QUEENSLAND INJURY SURVEILLANCE UNIT

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INJURY BULLETIN

Skateboard Injury

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Summary of findings

* QISU estimates that approximately 1,000 skateboard-associated injuries are seen at emergency departments each year in Queensland.
* 10-14 year old males are the most likely group to present to a QISU ED with a skateboard related injury.
* The peak time for skateboard injuries to occur is on the weekend and in the late afternoon.
* Only 19% of skateboard injuries occur at skate park facilities, with the remainder occurring in non-skate parks, on roads and footpaths.
* Risk factors associated with more severe injuries are, age less than 10 years and involvement in a motor vehicle crash
* The most common types of injuries are fractures and sprains of the upper limbs.
* Isolated head injuries represent approximately 5% of skateboarding injuries, but 60% of serious injuries requiring resuscitation. These injuries may be minimized or prevented with helmet use.

Introduction

Small wheeled recreational devices such as skateboards, inline skates, roller skates and scooters are very popular with young Australians. The Australian Sports Commission estimated that approximately 80,000 Australians aged 15 years and older used small wheeled recreational devices for their sports activity in 2007 [1]. Their data on people 15 years of age or older showed that users of these devices were predominantly young males (50% were aged between 15 and 24 years and 77.7% were male). According to the same report, approximately 11,000 Queenslanders aged 15 years and older were estimated to be involved in activities involving small wheel devices in 2007 [1].

The Queensland Injury Surveillance Unit (QISU) has previously reported on injuries associated with small wheel devices [2]. In that bulletin, injuries were more common among children aged between 10 and 14 years of age and skateboards were associated with the majority of small wheeled recreational device injuries. This issue of the bulletin reports on skateboard associated injuries presenting to Queensland emergency departments.

Method

The QISU database was searched for the 9-year period, January 1999 to December 2007 for all small wheel injuries. QISU data is collected at participating hospitals throughout Queensland and this data represents approximately one quarter of the state population. Data were extracted using a keyword search for “skateboard”, “skate”, “roller

QISU collects and analyses data from emergency department injury presentations on behalf of Queensland Health. Participating hospitals represent three distinct areas of Queensland.

QISU publications and data are available on request for research, prevention and education activities.

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skate", "roller blade", "inline skate" and "scooter" and a search of all codes allocated to small wheeled recreational devices. There were 5712 cases identified for further analysis.

Extracted data was further examined by searching the text injury descriptor. All skateboard related cases were identified and only cases where the injured person was riding the skateboard were included. Cases were excluded where the injury descriptor was "dropped a skateboard onto toes", "bitten by an insect while skateboarding" or "hit by a skateboard".

There were 2323 cases identified for inclusion, where the injury was associated with riding a skateboard. Analysis was conducted on this dataset. Demographic data and descriptive data were assessed and statistical analyses were conducted for assessing relationships between locations of injury and acuity level of triage at ED presentation. Chi-square analysis was conducted using Excel 2007.

Death data was accessed electronically via the National Coronial Information (NCIS) Database. [3]

Results

Deaths

A search of the National Coronial Information System database and personal communication with the Brisbane Coroner, revealed two recent deaths in Queensland in 2006 and 2008.

The first person was a male, aged 25 years and was riding on the road at the time of the injury. Helmet use was not recorded in the database. He was struck by a vehicle and sustained multiple injuries. The injury occurred late evening.

The second case was an 18 year old male who was riding on the road at speed in the late afternoon. He was not wearing a helmet and fell and struck his head.

Four other deaths were identified in Victoria between 2005 and 2007. All were males aged between 28 and 36 years. None of the deceased persons were wearing helmets at the time of injury. Two deaths occurred after a fall in a skate bowl. Two deaths occurred after a fall on a suburban road, not involving a motor vehicle crash (MVC).

In 5 out of 6 deaths, cause of death was attributed to a head injury alone. In the case of the man struck by a car, death was due to multiple injuries, but the head injury was a significant contributing factor.

In some cases, marijuana and alcohol use prior to the event may have contributed to the injury.

The Brisbane coroner investigated the legislative requirements for skateboarders and found;

Under the Queensland Road Rules they are considered pedestrians and the wearing of helmets are not mandated. Skateboarders are not permitted to travel on a road with a dividing line or median strip or a one way road with more than one marked lane or on roads with a posted speed limit of 70 kms per hour.

