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VicHealth

This edition of Hazard examines injuries to older children, many of which occur during recreational or sporting activity. Injuries sustained during the popular recreational activities of skateboarding, trail bike riding, Bicycle Motor Cross (BMX) riding and rollerblading, are investigated.

Recreational injury to older children (10-14 year olds)

Injury during recreational activity is common in older children (10-14 years of age). Skateboards, trail bikes, BMX bikes and rollerblades are commonly implicated in injury in this age group, which may be attributable to the speed, tricks and complicated manoeuvres involved in such activities. Almost two thirds of emergency department presentations were to males, 27% of injury occurred at home and 22% at school. The most common injuries sustained were fractures (25%), superficial injuries (23%) and sprains/strains (18%).

- The most common cause of skateboard related injuries were falls. Fractures, particularly to the wrist and forearm account for nearly half of the total injuries. Thirteen percent of cases required admission to hospital. These findings may be explained by: the high speeds reached by skateboarders; the fact that riders are likely to use outstretched arms to break their fall; and the infrequent use of protective equipment (particularly wrist guards).

- Half the total number of trail bike related injuries occurred on farms or at race tracks, mostly as a result of losing control of the bike. Half the injuries sustained were to the leg or arm and a third were superficial and largely preventable through wearing appropriate protective gear. Fractures were the other major type of injury, the prevention of which will require other measures, such as increased riding skills, improved bike design, more effective protective equipment and safer riding environments. Injuries leading to death were strongly associated with not wearing protective equipment of any kind, and three or four-wheeled motor cycles carried a high risk of fatality.

- Children aged 10-14 years were the most highly represented age group (45%) for BMX related injuries. BMX injuries did not differ largely from ordinary bicycle injuries, except for the greater number of injuries due to stunts and jumps. Injuries were mainly superficial, particularly to the upper body and open wounds to the head and face. Fractures, strains and sprains to the arms, hands, wrists and lower legs were also commonly reported.

- There has been a dramatic increase in the incidence of rollerblading injury in the 1990's. Falls up to 1 metre were the direct cause of 85% of rollerblading injury. The most common injuries were fractures of the forearm (27%), wrist (15%), elbow (4%) and hand (4%). Safety gear such as wrist, elbow and kneepads and helmets may be effective in preventing such injury. The effectiveness of such protective gear will be the subject of a review by the Monash University Accident Research Centre later this year.

Overview of injury to older children

Virginia Routley

The 10-14 year age group includes periods of rapid growth and development. Children in this age group may therefore not have sufficient awareness of their current body size and shape nor the consequences of risk taking behaviour. At this stage, however, they have mastered the basics of many physical skills and feel sufficiently confident to attempt speed, tricks and complicated manoeuvres.

The major factors causing injury to older children (10-14 year olds) are listed in table 1. Sport as a cause of injury has been covered in editions 8 and 9 of *Hazard* and is likely to be revised in the near future. Trampolines, rollerblades, horseriding, dogs and playground injuries have been covered in editions 13,15, 23, 26 and 29 respectively. In this edition injuries from skateboards, trail and BMX bikes are examined plus an update of rollerblade injuries. These are causes of injury for which data is often requested, especially from local government and agencies dealing with youth.

Original VISS and Victorian Emergency Minimum Dataset (VEMD) - VISS databases

There were 44,389 injuries in the 10-14 age group recorded by VISS (28,982 original database and 15,407 VEMD-VISS database). The original VISS database recorded details of injury presentations to 7 campuses of 5 Victorian public hospitals between 1988 and mid 1996.* The new electronic VEMD – VISS database replaces the original paperbased collection. The VEMD – VISS database collection began in October 1995 with 17 of the 23 participating Victorian public hospitals beginning data collection on this date, the others soon followed.†

The figure of 15,407 represents 9.1% of all injury cases recorded on the all age, electronic VEMD-VISS system collected in the period October 1995 to December 1996 (only the electronic figure quoted since the first three years of VISS were a paediatric collection only and the original database therefore overrepresents children). For the following 10-14 year old figures, in this and succeeding articles, the databases have been combined. Although it would be more accurate to quote figures from each database for every variable investigated, this approach was discarded in favour of clarity.

Of the 44,389 cases of injury to 10-14 year olds in the combined databases, 13% were admitted to hospital. Almost two thirds were male (64%). Fractures (25%), superficial wounds (23%), sprains/strains (18%) and open wounds (13%) were the most frequent injuries. The hand, wrist, forearm and elbow were the most common sites, representing 35% of injury. Falls of up to one metre were the most common cause of injury (29%); struck by/collision (18%), cutting/piercing (8%), and falls

Factors causing injury to older children **Table 1**

Factor	N	% of total
Bicycles	3 288	7.4
Australian Rules football	2 456	5.5
Basketball	1 670	3.8
Passenger cars	1 401	3.2
Soccer	1 068	2.4
Playground equipment	763	1.7
Horse riding	509	1.5
Stairs/steps	682	1.5
Cricket	627	1.4
Skateboards	560	1.3
Dog	585	1.3
Netball	587	1.3
Rollerblades	515	1.2
Trail bikes	469	1.1
Trampoline	332	0.8
BMX	199	0.5
Other	28 678	64.1
Total	**44 389**	**100**

Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996.

* Royal Children's Hospital 1988 to 1993, Western Hospital, Preston and Northcote Community Hospital 1989 to 1993, Royal Melbourne Hospital March 1992 to February 1994 and Latrobe Regional Hospital July 1991 to June 1996.

