

Keywords

Child, road, injuries, vehicles, safety, injury surveillance

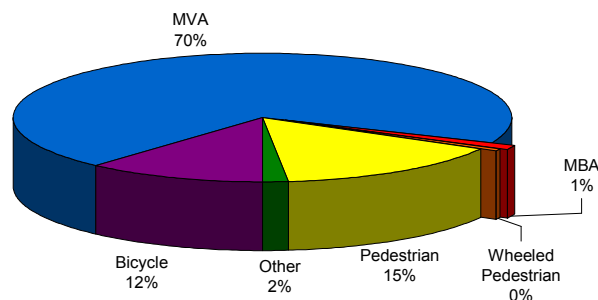
Body of paper

Introduction

Road traffic injuries are the leading cause of death by injury in Australia and the ninth leading cause of total deaths worldwide¹. In Australian children between the 0-14 years, road traffic injuries are the leading cause of death.

Road trauma is generally considered to be the result of motor vehicle accidents (MVAs). However, it also includes other modes of transport such as motorbikes, bicycles, scooters as well as injuries to pedestrians. The defining link is that the injury occurred on a designated roadway. (See Figure 1)

Figure 1: Transport Related Injury Presentations



Children are vulnerable road users, a fact directly related to their still developing cognitive and perceptual abilities. Those under 10 years of age are considered to have difficulty judging distance and speed of road vehicles.

While road trauma represents only a small percentage of annual total injury presentations to a paediatric emergency department, it represents a significant percentage of severe injury or death each year. Road trauma has both a physical and psychological impact, not only upon the injured but immediate family and witnesses to the road trauma

Methods

This analysis examines data collected for those children who presented to PMH emergency department (ED) during the near 8-year period January 2000 to November 2007. This data is recorded by the PMH Injury Surveillance System.

Results

During this period a total of 1,580 children between the ages of 0 – 16 presented to the ED following a road trauma injury. This represents an average 1.88% of the total injury presentations between Jan 2001 and December 2007.

Analysis indicates that primary school age children were the more likely to present following a road trauma injury. The average age of injury was 7.4 years, the gender ratio remained consistent with that for total injury presentations at 3:2 and no discernable difference was noted between weekdays and weekends. MVAs were the dominant cause, with injury peaking in the late afternoon and the children presenting to the emergency department within a short time frame.

Whilst road trauma is the leading cause of death for those aged less than 15 years of age, this study saw only 5 deaths – 4 pedestrian and 1 bicycle versus motor vehicle. The vast majority of children presenting had only soft tissue injuries, a fact reflected in an admission rate of 2 in 5 presentations.

Motor Vehicle Accidents

The dominant cause of road trauma in children is Motor Vehicle Accidents (MVAs). This is due to the dominance of road usage by vehicles, as well as the high opportunity for human error, high vehicle speeds and severity of impact. MVAs accounted for seven in every ten road trauma presentations to PMH ED between January 2000 and November 2007. Of the 1,099 presentations 1,094 were by vehicle passengers or occupants. The remaining five were vehicle drivers, ranging between the ages eight and fifteen years.

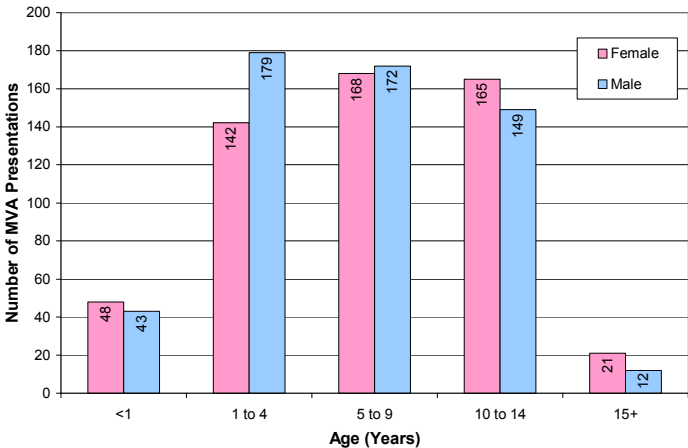
The highest number of MVA presentations occurred in 2006 with 165 presentations (15% of the total 1,099). Previous to that, presentation figures remained consistently between 11.1% and 11.8%. MVA injuries reflected the presentation pattern for total injury presentations in terms of the majority occurring over the weekend. 17.74% of MVA presentations fell on a Saturday. Approximately one third of MVAs occurred between 4.00 and 7.59pm (n=350).