Injuries

A total of 2323 cases of injury associated with riding a skateboard were identified over the 9 year period. There was year to year variation in the number of presentations, but no trend was identified. The average number of presentations per year was 258 cases per year (±39.9; 95% CI). (Table 1)

Year	Total	Male	Female
1999	265	237	28
2000	378	337	41
2001	344	318	26
2002	241	213	28
2003	240	204	36
2004	187	157	30
2005	189	164	25
2006	231	194	37
2007	248	225	23
Total	2323	2049	274

Table 1: Presentations with skateboard injury, by year, 1999 to 2007.

Age and Gender:

Eighty-eight percent of cases were male (2049/ 2323 cases). The majority of cases were children aged between 10 and 14 years (1222/2323 cases; 53%), followed by adolescents aged 15 to 19 years (494/2323; 21%) and younger children aged 5 to 9 years (307/2323; 13%) (Figure 1). There were very few cases in the other age categories.

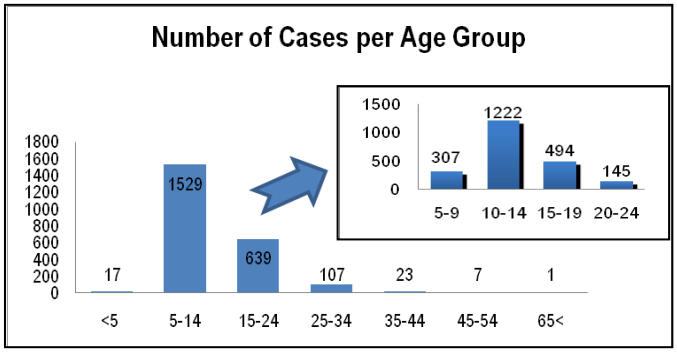

Figure1: Age distribution of skateboard injuries, 1999-2007.

Time of Injury

The number of cases decreased in winter months (471/2323; 20%) compared to summer (686/2323; 30%) (Figure. 2)

The majority of injuries occurred on the weekend (984/2323; 42%) (Figure 3) and in the late afternoon (17:00-17:59) (Figure 4). The peak injury time was consistent across months and days of the week.

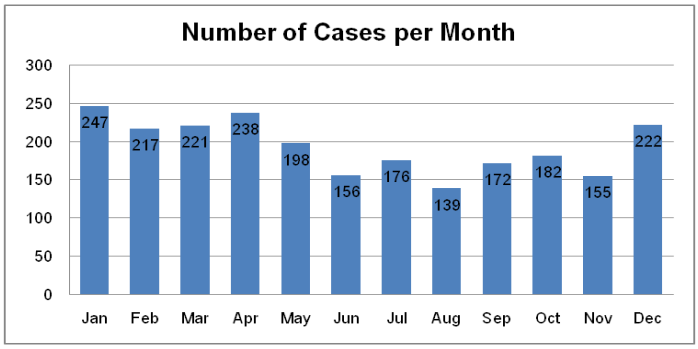

Figure 2: Number of skateboard injuries by month, 1999 to 2007

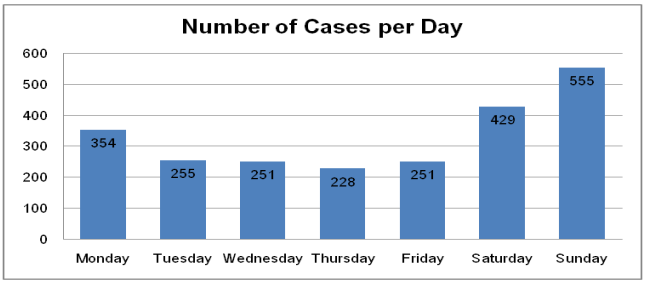

Figure 3: Number of skateboard injuries by day of the week, 1999 to 2007

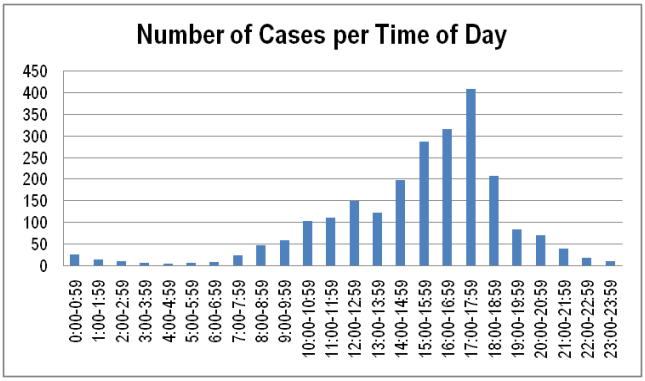

Figure 4: Number of skateboard injuries by time of day, 1999 to 2007

Place Occurred		Narrower Description	
Park	638	Skate park	349
		Park	289
Road	416	Road	395
		Bitumen road	17
		Dirt road	4
Footpath	259		
Home	219	Home	180
		Yard	31
		Garage	3
		Room	2
		Patio	2
		Stairs	1
Car park	177		
Driveway	55		
Bikeway	29		
School	12		
Others	19	Shopping center	7
		Playground	3
		Beech	2
		Basketball/ Tennis court	2
		Church	1
		Daycare	1
		Sport club	1
		Service station	1
		Youth center	1
Unspecified	499		
Total	2323		