† From October 1995: Austin and Repatriation Medical Centre, Ballarat Base Hospital, The Bendigo Hospital Campus, Box Hill Hospital, Echuca Base Hospital, The Geelong Hospital, Goulburn Valley Base Hospital, Maroondah Hospital, Mildura Base Hospital, Preston and Northcote Community Hospital, Royal Children's Hospital, St Vincent's Public Hospital, Wangaratta Base Hospital, Warrnambool and District Base Hospital, Western Hospital, The Williamstown Hospital and Wimmera Base Hospital. From November 1995: Dandenong Hospital. From December 1995: Royal Victorian Eye and Ear Hospital and Mornington Peninsula Hospital. From July 1996: Alfred Hospital and Monash Medical Centre. From September 1996: The Angliss Hospital.

over 1 metre (4%) were other common causes of injury.

Almost all (93%) were unintentional injury, 2% were intentional and the remainder were of unknown intent. In regard to location, 27% occurred in the home, 22% at a school, 14% on roadways, 10% sports grounds and 9% place for recreation (including parks). For context 47% were leisure, 22% sports and 2% education. The majority of the remaining, for all variables, were unspecified or missing.

As noted, the following articles cover injury from skateboards, trail bikes, BMX bikes and an update on rollerblading. Although not the major causes of injury for 10-14 year olds (see table 1), they are common causes, over-represented in this age group, and have not been covered by other editions of *Hazard*.

Skateboard related injury

Anita Imberger‡

Skateboards were first marketed in the 1960's, and since this date, their popularity has waxed and waned[1] . The original wooden skateboards with steel or clay wheels, have been replaced by new designs with surface gripping polyurethane wheels[2]. Advances in skateboard technology have tended to stress high manoeuvrability and speed, often at the expense of balance and control. The size and material of the wheels, and the low rotational friction of axles, allow riders to achieve speeds greater than 80km/h[1,2]. At the same time, the small wheels are highly sensitive to irregularities in the riding surface, and slight shifts in the rider's centre of gravity cause great changes in the skateboard's direction. Considerable skill is required to successfully operate this "inherently unstable vehicle"[3]. For these reasons, it is not surprising that there are high numbers of skateboard injuries.

Skateboard injuries by location **Table 2**

Location	N	%
Public road/footpath/parking area	217	39
Residential home (incl. driveway)	125	22
Skateboard ramps/bowls/facilities	87	16
Park/recreation	25	4
School	22	4
Area for sport	4	1
Other	7	1
Unknown	73	13
Total	**560**	**100**

Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996.

Emergency Department Presentations

In the period of data collection, 560 cases of 10-14 year olds with skateboard related injuries were identified among presentations to Victorian emergency departments. The majority of these cases were males (89%). This is a common finding [4,5,6,7,8] which may partly be explained by the high exposure of males, particularly those in the 10-14 year age group, to skateboards [9,10].

Around half of the skateboard injuries occurred between 2 and 6pm, and most occurred on the weekends (40%). Injuries were more frequent in the warmer months of the year (44% from December to March).

Location

Skateboard injuries most commonly occurred on public roads, footpaths or at parking areas. Of the total, at least 22% occurred on a public road, and 13% on the footpath. Other common locations for skateboard injuries were at a residential home (22%), particularly driveways and yards, and skateboard ramps, bowls or facilities (16%) (see table 2). Fifteen of the cases occurring at skateboard ramps, were at private ramps in backyards.

Treatment

Patients were most commonly referred to an outpatient department (30%), treated without referral (19%), or were reviewed in the emergency department (16%). A further 13% were admitted to hospital, and 14% were referred to general practitioners or other medical practitioners.

Nature of injury and body part

In total, 619 separate injuries were sustained by the 560 children (as VISS recorded up to 3 injuries per case until 1996). The forearm, wrist, and hand were the most frequently injured body regions (see figure 1). Injuries to the head were more common in admitted patients (23%) than the total group (7%).

Almost half (48%) of the total injuries were fractures. Superficial injuries such as bruising, inflammation and swelling were relatively common (22%), as were sprains and strains (12%) and open wounds (7%). Intracranial injuries, which include concussion, accounted for 4% of the total. For cases that required hospital admission, fractures and intracranial

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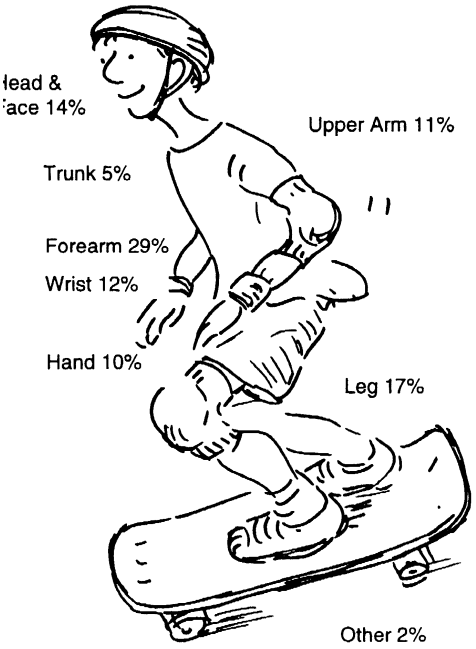
Skateboard injury in the 10-14 year old age group by body region — Figure 1



Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996

injuries were more common, constituting 66% and 11% of injuries, respectively.