A regional breakdown shows that the north and south metropolitan regions both accounted for approximately one third of total MVA presentations, with 344 and 362 presentations respectively. 106 (10.8%) were from regional WA. The proportion of rural presentations are greater than for total injury presentations to PMH (6%), possibly due to the severe nature of injuries sustained in vehicle accidents.

The most common injuries sustained were contusions (38.1%) and head injuries (26.8%). Gender ratios equated to nearly 1:1. This differs from both the figure for total road traumas (1.3:1), and for total injury presentations to PMH (3:2), where males consistently display higher injury rates than females.

MVAs were clearly the dominant cause of injury for all age groups. The less than five years age group dominated MVA injuries (n=412), with the number of injuries decreasing with age. This supports the belief that children are most vulnerable to MVA injury when in their youngest years.

Figure 2: Number of MVA presentations by age and gender



70% of children involved in a MVA were wearing a seatbelt or restrained in an appropriate child car restraint. This figure peaked at 78% in the pre-school age category. Only 8.63% of presentations reported no use of safety equipment.

Although road trauma is the leading cause of death in Australian children, no children presenting after Motor Vehicle Accidents either died in the ED, or were pronounced dead on arrival. One third of presentations were admitted, with the remaining two thirds departed after treatment completed in the ED.

Bicycle

Learning to ride a bike is part of growing up. However, like all activities, there is risk involved. This risk increases when the activity involves elements such as fast moving vehicles and the unpredictability of public roadways.

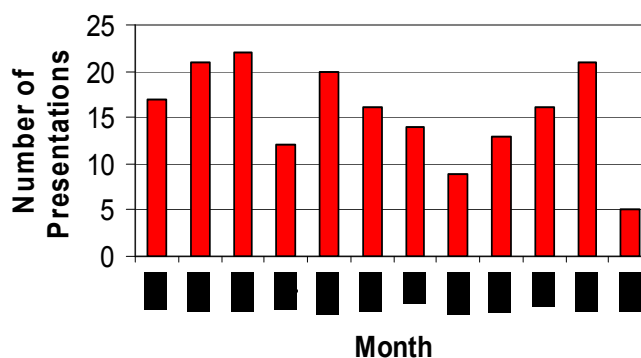
Children under the age of ten years should not be allowed to cycle unsupervised on public roads. They do not have the road knowledge, and often not the bike skills to be able to negotiate traffic. From an early age children should be taught the rules of the road, what road signs mean, and should always use cycle paths.

11.86% of road trauma presentations (n=186) were by children who sustained injuries whilst riding a bicycle on the roadway. Of these, 151 accidents also involved a car (81.2%). Twelve of these (6.5% of all bicycle injuries) were with a parked car.

The highest number of bicycle road trauma injuries occurred in 2001, with the 29 presentations representing 15.6% of total bicycle presentations during the eight year period. This peak was followed by a low of only 18 presentations (9.7%) in 2002 (Figure 3).

February and March were the most common months for children to present to PMH following a bicycle accident, each month accounting for over 23% of presentations. The lowest rates occurred in December with 2.69% (n=5).

Figure 3: Monthly number of bicycle presentations



The weekends did not see an increase in presentations. Instead, the injury rate peaked on Tuesdays with 34 injuries (18.3%). Injuries spiked in the after school hours of 4.00-5.59pm, while no injuries were recorded between 6.00am and 7.59am.

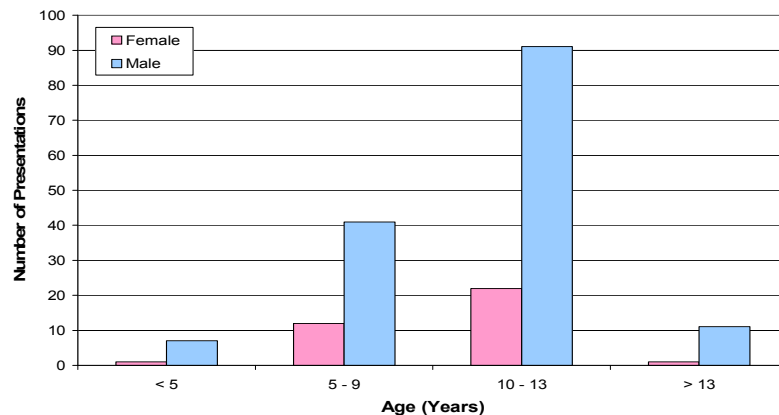
Residents from the Eastern metropolitan region presented at a lesser rate for bicycle road trauma injury than for any other form of road traffic injury. The eastern region accounted for only 19.5% of bicycle road trauma injuries (n=5), compared to 37.3% (n=15) and 36.2% (n=14) for the north and south metropolitan regions respectively. The proportion of rural bicycle injury presentations was less than half that for all rural road trauma injuries (4.3% vs. 9.63%).