Table 2: Part of place where skateboard injury occurred 1999 to 2007

Location

The exact location of the injury was not recorded for 499 cases (22%). Of the remaining 1824 cases, over one third of the injuries occurred at a park (638 /1824; 35%) and nearly one quarter of the injuries occurred on the road (416/1824 cases; 23%). Of those injured in the park (638) roughly half were said to be at a "skate park" (349/1824; 19%). The next most common locations for skateboard related injury were the footpath (259; 14%), home (219; 12%) and car park (177; 10%). (table 2)

There was no clear correlation between age and the location where the injury occurred, nor between time of day and the location where the injury occurred.

Nature of Injury

The most common body part injured was the upper limb (1270/2323; 55%) followed by lower limb (542/2323; 23%) and head/face (334/2323; 14%). Cases sustaining multiple injuries were rare (0.9%) (Table 3)

The most common type of injury associated with skateboarding was a fracture (847/2323; 37%) followed by a sprain (622/2323; 27%). More serious injuries such as intracranial injury and injury to internal organs accounted for 109 (5%) and 6 cases respectively (Table 4).

Body Part	Total
Upper Limb	1270
Lower Limb	542
Head/Face	334
Trunk	36
Hip/Pelvis	24
Multiple	20
Back	14
Neck	8
Not required	25
Unspecified	49
Blank	1
Total	2323

Table 3: Number of skateboard related injuries by body part injured, 1999 to 2007

Type of Injury	Total
Fracture	847
Sprain	622
Superficial	283
Open wound	248
Intracranial injury	109
Dislocation	37
Crushing injury	19
Eye injury	10
Dental injury	9
Injury to internal organ	6
FB in soft tissue	3
Multiple injuries	2
Injury unspecified	120
Other specified	6
Blank	1
Total	2323

Table 4: Number of Skateboard related injuries by type of injury, (1999 to 2007)

Injury Severity

There were 105 cases triaged as requiring rapid or immediate attention; 5 requiring resuscitation and 100 requiring rapid (emergency) attention. Most cases were triaged to the semi-urgent category (1404 cases/2323 cases; 60%) (Table 5).

Triage Level	Total
Resuscitation	5
Emergency	100
Urgent	591
Semi urgent	1404
Non urgent	208
Unspecified	15
Total	2323

Table 5: Number of Skateboard related injuries by triage category, 1999 to 2007

There was a weak association between the age of skateboarders who were injured and triage category. Younger children were more frequently assigned a more urgent triage score. Odds ratio for being categorized as higher acuity (resuscitation or emergency) among children younger than 10 years old was 1.6 (95%CI 1.0-2.5) compared to subjects older than and equal to 10 years of age. Of the 5 cases requiring resuscitation, 4 were aged 10 to 14 years and 1 was aged 15 to 19 years. (table 6)

These are summaries of the cases triaged as requiring "resuscitation."

Case	Age	Gender	Month	Day	Time	Location	Body Part
1	10	male	April	Tuesday	11:15	park	head
2	12	female	November	Saturday	7:00	unspecified	head
3	14	male	December	Saturday	17:30	road	multiple
4	14	male	September	Saturday	18:40	home	thigh
5	16	male	December	Monday	18:00	unspecified	head

Table 6: Cases of skateboard injury triaged as requiring "resuscitation", 1999 to 2007

Case 1 was 14 year-old male who was hit by a car while skateboarding. He sustained multiple injuries including a head injury. Cases 2, 4, and 5 sustained head injuries. Case 3 sustained a fractured femur.

We further investigated triage levels of cases relative to the location where the injury occurred. The majority of cases were triaged semi urgent for injuries occurring both at the park (374/638; 59%) and on the road (246/416; 59%). Children injured on the road tended to be allocated higher triage codes, however, this was not statistically significant.

Helmet Use

Helmet use (whether used or not) was recorded in only 100 of the 2323 cases (4%).