Overwhelmingly, fractures to the forearm (particularly the radius/ulna) and wrists were the most common types of injuries (see table 3). This finding has been well documented in the literature[2,4,6,8,11,12], and is due to the biomechanics of falling from a height, at a speed[13] . An instinctive reaction of older children, is to break their fall with outstretched arms, resulting in a force directly onto the forearm, wrist or elbow[1,13,14].

Events leading to injury

Falls (n=486)

The most common cause of skateboard injuries, were falls, accounting for 87% of all cases (see table 4). Although only 87 cases specified loss of control and balance as the main cause of the fall, it is likely that this scenario played a part in most falls. Falls from ramps and skateboard bowls accounted for 15% of all skateboard injury cases. Other falls were due to skaters hitting irregularities or small obstacles, such as stones, small bumps, cracks in the path, gutters and drains. These resulted in the skateboard stopping suddenly, causing the rider to project forward and fall. As previously mentioned, the small wheels of skateboards, makes them more sensitive to slight surface irregularities than other riding vehicles, such as bicycles[1].

A further group were injured from falls caused by performing tricks or difficult manoeuvres on skateboards. These ranged from attempting sharp turns on bends and skating on steep inclines, to jumping over obstacles, riding on steps, riding two skateboards at once, and being towed by cyclists.

Only two cases possibly related to faulty manufacturing of the skateboard. In one case the wheel fell off, and in the other the rail on the board broke. This is a positive finding given that there are no Australian Standards for skateboards.

Hit/struck/crush by skateboard (n=29)

Thirteen cases were caused by skateboards hitting riders, often as a result of flicking up. There was some indication that this may be due to the stopping mechanism of skateboards, as riders have to angle the boards onto the raised back or front section in order to stop.

In twelve cases, hands or fingers were crushed by skateboards. They either became caught in the wheel, or were run over (when using hands to push or stop the skateboard).

Collisions (n=23)

Four percent of cases were caused by collisions, mostly with objects or people. Skateboarders either travelled into walls and fences after losing control, or hit against windows and poles. Most people collisions were caused by other skaters or cyclists, with only one instance of a bystander being hit by a skateboard rider. It may be the case that bystanders likely to be hit are not aged between 10 and 14 years, or that their injuries do not require emergency attention.

Only 1% of cases (n=6) collided with cars. Half of those hit by cars were admitted to hospital with fractured leg/s or intracranial injuries. The remainder, who did not require hospital admission, sustained sprains/strains or bruising.

Main skateboard injuries sustained — Table 3

Main injuries	N	%*
forearm fracture	148	24
wrist fracture	38	6
finger fracture	26	4
intracranial injury (including 20 concussion)	22	4
ankle sprain or strain	18	3
wrist sprain or strain	17	3
wrist bruising/inflammation/swelling	16	3
lower leg fracture	16	3
forearm bruising/inflammation/swelling	14	2
cuts and laceration to external mouth (eg jaw, lip)	13	2
upper arm fracture	10	2

Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996.

Events leading to skateboard injury — Table 4

Event leading to injury	N	%
Fall	486	86.8
lost control/balance	*87*	*15.5*
fall from ramp/bowl	*83*	*14.8*
hit irregularity/obstacle	*48*	*8.6*
performing tricks/difficult manoeuvres (excl. on ramps)	*31*	*5.5*
going too fast	*10*	*1.8*
faulty skateboard	*2*	*0.4*
other/not specified	*225*	*40.2*
Hit/struck/crush by skateboard	29	5.2
hit by skateboard	*13*	*2.3*
hand/fingers caught in/under wheel	*12*	*2.2*
other/not specified	*4*	*0.7*
Collisions	23	4.1
with person	*7*	*1.2*
with car	*6*	*1.1*
with wall/fence/pole	*5*	*0.9*
part of body (arm/wrist/hand) with object (window/pole/ramp)	*5*	*0.9*
Fall and hit/struck/crush by skateboard	7	1.2
Other/not specified	15	2.7
Total	**560**	**100**

Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996.

Use of protective equipment

Protective equipment was noted in only 14% of cases. This figure may not be complete and is not necessarily representative of the entire population using skateboards, as those wearing protective equipment may not require emergency care or may escape injury altogether.

Of those injured whilst skateboarding at ramps, bowls or skateboard facilities, 40% reported wearing protective equipment. Other studies have also suggested that the type of skateboarding practised influences the use of protective equipment, with those skating on ramps using protective gear most often, and street skaters using it least often[1].

Patients not requiring hospital admission were also more likely to have worn protective equipment (15%) than those admitted to hospital (9%), suggesting that protective equipment may affect the severity of the injury sustained.

Kneepads or helmets, followed by elbow pads, were the most common pieces of protective equipment worn, often in combinations (see table 5). In particular, helmets were often worn in addition to some type of padding (n=25), particularly knee and elbow pads (n=18). Only 34 cases were wearing just one type of protective equipment, (n=17 kneepads, n=16 helmet, n=1 elbow pads). No cases mentioned the use of wrist guards.

Discussion

Restricted areas and skateboard designated areas

Over a fifth of the injuries in this data were sustained on public roads. Although collisions with cars are rare, they are often serious, and in many U.S. cases, fatal[1]. Traffic speeds may also encourage high-speed skating, and streets often have surface irregularities that readily affect small skateboard wheels[1]. For these reasons, most researchers agree that skateboard use should be restricted or prohibited on public roads and near high-density or high-speed traffic[1,2,4,7,12,13,14].