The most common injury sustained during road bicycle accidents was head injuries (34.4%). Lacerations, lower and upper limb fractures also occurred at a higher rate than the rate for overall road trauma accidents.

The gender ratio for bicycle presentations was greater than the ratio for overall causes of road trauma, and for total injury presentations. Of the 186 bicycle injury presentations, only 36 were female. This gives a male to female gender ratio of 4:1, compared to 1:1 for all road trauma presentations, and 3:2 for total injury presentations. (See Figure 4)

The 10-13 year age group accounted for the highest number of bicycle road traumas (n=98, 52.7%). Children aged less than 5 years accounted for only 8 of the 186 bicycle presentations (4.3%). This low number is not unexpected, as many children less than five years are not yet riding pedal cycles, while those who are should not be riding on the roadway due to a lack of bicycle skills and road knowledge

Figure 4: Number of bicycle presentations by age & gender



Only 27% of children suffering from bicycle road trauma were known to be wearing a helmet at the time of the accident. Helmet status was unknown in a further 40% of cases, leaving 33% of children to not have been wearing a helmet at the time of their accident. The lack of safety equipment is reflected in the high number of head injuries sustained by this group (34.4%).

The severity of injuries sustained in bicycle road trauma incidents is reflected in the proportions of dispositions. Over 51% of children presenting to PMH ED with bicycle injuries were admitted, compared to 39.8% for all road trauma presentations. During this seven year period one child was pronounced dead on arrival, after being involved in an accident with a truck and receiving multiple injuries.

Pedestrians

Walking is an important part of children’s lives. It is important for health, fitness, and their ability to get around their Neighbourhood and community independently. However, pedestrian injury is a leading cause of child injury death in Australia.

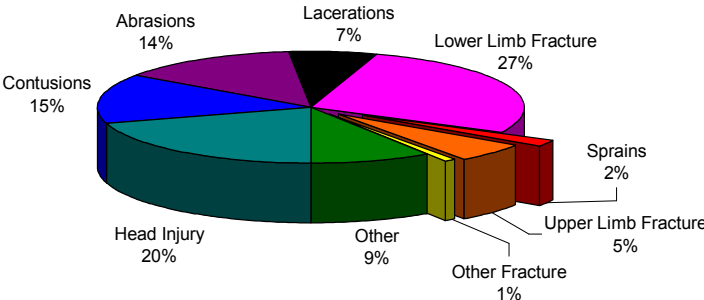
The highest numbers of pedestrian injuries occurred in 2002 (n=37) and 2004 (n=38), with the lowest number falling in 2003 (n=22). The greatest number of pedestrian injuries occurred in August (11.9%), with the lowest occurring in January (5.33%).

Injury rates did not increase on the weekends as is normally seen for injury presentations. Instead, Saturday was the day of fewest pedestrian presentations (n=24), followed by Sunday with only 27 presentations.

The regional breakdown of pedestrian presentations mirrors that for total road trauma presentations. Approximately one third of victims stemmed from both the north and south metropolitan regions. 23% were from the eastern suburbs, with the remaining 22 (9.2%) were from regional Western Australia.

The collision between vehicle and pedestrian can result in severe injuries. Bodily contact is direct, lacking the protection of a vehicle. Head and internal injuries are common among those hospitalised. Because of this, pedestrian injuries are a significant cause of child disability. The most common form of injury sustained by pedestrians between 2000 and 2007 was lower limb fractures (38.8%). Pedestrians were the most likely road users to suffer from lower limb fractures. The increased rate of these injuries in pedestrians is due to the extreme, direct impact upon the victims’ legs which is lacking in other causes of road trauma. (See Figure 5)