In this small subset of cases, not wearing a helmet was associated with head injury. Skateboarders who did not wear a helmet had a 13 times higher chance of presenting with an intracranial injury compared to those who wore a helmet (odds ratio 13.6, 95%CI 1.6-110.5). The distribution of all other types of injury in this group was similar except for intracranial injury.

Outcome of Injuries

The majority of cases (82.3%) were discharged home after their treatment in the ED; however, 15% (341/2323) of injured skateboarders were either admitted or transferred for their care. Examining the subset where helmet use was known (n = 100), the Odds ratio for being admitted if skateboarders used a helmet was 0.25 (95% CI 0.03-2.37). This was not statistically significant.

Motor Vehicle Crashes

Twelve cases (12/2323, 0.5%) were identified as being due to a motor vehicle crash (MVC) (Table 7). MVC-associated skateboard injuries were 25 times more likely to be triaged higher acuity (resuscitation and emergency) compared to non MVC injuries (95% CI: 7.4-88.4). Of these 12 MVC associated skateboard injuries, eight occurred on the road, one in a driveway, one on the footpath and in two the location was not specified.

Triage Level	MVC	Non MVC	Unspecified	Total
Resuscitation	1	4	0	5
Emergency	3	95	2	100
Urgent	4	573	14	591
Semi urgent	4	1373	27	1404
Non urgent	0	207	1	208
Unspecified	0	15	0	15
Total	12	2267	44	2323

Table 7: Number of MVC associated skateboard injuries according to triage, 1999 to 2007

Discussion

Skateboard-associated injuries have been reported globally (but mainly in developed countries) since the mid-1970s [4-8]. According to a report from the US Consumer Product Safety Commission (CPSC), the number of skateboard-associated injuries peaked in the late 1970s, then declined by almost 90% in the early 1980s [9]. This significant drop was thought to be due to decreased skateboard activity, improved product safety, and implementation of injury prevention strategies. However, there has been a steady rise in the number of skateboard-associated injuries since the mid1990s as skateboard activities have been gaining in popularity again [9].

A similar trend has been observed in Victoria, where the number of reported skateboard-associated injuries has increased by 4-fold from 1996 to 2001 [10]. QISU data did not show any trend with the number of skateboard-associated injuries. The total number of injuries presenting to QISU participating EDs per year have remained around 260 per year. The QISU injury data collection represents approximately one quarter of the state's injury data and so we estimate that about 1,000 skateboarders visit Queensland emergency departments annually.

QISU data is consistent with previously reported data regarding gender and age characteristics of patients presenting with skateboard injuries [9-12]. Almost 90% of injured patients were male and the peak age was between 10 and 14 years. QISU data showed that the number of skateboard injuries increased during the summer, on weekends, and in the evening. Since skateboarding is usually a recreational activity, this variation in the number of skateboard injury presentations is likely to mostly be explained by greater skateboarding activity at those times.

Of the cases where the location of injury was known, only 19% of skateboard injuries in this series occurred at a "skate park". Many of the injuries that occurred in regular parks, on roads and footpaths, may have happened en route to the skate park facility. The variation in location may also reflect a difference between those who use skateboards as a mode of transport versus those who use it as a recreational activity. A report from the US showed that 65% of skateboard-associated injuries occurred on public roads, in parking lots, and on footpaths, which were outside of areas designated for

skateboarding [12]. Some American universities regulate skateboarding with limitations on where students can ride on campus [13-15].

Skate parks are purpose built areas designed for recreational activities with small wheel devices and sometimes bicycles. The impact of the number of and design of skate parks on skateboard related injury patterns is unclear. Some have reported no decrease in the number of injuries associated with skateboarding following the building of a new skate park [16]. Others have reported that the use of skate parks has increased the risk of fractures in their locality [17]. Injury patterns are likely to be influenced by usage patterns and the design of parks [18], in particular the curve of the transition and construction material (exposed concrete edges and corners).

In this series, severity of injury correlated with age under 10 years and association with a motor vehicle crash. This has previously been reported in Australia [19]. Road use by skateboarders increases the likelihood of a collision with a vehicle as well as allowing longer descents (steep hills are a favorite) and greater speeds. Both factors may contribute to likelihood and severity of injury.

Children under the age of 10 years are still developing physically and cognitively. There is evidence to suggest that their ability to judge speed and distance is still developing and that this may contribute to higher pedestrian and cycling injuries in traffic situations [20]. The additional challenge of learning the skateboarding skills required to maneuvre and avoid obstacles is likely to further contribute to injury risk. Higher risk activities such as sitting on the skateboard to ride down hill on a road or "skitching a ride" behind a moving vehicle also increase the risk of severe or fatal injury. The American Academy of Pediatrics has published a policy statement recommending that skateboarders do not ride in or near traffic regardless of traffic volume [21].