Restricting street skating, however, may create problems for pedestrians[1]. Although there were no older pedestrians with injuries caused by skateboarders in this data, these bystanders may still be injured or threatened without requiring emergency care. It is also argued that avoiding street skating would interfere with those who use their skateboards for transportation[1]. The City of Melbourne Council has recently accepted a new

Protective equipment worn by injured skateboarders — Table 5

Type of protective equipment worn (n=80)	N	%#
Kneepads	46	58
Helmets	41	51
elbow pads	27	34
pads ns	3	4
ankle supports	1	1
protective clothing/other safety device (ns)	12	15
Total	**130***	**163*%**

Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996.

skateboard (and in-line skating) strategy which attempts to deal with these issues. They will declare "no-skate" zones in certain city streets, and nominate "preferred" access routes through the city for skaters to get to activities (for example, footpaths on certain sides of the street). Skaters who intimidate, obstruct or threaten the safety of others will be fined or prosecuted.

Another way of minimising collisions with solid objects, pedestrians and motor vehicles, is to provide specific skateboard areas or parks[1,4,7,13]. Again there are some problems with this safety intervention. In particular, "councils are reluctant to build ramps because of cost, possible litigation, local resident opposition and because they often are a focus for children engaging in undesirable behaviour"[4]. It is also suggested that skaters may take greater risks in these parks unless supervision is strict[7]. It is generally agreed, however, that these facilities are better than riding on roads. The new City of Melbourne skateboard strategy includes providing a permanent skate venue in the Central Business District.

Surfaces

As skateboards require hard surfaces for a "good ride", falling onto a solid, firm surface is likely[11]. Falling from heights such as from ramps, is particularly dangerous when hard surfaces surround the ramp[14]. Where possible, impact absorbing surfaces, similar to those used beneath playground equipment, should be used around and under ramps[15].

Protective equipment

This data and others show that the wrist and forearm are particularly vulnerable to injuries caused by falls from skateboards, indicating the need for devices to protect these areas. Wrist guards are designed to protect against sudden, forceful wrist extension and direct contact with the hard surface[11]. A recent study assessing wrist guards, found that the risk of wrist or elbow fracture was greater when wrist guards were not worn[13]. Wrist guards therefore appear to effectively absorb the energy of impact onto a rigid surface. The author suggests that the guards may also reduce elbow injury by absorbing energy that might otherwise be transmitted up the bones of the forearm.

Another study found that most or all of the head injuries in their sample would have been prevented if the skateboarder was wearing a helmet[4]. Protective helmets should therefore be worn whilst skateboarding[1,4,6,12,14,16]. Helmets tested to the Australian standard for bicycle riding are considered sufficient protection for skateboard riders[17].

Protective padding such as elbow and knee pads should also be worn by skateboarders[1,14]. There is some debate about the degree of effectiveness of this padding. The main concern is that whilst padding may protect the superficial tissues, the force of the impact may still be transmitted through protective clothing to cause fractures, whereas unprotected soft tissue may absorb the brunt of the injury[1,7]. One study found a significantly higher incidence of fractures compared to soft tissue injuries in skateboarders who were wearing helmets, gloves, knee and elbow pads, and who were skateboarding at a skate park at the time of injury[7]. It is likely that protective padding designs have improved since this study. It is also important to recognise that this study did not look at skateboarders who wore protective padding, and escaped injury.

As riders become more experienced, it is likely that they perform riskier manoeuvres. The effectiveness of personal protective equipment in these riskier situations also requires investigation.

Conclusion

It is important to recognise that this data underestimates the total number of people injured by skateboards, as the VISS data collection does not cover all hospitals, and not all injured cases present to emergency departments, or fall into the 10-14 year old age group. When considering the all age VEMD data, only 33.2% of cases were in the 10-14 year old age group. One study has shown that when correcting for exposure to skateboards, the 15-19 year old males had the highest numbers of injuries[9]. Also of concern is the fact that younger children, with their immature motor co-ordination and control, tend to sustain more severe injures and more head injuries than older children[1]. These results indicate that skateboard related injuries are sufficiently frequent and severe to warrant attention[1]. The launching of the new City of Melbourne skateboard strategy, with its new "Education and Awareness" program for skaters and pedestrians, is a first step to address this issue.

Recommendations

- Provide specific skateboard areas or parks to minimise collisions with objects, pedestrians and motor vehicles.
- Restrict or prohibit skateboarding on public roads or near high-density, high-speed traffic.
- Use impact absorbing surfaces around and under ramps (where possible).
- Adequately maintain skating surfaces in skateboard areas or parks, and ensure they are free from irregularities, stones and broken glass.
- Encourage skateboarders to wear full protective gear: helmets, wrist guards, knee and elbow pads.
- Use population based data to evaluate the true magnitude of protection offered by protective padding and wrist guards.
- Increase skateboarders' awareness of the dangers of skating even when wearing protective equipment.
- Offer courses through local sporting clubs or skating organisations, which teach braking techniques (to prevent collisions), and stress balance and control as opposed to speed and trickery[2,13].
- Encourage other councils to adopt a similar skateboard strategy as that accepted recently by the City of Melbourne. (For a summary of the strategy, contact Natalie Reddall, Ph: 9658 9658 Email: NATRED@melbourne.vic.gov.au).

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Trail bike injury to older children (10 to 14 years)

Stephen Begg[1]

Introduction

This article describes patterns of trail bike related injuries in 10 to 14 year olds. The term 'trail bike' is used here to refer to motor cycles designed primarily for off-road use, including trail bikes, dirt bikes, mini-bikes and three or four-wheeled agriculture vehicles. The primary aim of the article is to update and expand upon information provided in *Hazard 20* and a Monash University Accident Research Centre study *"Motorcycle-related injuries to children and adolescents"*.