Figure 5: Type of injuries sustained for pedestrian presentations



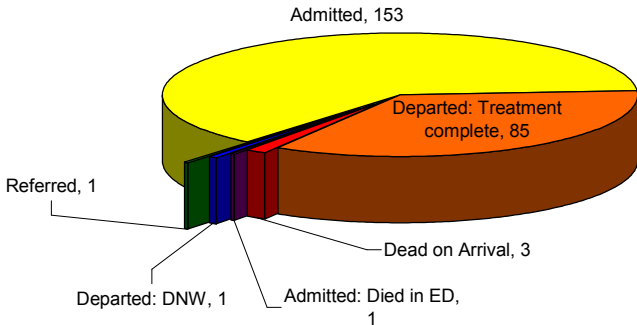
Children aged ten to thirteen years were the highest presenting group of pedestrian road trauma victims, accounting for 34.5% of presentations (n=84). Five to nine year olds comprised 30.9% of presentations (n=79) and children less than five 24.6% (n=60).

The increase of pedestrian injury presentations with age until 13 years may be due to increased independence of children and decreasing parental supervision. This decreased supervision is often premature, as children may not have the skills, knowledge or awareness to negotiate busy roadways.

The decrease in presentations by children over 13 years is due to their development of these knowledge and skills, as well as to older adolescents beginning to be treated in non-child-specific hospitals (n=21, 8.6%).

The severity of pedestrian injuries is evident when examining the rates of disposition from PMH. 63% of children presenting with pedestrian injuries were admitted to a ward or inpatient unit, compared to the average of 39.8% for total causes of road trauma.

Figure 6: Disposition of Pedestrian Presentations

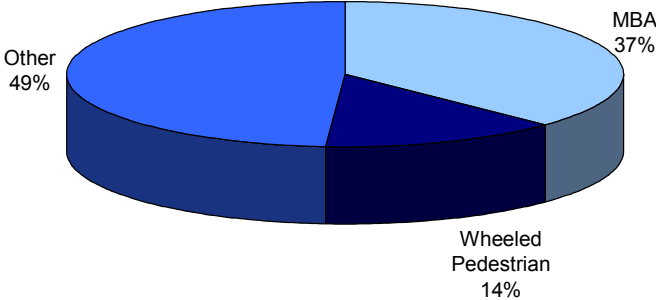


Four out of the five road trauma deaths seen at PMH ED between 2000 and 2007 were pedestrian injuries. Of these, three were pronounced Dead on Arrival, with the last passing away after being admitted to the Emergency Department (See Figure 6). Of the pedestrian presentations that sustained fatal injuries, two were aged between five and fourteen years. Pedestrian injuries account for 1 in 5 injury deaths for 5-14 year olds. They are second only to car passenger deaths for this age group⁵.

Combined Other

The remaining 51 road trauma presentations to PMH ED (3.2%) have been combined due to their low presentation rates and overlapping features. “Combined Other” includes injuries sustained to wheeled pedestrians, to children in Motorbike Accidents (MBAs), and in all other circumstances of road accidents.

Figure 7: Summary of “Combined Other” category



There were seven presentations during the study period that were classified as wheeled pedestrians. Five of these were children injured whilst riding a scooter, one while on rollerblades, and the last while riding a billycart.

Nineteen children presented with injuries following a MBA. Ten of these children were pillion passengers, eight were drivers of the motorbike and the remaining child was seated upon the handlebars of a cousin’s motorbike. The presentations included a variety of injury scenarios, including trail-bikes, four-wheel motorbikes, collisions with moving and stationary vehicles, being hit by vehicles, being hit by vehicles whilst stationary, and falling off while riding pillion.

The final 25 road trauma presentations are those that have been recorded in the ED as “other pedestrian conveyance”, “other transport”, or “other transport event”. These included children being hit by a vehicle while in a pram, falling from a pram while on the roadway, injuries sustained in/by a car other than in a MVA, collisions between pedestrians and motorbikes, as well as some instances of children on scooters or go-carts.