The most common type of injury observed in this series is a fracture or sprain of the upper limb. This pattern is consistent with other reports [10, 22]. Head and face injury, although less common still comprised a moderate proportion of injuries (14%), with intracranial injury accounting for 5% of presentations. Of 6 coronial cases reported in this bulletin, 5 died of isolated head injuries. Analyzing a small subset in this series where helmet use was known demonstrated that helmet use is likely to reduce the risk of intracranial injury. Despite legislation requiring cyclists in Australia to wear helmets, there is no regulatory requirement for helmet use while skateboarding. This type of requirement has been implemented in the State of California, United States, where penalties apply if people are on the road while skateboarding, cycling, or riding other small wheel devices without a helmet [23].

Newer skateboard designs like the "wave board" and "caster board" have only 2 wheels and the boards are articulated in the centre. These boards are not suitable for use in most skate parks as tricks cannot be performed at the coping level. Typically young children use these boards as a cheaper alternative to buying a standard skateboard. Due to the design, injury at speed down a hill is the most likely risk. Standard skateboards are far more stable at speed. In addition to these challenges, the newer designs are likely to contribute to future skateboard injury numbers as they trigger a rise in popularity and an increase in new users.

Safety Recommendations

1. Choose an Appropriate Skateboard

There are no safety, design, or performance requirements or regulations for skateboards. There are two ways to obtain your own skateboard; purchase a premade skateboard or purchase skateboard parts to assemble by yourself. If you are a beginner, it is safer to purchase a premade skateboard. The downside with premade skateboards is that some products may use poorer quality parts. The length and width of skateboard deck varies. In order to choose an appropriate skateboard, it is best to ask for advice at skateboard shop.

2. Wear Appropriate Protective Gear

Protective gear for skateboarders includes a helmet, wrist guards, elbow pads, kneepads, ankle braces, gloves, and mouth guards. It is also important to wear fully enclosed footwear. Skateboarding shoes are specially designed and provide more protection for the feet as the tops of the shoes are typically more robust than a standard running shoe. Out of all the protective gear, the most important is the helmet. The helmet must at least meet the mandatory standard [24], be undamaged and worn appropriately, with the chin strap fastened firmly.

3. Start gently

Fountain [12] reported that 33% of skateboard injuries occurred during the first week of skateboarding. Beginners do not know how to control the speed or how to stop without falling off. Beginners should spend some time on flat surfaces, well away from traffic and supervised by experienced skateboarders before going alone. Some local councils run skateboarding classes at local skate parks.

4. Age Limitation

Head and neck injuries are more common and severe among skateboarders aged less than five years [11]. The American Academy of Pediatrics (AAP) strongly recommends that children younger than five years should not use skateboards [21].

5. Appropriate Skateboarding Locations

Road use and high speed are associated with severe and fatal skateboarding injuries. Such injuries may be compounded by lack of protective equipment (helmet) and higher risk activities ("skitching").

Consideration needs to be given to reviewing current legislation, which treats skateboarders as pedestrians when using roads.

6. Providing Safe Skating Areas

Skate parks are designed for skateboarders to socialize, learn and perform stunts, while separating them from traffic and other pedestrians. Councils are providing these facilities as a community service, giving skateboarders an alternative to riding in car parks, on roads and footpaths. The difficulty of the stunts attempted and the design of the skate park as well as safety regulations (particularly helmet use) are likely to determine the pattern of skate park injuries. Planning for safe skate parks requires an integrated approach between designers, builders and users [25] as well as regular maintenance. Cracked concrete, exposed concrete aggregate and coping damage due to age and wear contribute to skating hazards.

7. Skating and Drugs don't mix

Many drugs alter perception of hazards, reaction times and protective reflexes. In some of the skateboard related deaths reported in this bulletin, alcohol and marijuana may have been a contributing factor to the event. Skateboarders should avoid skating when under the influence of drugs.

Summary

Skateboarding is a recreational activity that is particularly popular amongst young males in Queensland. The injury profile of this activity is influenced by environmental, social and cultural factors. Severe injuries amongst skateboarders could be minimised or prevented by helmet use and tighter regulation around road use. Consideration should be given to adopting legislative requirements for skateboarders to wear helmets (similar to the legislative requirements for cyclists). A move to require helmet use would be unpopular and require strategies for enforcement before a reduction in injuries could be expected. Alternative strategies to encourage helmet use and discourage high risk behaviours may be more appropriate, but will require long term investment to effect any change.

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