Most trail bike riding amongst 10 to 14 year olds occurs 'off-road' on unregistered bikes. There is, therefore, no official information on the extent of trail bike riding in this age group or on the types of bikes they ride. In addition, there is little research into the training experiences of these riders (Reeder et al, 1996). In general terms, however, they can be characterised as being:

- relatively inexperienced
- riders of light, low capacity machines, often with poor braking power
- recreational riders rather than riders for transport reasons
- more likely to ride on rougher more slippery surfaces and at lower speeds than 'on-road' riders.

The primary sources of information for describing trail bike related injuries in children are the Coroner's database (CFS), Victorian Inpatient Minimum Dataset (VIMD) - hospital admission data and Victorian Injury Surveillance System (VISS) - emergency department surveillance data, each of which will be referred to in this article.

Deaths

Eight trail bike related fatalities were identified in the above-mentioned data sources (3 in the CFS over the period 1990 to 1994 and 5 in the emergency department surveillance data). Of the 3 CFS fatalities, 2 died as a result of colliding with a car, the other drowned in an irrigation ditch after losing control of a three-wheel motorbike. Apart from the fact that one of the car-related cases was wearing a helmet, it is not known what protective equipment these children were wearing.

Of the 5 emergency department fatalities, 2 died while riding three or four-wheeled motor cycles on farms, 2 died after colliding with each other while at a suburban race track and one died as a result of losing control of a trail bike at an unknown location and sustaining severe head injuries. One of the three or four-wheeled motor cycle related fatalities occurred as a result of a spider or snake bite while being pinned under the bike, having swerved to miss an electric fence. The other occurred as a result of unknown injuries after losing control of the bike in an empty dam. The cause of death in the race track fatalities is unknown. Attempts to cross reference these 5 cases with the 3 cases in the CFS were unsuccessful.

Hospital admissions

VIMD data does not provide sufficient detail to determine what types of motor cycles were implicated in motor cycle accidents involving children, or any of the surrounding circumstances other than the parts of the body that were injured. Despite these limitations it is an excellent source of time series information on injuries requiring hospitalisation. Analysis of the data over the period 1987/88 to 1995/96 reveals that there were between 17 and 30 children per year admitted to public hospitals as a result of 'off-road' motor cycle crashes, three-quarters of whom were admitted directly from an emergency department. No trends in terms of admission numbers were apparent over this period.

[1] Stephen Begg: Research Assistant, Monash University Accident Research Centre.

The four most common reasons for admission were fractures of the lower and upper limbs (29% and 22%), intracranial injuries excluding skull fractures (19%) and open wounds to the head (7.5%). Seventy-five per cent of children were discharged from hospital within 3 days, 95 per cent of whom were discharged to a private residence. Six children were in hospital for over a month.

Emergency Department Presentations (not resulting in death)

Emergency department injury surveillance data is an important source of descriptive information regarding injury. In the 10 to 14 year old age category, 386 children in the original VISS system (346 males and 40 females) and 83 in the VEMD-VISS (64 males and 19 females) were identified as sustaining trail bike related injuries.

Location

Table 6 shows that the most common locations for trail bike related injuries were on farms or at athletics or sports areas, with smaller proportions occurring at unspecified places or at home. Only a small proportion of riders were injured whilst riding on public roads. A closer analysis of VISS data reveals that 94 of the 98 cases sustaining an injury at an athletics and sports area were at race tracks. These tracks are designated for the purpose of allowing young riders to compete against each other and are located throughout the metropolitan area and in rural centres throughout Victoria.

Cause of injury

Sixty-four percent of injuries occurred because riders lost control of their bikes, reinforcing the notion that inexperience plays an important role in injuries to this group. Hitting obstacles such as rocks, ditches and gutters and failing to negotiate jumps were frequently cited reasons for this cause of injury. Falls were the next most common reason (18%), although the majority of falls were also attributable to loss of control. Collision was the least common cause of injury (7%), which contrasts sharply with the 18 to 20 year old group of off-road riders for whom collision is the most common cause (Haworth et al, 1994). Collisions into walls, fences, trees and fence posts at relatively low speeds were commonly cited collision incidents.

Location of trail bike related injuries, 10 to 14 year olds **Table 6**

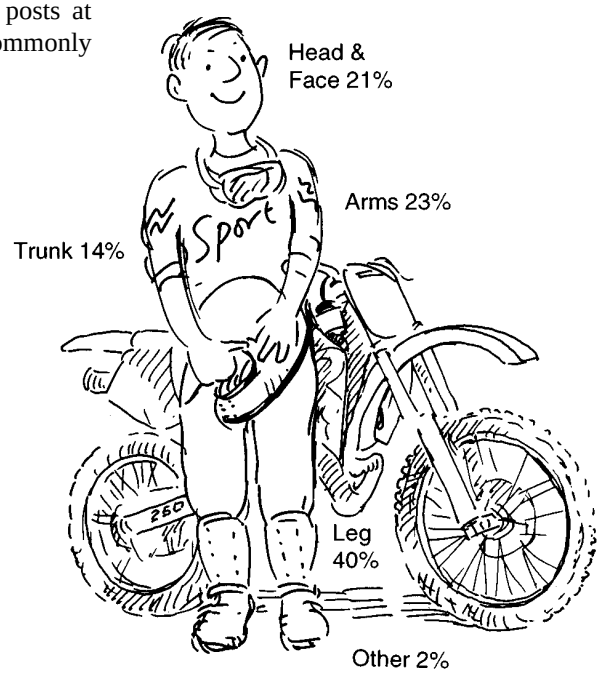
Location	VEMD-VISS	VISS	Total	%
Farm	13	92	105	22.4
Athletics and sports area (race tracks)	6	98	104	22.1
Unspecified place	14	75	89	19.0
Home	22	54	76	16.2
Other specified place	2	41	43	9.2
Place for recreation	15	8	23	4.9
Road, street or highway	9	9	18	3.8
Residential institution	1	3	4	0.9
School, day care, public admin area	1	3	4	0.9
Industrial/construction area	0	2	2	0.4
Mine or quarry	0	1	1	0.2
Total	**83**	**386**	**469**	**100**

Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996

Body part

Legs were the most common body region to be injured, with knee and lower leg injuries making up over half the injuries in this region. Arms were the next most common region with the majority of injuries occurring to the forearm and hand. In the head region, half the injuries were to external parts of the head other than the face and a fifth were intracranial. In the trunk region, half the injuries were to the shoulder and a fifth were to the chest.

Trail bike injury in the 10-14 year old age group by body region **Figure 2**



Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996

Treatment

Treatment patterns give an indication of seriousness of injury. An analysis of this aspect of the data reveals that a third of the children were treated in emergency departments then referred elsewhere for ongoing treatment and more than a quarter were admitted from an emergency department to a ward. Smaller proportions received minor treatment (18%), remained in emergency for review (15%), received no treatment (3%) or were transferred to another hospital (1%). One per cent were dead on arrival or died soon after admission.

Nature of injury

In terms of the types of injuries sustained by riders, a third of the injuries were fractures, a third were superficial injuries and the remainder were open wounds (13%), sprains and strains (8%), intra-cranial injuries (4%) or other types of injuries (11%). It should be noted that a number of riders sustained multiple types of injuries.

Safety equipment

The following comments regarding safety equipment relate to the 386 original VISS database cases. Although likely to be an under-estimate, only sixty per cent of injured children were noted as wearing protective gear at the time of injury. None of the 5 VISS fatalities were in this category. Of the 29 children who received head injuries, 16 were wearing motorbike helmets, 2 were wearing bicycle helmets, and the remaining 11 children were not wearing safety equipment of any kind.

Commonly worn types of protective gear other than motor bike and bicycle helmets included body armour, gloves, boots and kidney belts. However only a minority of children with open wounds and superficial injuries (the categories of injury the severity of which can be reduced by these types of protective equipment) were wearing equipment related to the affected part of the body: 6 out of 27 children with foot injuries were wearing protective boots, 4 out of 15 children with hand injuries were wearing gloves, 8 out of 52 children with trunk and arms injuries were wearing body armour and 3 out of 70 children with leg injuries were wearing leg protection. Unfortunately, no comments can be made regarding eye protective equipment as helmets with visors and those without could not be disaggragated from the data.

Recommendations

- Young motor cyclists should be educated about the value of protective clothing and be encouraged to wear it.
- An appropriate government authority (or authorities) need take responsibility for motor cycling safety off-road.
- Parents need be made aware through retailers and off-road motor cycle clubs that slowing down motorcycles for children will not eliminate injuries warranting hospital admission.
- Parents need be made aware through retailers and off-road motorcycle clubs of the risks to young people associated with riding three or four-wheeled motor cycles.

Adapted from Haworth, 1994, p.71-2.

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BMX Bicyclist Injury to older children (10-14 years)

Voula Stathakis[1]

BMX is an abbreviation for *bicycle motocross*. The Collins English Dictionary (1986) defines BMX as "stunt riding on rough ground or over an obstacle course on a bicycle; a bicycle designed for bicycle motocross." When analysed, BMX bicycle injuries were very similar to ordinary bicycle injuries except for the large number of injuries due to stunts and jumps. The following is a description of injuries among 10-14 year olds involving BMX type bicycles.

BMX related injuries were identified using a two step process. Firstly, all bicycle injuries to 10-14 year olds were selected and then a text search for the word "BMX" or "B.M.X." was undertaken. The type of bicycle involved in the injury event was not always specified, therefore the total of 199 cases is an underestimate of the true value.

Emergency Department Presentations

There were 199 cases of injury relating to BMX bikes presenting to the Emergency Departments of hospitals on the original VISS database combined with the VEMD database for children aged 10-14 years. This age group represents 34% of all bicycle related cases of injury on the database. Six per cent of bicycle injuries to 10-14 year olds are BMX related injuries. The 10-14 year age group represents the peak affected age group (45%), followed by 5-9 year olds (31%) and 15-19 year olds (13%), involving BMX bike related injury. Eighty-five percent of injured children were male. Hospital admission was required for 18% of 10-14 year old BMX cases compared with 19% for all age BMX cases. A further 52% required a review or referral, 21% minor treatment and 9% no treatment.

[1] Voula Stathakis: Research Assistant, Monash University Accident Research Centre.