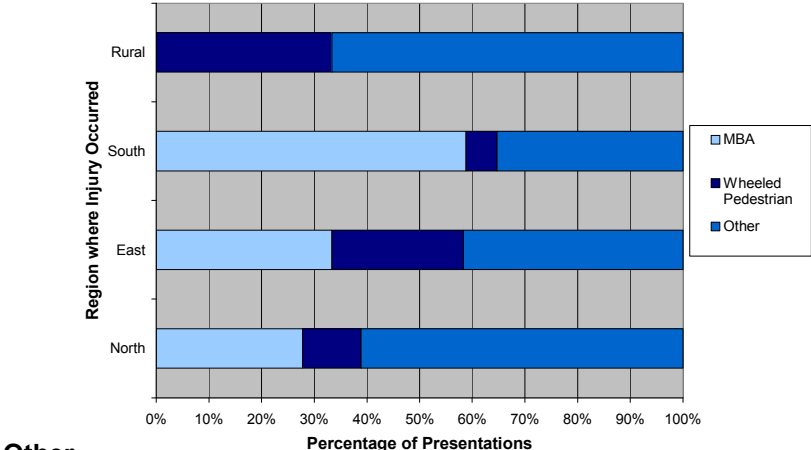
2005 saw the greatest number of road injuries categorised as combined other (n=15, 29.2%). In this year, there were four MBAs (21.1%), three wheeled pedestrians (42.9%) and eight “other” presentations (32%). The greatest number of MBAs occurred in 2003, the eight presentations in this year accounting for 42.1% of all MBA presentations.

No MBA or wheeled pedestrian presentations occurred on a Wednesday, and no “other” presentations occurred on a Saturday. Seven of the nineteen (36.8%) MBAs presented on a Sunday, while Monday was the most common day for wheeled pedestrian accidents (42.9%).

The Autumn months of March, April and May were the most common months for MBAs (36.8%). The highest risk period for wheeled pedestrians was 4.00-5.59pm (42.9%) and was 2.00pm-3.59pm for MBAs (31.6%).

The regional distribution mirrored that for all causes of road trauma. Approximately one third of children presenting to the ED were from both the north and south metropolitan regions, while 23% were from the east metropolitan region and 10% from rural Western Australia.

Figure 8: Regional Distribution for Combined



Other

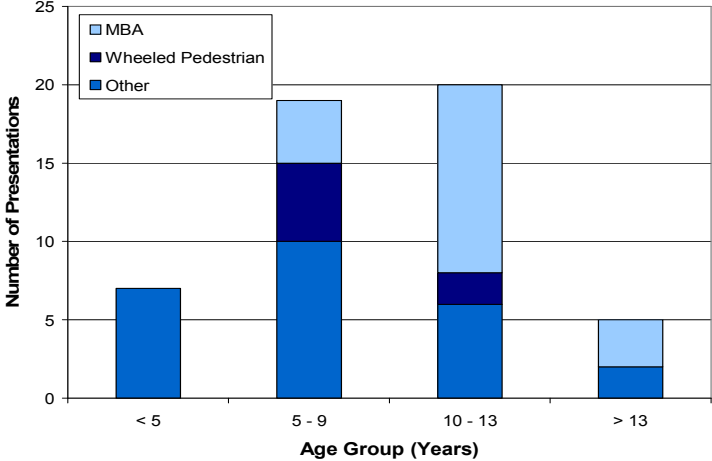
MBA presentations were most frequent by children from the southern suburbs (ten out of the nineteen). Three out of the seven wheeled pedestrians were from the eastern region, while “other” causes of road trauma were most likely from children from the northern metropolitan region (n=11, 45.8%). (See Figure 8). No MBA presentations were recorded for the Rural region, however this may be due to the off-road use of these types of vehicles by children.

MBAs, wheeled pedestrian accidents and other road traffic accidents displayed distinct differences in injuries sustained. The single feature consistent between the three was the lack of sprain injuries. Sprains accounted for only 0.2% of injuries for “combined other”, compared to 13.3% for total road trauma.

The most likely injury to be sustained in an MBA was contusions (46.2%). Interestingly, there were no upper or lower limb fractures recorded for the nineteen MBAs. Alternatively, 16.7% of wheeled pedestrians sustained lower limb fractures, with a further one third having upper limb fractures. Presentations from MBAs were restricted to the upper age groups, with none occurring in either the under 5 group. Children under five are rarely placed on motorcycles due to their lack of suitability for transporting young children. 63.2% of children (n=12) presenting after an MBA were between 10 and 13 years.

No presentations were made to PMH ED from wheeled pedestrians under five years, or over 13 years. Five of the seven were aged 5-9 years. Children aged 5 to 9 accounted for 40% of “other” presentation. (See Figure 9)

Figure 9: Combined Other presentations by age



Only one child presenting to PMH ED following a MBA was recorded as wearing a helmet at the time of the incident. No wheeled pedestrian was recorded as having been wearing, or using, any form of safety equipment.

The disposition rates for this category were similar to the overall rates for road trauma injuries. 43.1% of presentations were admitted, and 54.9% departed after their treatment was completed in the ED.

Discussion and Recommendations

It is estimated that nearly 1.2 million people sustain fatal injuries in road crashes each day, with as many as 50 million injured¹. These figures are predicted to increase by 65% by the year 2020¹ unless something can be done to reverse the increasing trend.

Road trauma is the leading cause of death for children aged between 1 and 14 years of age in Australia. While recent trends show that child road death is in fact decreasing, the numbers of injuries from road traffic accidents are not. The decrease in deaths is due to improved life-saving measures rather than a decreased accident rate or level of severity². This has the implication of an increase in serious but non-fatal injuries, posing long-term disability and burden on the health care system². Whilst it accounts for less than 2% of total injury presentations to the emergency department at PMH, the impact of road trauma upon each victim may be life long.

Motor vehicle accidents were the highest cause of injury presentations examined within this report, however very few resulted in serious injuries. This was no doubt due to the high use of appropriate safety devices and the low speed of impact, with the majority occurring on metropolitan roads. However the fact that 9% were not restrained should be of concern to those involved in road safety campaigns. This is such a simple and effective method of injury reduction or prevention.

Evidence shows that the use of appropriate safety devices such as seat belts and child car restraints can minimise the occurrence and severity of road traffic injuries and resulting death. In accordance with the Australian Road Traffic Code 2000, it is the driver's duty to ensure that all passengers between the ages of one year and 16 years, who are occupying seat positions with a seat belt, are wearing the seat belt and it is correctly adjusted and securely fastened³. Alternatively, the passenger is permitted to wear a suitable child restraint that is properly adjusted and securely fastened³.

All children under one year of age must be restrained in an Australian Standard AS: 1754 child restraint, suitable for the child's size and weight when travelling in a motor vehicle⁴. A correctly fitted child car restraint appropriate for the child's age and weight can reduce the risk of serious injury or death in road crashes by up to 70%⁴.

Kidsafe WA recommends that children under 12 years of age do not sit in the front passenger seat. This is due to the injuries that can be caused to children by front airbags. Front airbags are designed to protect adults in the event of a crash, deploying at 320km/h at adult chest height. Children sitting in the front seat can receive severe and often fatal injuries to the head, neck and spinal areas. The ideal position for children to be seated in a vehicle is in the centre rear position, to protect them from side impacts⁴. Older children who enter and exit from the car unassisted should be seated in the rear centre or passenger side position, to minimise their exposure to traffic on the street⁴.

As evident from this report, children are at risk of road traffic injury even when not traveling in a vehicle. Pedestrians, wheeled pedestrians and bicyclists are frequent victims of road trauma. This is because children are less well developed than adults

physically, cognitively and in terms of their traffic experience⁵. Their small size means they have difficulty seeing hazards on the road, and are not easily seen by drivers⁵. They have difficulty telling where sounds are coming from and may expect traffic from the wrong direction⁵. They also have trouble judging the speed of cars reliably⁵. Because of differences such as these, children not only need to be taught about road safety, but they need frequent reminders to ensure they use safe behaviour *consistently*⁵. Children under ten years of age should be accompanied by an adult at all times while they are a pedestrian, wheeled pedestrian or bicyclist using the roadway⁵.

Injury minimisation is enhanced by the use of appropriate safety measures. However, the analysis indicated that with the exception of motor vehicle passengers, many children did not make use of these measures. The lack of helmet or other safety equipment use by children riding skateboards, rollerblades, scooters and the like on the roadway is of concern. The use of helmets and safety equipment is not a legal requirement, but is highly recommended as their usage reduces injuries in the event of a collision with a motor vehicle, or any other form of accidents. Prevention is always the best method of injury reduction. School age children need reminding that when using a roadway an awareness of motor vehicles is essential for their own safety. Whilst the use of helmets and the like may help reduce an injury, not being struck by a motor vehicle is better.

Conclusion

Road traffic injury is a major public health issue, however it is often overshadowed by less frequent but more media worthy types of tragedy¹. Concerted and collaborative efforts are required to ensure that road trauma prevention becomes a priority. This will have immense benefits, because as stated by WHO, "*Road crash injury is largely preventable and predictable; it is a human-made problem amenable to rational analysis and countermeasure*"¹.

Acknowledgements

Princess Margaret Hospital Injury Surveillance Officers

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