Cause of Injury for BMX riders aged 10-14 years Table 7

Cause	N	%
Falls	157	79.0
On concrete/footpath	*35*	*17.6*
On road	*17*	*8.6*
Onto part of bike	*14*	*7.1*
Over handlebars	*10*	*5.0*
Bike onto victim	*6*	*3.0*
Onto rock/glass/sharp object	*4*	*2.0*
Other including ground	*71*	*35.7*
Collisions	25	12.5
Motor vehicle	*10*	*5.0*
Wall/fence	*6*	*3.0*
Pole/tree	*5*	*2.5*
Other bicycle rider	*2*	*1.0*
Other object	*2*	*1.0*
Caught in part of bicycle	6	3.0
Doing tricks/jumps/dinks/races	1	0.5
Other specified	1	0.5
Unknown/not specified	9	4.5
Total	**199**	**100**

Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996.

There was one recorded fatality (DOA or died in the emergency department).

Forty percent of cases occurred at weekends and 48% occurred over the January to April period, peaking in February with 14%. Injury locations varied, public roads/streets were the most common (45% of total cases), followed by BMX tracks 16%, home and the footpath representing 12% and 8% respectively. Forty percent of cases reported wearing a safety device (38% wore a helmet and 2% used some other specified safety device). A study by Finch et al (1993) examined bicycle use and helmet wearing rates and found that, when compared to primary school aged children and adults, the 12-17 year age group had the lowest helmet wearing rate, (21% in 1990), prior to and after the introduction of the helmet law in July 1990 (helmet wearing rates were 45% in 1991 and 59% in 1992). Although helmet wearing rates improved significantly after the introduction of the helmet law for this age group, they still remained lower than other age groups (Finch et al. 1993).

Events leading to injury were most commonly the victim losing control of their bike (29% of cases), falls/collisions (24%), bicycle parts failing (14%), and performing tricks/jumps/dinking people (11%). Other factors included unfavourable surface conditions ie. wet, slippery, bumps (8%), hitting rocks or stones (5%), becoming caught in bicycle part (3%) and during maintenance (1%). Bicycle part failure consisted of chains coming off while in motion, brakes failing or locking up, wheels coming off while in motion, frames and handlebars breaking and collapsing. Causes of injury are summarised in table 7 with falls being the main cause of injury (79% of all cases), followed by collisions (13%).

Up to 3 separate injuries can be recorded for each case and percentages represented the proportion of total injuries rather than the proportion of cases. A total of 254 separate injuries was sustained by 199 cases. These were commonly superficial injuries (33%), particularly to the upper body, fractures (24%), especially to the arm, open wounds (17%), particularly the face, strains and sprains (13%), especially the arm and intracranial injuries (mainly concussion) (5%).

The most frequently injured body regions were the head and face (excludes the eyes) (22%), arm (includes upper arm, elbow and forearm) (21%), hand (includes wrist, hand and fingers) (21%), and the lower leg (includes the ankle and feet, excludes knees) (10%), knee injuries represented 8%, other injuries were to the trunk (9%), shoulders (6%) and other (3%) (see figure 3). Head injuries were sustained by 17 cases, 77% of whom did not report wearing a bicycle helmet.

Discussion

Eleven percent of injuries were the result of 10-14 year olds attempting tricks with their bikes, such as jumping off makeshift ramps (ie. a few bricks and a plank of wood) or riding up on one wheel. An examination of non BMX bicycle injuries for this age group yielded only 2% of cases performing tricks/jumps, depicting the main difference between the bicycle types. All other factors, such as location, injury type and severity were evenly distributed between BMX and non-BMX riders, as was also found by Worrell (1985) and Illingworth (1984, 1985). However, there were more injuries recorded per case (1.28:1) for BMX riders compared to non-BMX riders (1.02:1), for the 10-14 year age group.

The injury literature reported several serious injuries solely attributable to BMX bikes, particularly during the 1980's, when these bikes first came onto the market (Sparnon, 1982, 1984; Adlam, 1984; Tuck, 1984). These were typically abdominal and scrotal injuries, caused by BMX handlebars impaling riders while performing jumps/stunts, usually attributed to the facility of handlebars to be turned at angles greater than 90°. There were only 2 injuries, inadequately describ-

ed, of this nature and not enough information from VISS to indicate the cause. There have been no recent publications on BMX injury, perhaps an indication of changes to the bicycle itself or the introduction of new bicycle models, ie. Mountain bikes.

Strict safety guidelines regarding personal and bicycle equipment apply to competitive BMX riding, (John Walczuk, BMX Victoria). In the 1995 Riders Manual, published by BMX Australia Inc., personal protective items such as helmets, long sleeves and long pants, ankle length socks, shoes or boots and suitable gloves are required to be worn by all competitors. Other items, such as padding on the bicycle itself, particularly the brace bar on handlebars, gooseneck and upper frame and both ends of handlebars being plugged, are also mentioned. Helmets must be "full face helmets of a one piece construction", and are unacceptable if they do not cover the ears. This point is also noted in the 1995 Catalogue of Australian Standards and Other Products, where it states that the current bicycle helmet standard "applies to helmets for all cycling activities, except BMX racing, for which cyclists may require more extensive protection".

Recommendations

- Bicycle helmets that meet the Australian Standard (AS2063.2-1990) should be worn at all times.
- Protective clothing, (full face protection, knee pads, elbow pads, keeping outer extremities covered) should be worn when engaged in BMX activities.
- Protective padding on various parts of the bicycle, (ie. brace bar on handlebars, gooseneck , upper part of frame) which is mandatory for competition BMX.
- Parental/guardian supervision.
- Provision of training/guidance for performing stunts and bicycle maintenance.
- Bicycles should be checked by parent/guardian to ensure they are safe to ride.
- The practice of "dinking" other children should be discouraged.

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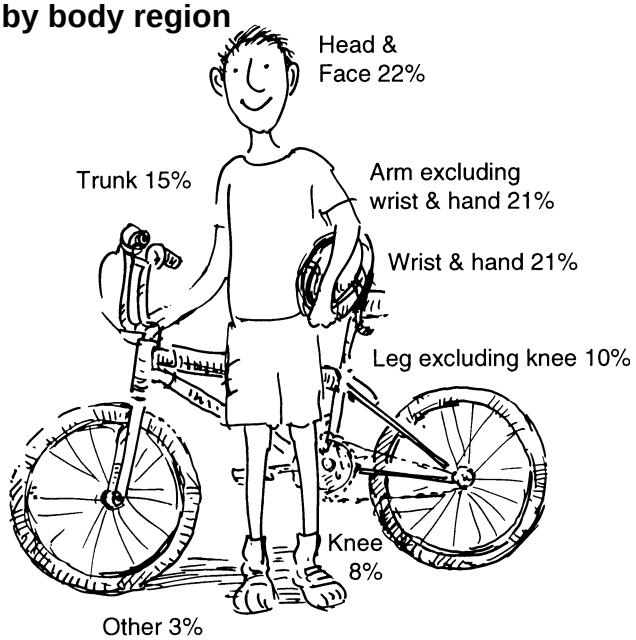
BMX bike injury in the 10-14 year old age group by body region **Figure 3**



Source: Victorian Injury Surveillance System, Emergency Department Presentations, 1988-1996

Rollerblading Injury to older children (10-14 years) – An update

Virginia Routley

Hazard 15 initially reported on rollerblading injuries in July 1993. The article reported on VISS data and a followup telephone survey of 10-14 year olds. At that stage there had been little in the way of published research and this was not surprising since the dramatic increase in rollerblade injuries, coinciding with a decline in skateboard injuries, commenced, at least for VISS hospitals, in 1991. This increase was not confined to Victoria. In the US rollerblade emergency department treatments tripled between 1993 and 1996, reaching 100,000 in the latter year. The results of VISS data, an extended survey and a comparison of rollerblade injuries, with those of skateboards and rollerskates, with reference to literature at the time, were published in the *Journal of Paediatrics and Child Health* (Feb 1996).[1]

This update examines data from the new electronic database (VEMD-VISS) and some of the recent more extensive literature.

Emergency Department Presentations

There were 256 emergency department rollerblade presentations on the VEMD-VISS database in the 10-14 age group. These represented one half of all rollerblade injuries. Sixty-one percent were male and 15% were admitted to hospital. The most common injuries were fractures of the forearm (27%), wrist (15%), elbow (4%) and hand (4%). Sprains and strains to these areas were also common (13% in total). Injury patterns were consistent with those of the earlier*Hazard* article. There is consistency in the literature regarding fractures of the forearm, wrist, elbows and hands being the most common rollerblading injuries.[2,3,4] Such injuries usually occur from falling onto outstretched hands.

Rollerblade injuries occurred equally most often in home or transport areas (each 27%) or places for recreation (23%). Falls of up to one metre were the direct cause of 85% of rollerblade injuries eg *'fall on outstretched hand while rollerblading'*, falls over 1 metre represented 2.3% eg *'fell down four steps while on rollerblades', 'fell from rollerblades on a jump'* and collision with an object or person (1.6%) eg *'collided with a wall whilst rollerblading', 'bladed into side of car'*. There were some very risky scenarios eg *'child going down playground slide on rollerblades, fell at base of slide'* and *'being towed by bike on rollerblades and fell'* which, not surprisingly, resulted in injury.

Deaths

In Victoria, as yet, there have been no deaths from rollerblading, despite fatalities having occurred elsewhere. In the US National Electronic Injury Surveillance System database (NEISS) there were 43 rollerblading deaths recorded between Jan 1992 and August 1996. Two thirds of these involved motor vehicles and at least two thirds suffered head injuries. None of these fatalities were recorded as wearing a helmet. Based on this fatality rate for the US, Victoria could expect about one rollerblade fatality in every 6 years.

Protective gear

Safety gear is available in the form of wrist, elbow, kneepads and helmets to protect against injury. Wrist guards are regarded by some researchers and practitioners to be protective against distal forearm and wrist fractures. They may also reduce injuries to the elbow by absorbing energy which might otherwise be transmitted up the arm bones.[5,6.] There is some debate however over the effectiveness of currrent wristguards.[7, 4] The effectiveness of protective gear, including wrist guards, will be the subject of a rollerblading countermeasure review, to be undertaken by MUARC in the second half of 1997, for the Department of Sport and Recreation, Victoria.

Recommendations

- Novice skaters should learn the basics of controlled skating and stopping in supervised settings.
- Protective gear, especially wrist guards should be worn at all times.
- Skating should not occur at night – skaters can't be seen, and they can't see obstacles or other skaters.
- Rollerblading should not take place on roads or amongst pedestrians. Smooth areas should be set aside, by local government, for rollerbladers. These may need to be shared with cyclists or skateboarders eg bike paths.
- Hire shops should require safety equipment to be hired out with rollerblades.
- More research should be undertaken into the effectiveness of protective gear and any recommendations incorporated into improving the ability of a product to prevent fractures.

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Of the 100,000 *Big Poisons for Little People* brochures printed, there are only 10,000 still available for distribution.

This brochure is based on findings from a VicHealth funded study on childhood poisoning, based on research by Monash University Accident Research Centre, the Royal Children's Hospital and the Department of Human Services, Victoria. Esso Australia provided generous support in disseminating the findings of this project.

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