Safekids New Zealand
Position Paper:

CHILD SKATEBOARD AND SCOOTER INJURY PREVENTION

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Safekids New Zealand
5th Floor, Cornwall Complex,
40 Claude Road, Epsom, Auckland 1023
PO Box 26488, Epsom, Auckland 1344
New Zealand
P. +64 9 630 9955 F. +64 9 630 9961

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If you have further queries, call the Safekids New Zealand Information & Resource Centre on +64 9 631 0724 or email us at Infocentre@safekids.org.nz.

This document is available on the Safekids New Zealand website at www.safekids.org.nz

This Safekids New Zealand position paper on skateboard and scooter injury prevention was made possible thanks to Jetstar's Flying Start Programme grant. Photo shows Jetstar's Captain Richard Falkner, Safekids Director Ann Weaver, Jetstar Ambassador Steve Price and children from Vauxhall Primary School.

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Safekids New Zealand Position Paper:

CHILD SKATEBOARD AND SCOOTER INJURY PREVENTION

Summary

Skateboards and non-motorised kick scooters provide children with a valuable form of exercise and transport. Learning to ride a skateboard or scooter can be an important part of play, risk taking and development. The popularity of skateboards and scooters has increased considerably in recent decades. Unfortunately, this rise in popularity has been coupled with an increase in scooter and skateboard-related injury.

In New Zealand between 2007-2011:

- 725 children were hospitalised with skateboard-related injuries
- 158 children were hospitalised with scooter-related injuries
- Skateboard-related injuries were most common for Māori and European males aged 10-14 years
- Scooter-related injuries were most common for European males aged 10-14 years, and European males and females aged 5-9 years
- Falling was the most common cause of skateboard and scooter-related injury

Safekids New Zealand recommends that the following interventions are supported to reduce the risk of injury and death to child skateboarders and scooter riders.

Helmets

Appropriately fitted helmets save lives and reduce the severity of brain injury and facial injury. Wearing a correctly fitted helmet when skateboarding or scootering will help to reduce the number of head and facial injuries experienced by children. Safekids New Zealand recommends that all children wear an appropriately fitted helmet that meets an approved safety standard when riding a skateboard or scooter, whether they are commuting to school, riding recreationally or attempting tricks. Safekids New Zealand encourages schools to adopt a policy that children riding skateboards or scooters to school must wear a helmet. Members of schools and other community groups are encouraged to role model helmet wearing when skateboarding or scootering, and to advocate for the use of helmets in their communities. Informed by legislative action internationally, Safekids New Zealand recommends the development of helmet regulation for skateboards and scooters.

Protective equipment

Wearing elbow and knee pads when skateboarding or scootering can prevent or reduce the severity of injury to the upper and lower limbs. Safekids New Zealand recommends that all children wear elbow and knee pads when riding a skateboard or scooter, whether they are commuting to school, riding recreationally or attempting tricks. Safekids New Zealand also recommends that caregivers ensure children wear elbow and knee pads. Members of schools and other community groups are encouraged to role model elbow and knee pad use when skateboarding or scootering, and to advocate for the use of elbow and knee pads for child skateboarders and scooter riders in their communities.

Wearing wrist guards when skateboarding can prevent or reduce the severity of injury to the upper limbs. Safekids New Zealand recommends that all children wear wrist guards when riding a skateboard, and that caregivers ensure children wear wrist guards. Members of schools and other community groups are encouraged to role model wrist guard use when skateboarding, and to advocate for the use of wrist guards for child skateboarders in their communities.

Skate park design

Skate parks enable children to be separated from motor vehicle and pedestrian traffic, enable closer caregiver supervision, and offer an environment where use of helmets and other safety equipment can be more easily regulated. Ensuring that skate park design incorporates best practice design principles, including injury prevention, while at the same time enabling children to engage in risk taking behaviours, is important. Safekids New Zealand recommends that an Australian/New Zealand voluntary standard for skate park design is developed, which incorporates design features that enable safe use of a variety of devices, including skateboards, scooters and other small wheeled recreational devices. A skate park standard could also include provision of areas for caregivers to supervise children, and highlight the need for careful planning regarding the geographical placement of the park to ensure safe access for children. Safekids New Zealand recommends that New Zealand research is undertaken into the design, placement and community health and social impact of skate parks. Safekids New Zealand encourages schools, community groups and other organisations to advocate for a voluntary skate park standard for child skateboarders and scooter riders in their communities.

Safe child pedestrian space

To reduce the risk of skateboard and scooter-related injury, pedestrian spaces should be safe for children. Safekids New Zealand recommends that areas where children skateboard and scooter regularly, such as school journey routes, should be prioritised for engineering actions to improve child safety. It is recommended that engineering actions on school routes should include installation of pedestrian crossings suitable for children, improvements to and maintenance of footpath integrity, greater driveway visibility, 30 kph lower speed zones, and traffic calming solutions such as self-explaining roads. To promote equity, Safekids New Zealand recommends that engineering actions are prioritised to areas with high Māori and Pacific child populations. Communities are encouraged to advocate for actions to improve the safety of child pedestrian space for skateboard and scooter users.

The most severe injuries experienced by children using skateboards and scooters involve motor vehicles. Members of schools and other community groups are encouraged to enhance awareness of pedestrian space as the safest place to ride skateboards and scooters, and to role model the appropriate use of skateboards and scooters in pedestrian space.

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Introduction

Skateboards and non-motorised kick scooters provide children with a valuable form of exercise and transport. Learning to ride a skateboard or scooter can be an important part to play, risk taking and development. Skateboarding and scootering may provide active and sustainable transport benefits similar to other active transport modes. Potential co-benefits to the individual and broader community may include:

- reduction in fossil fuel use associated with school motor vehicle pick-ups and drop-offs,
- economic benefit to families through reduced purchase of fuel,
- increased use of pedestrian space resulting in enhancement of social cohesion and promotion of more liveable community environments,
- cumulative positive effects on the health and social outcomes of the individual and broader community [1-4].

Skateboards and scooters have been used for much of the last century, and their popularity has increased considerably in recent decades. First commonly used in the 1960's, skateboard popularity rose dramatically in the 1990's [5]. The non-motorised kick scooter has recently seen a significant rise in popularity beginning in the early 2000's [6].

Skateboards contain four small wheels, each of approximately 48-100mm diameter, connected to the front and back of a wooden or perspex board of varying length. The board is propelled by one foot, whilst the other remains on the board. No braking mechanism exists; to stop motion, the user steps off the board. The quality of skateboard wheels has changed significantly in recent years, with current skateboards now utilizing stronger materials and low-friction polyurethane wheels similar to those of in-line skates. Advances in skateboard design technology have enabled skateboards to become increasingly agile and to reach considerable speeds of up to 50km per hour [7].

New variants of the skateboard include the snakeboard and casterboard, which involve two moveable footplates with one-two wheels under each footplate depending on the model. These boards are propelled by alternating movements of the feet, and adjustments of weight through a twisting movement of the legs and hips. These boards have no braking system; to stop, the user must step off the board, which may be particularly challenging given that the snakeboard includes footstraps.

Non-motorised kick scooters include a frontal pole with T-handlebars connected to a footplate with a small front and back wheel. A braking mechanism is situated above the back wheel. The scooter is propelled by kicking with one foot, whilst standing the other foot on the footplate. The handlebars enable steering, and are often height adjustable. Scooter wheels are small in diameter, being similar to those used in in-line skates - approximately 100mm-200mm diameter [6]. Scooters are usually constructed of aluminium, and many are able to be folded to become highly portable [8].

The rise in popularity of, and subsequent exposure to, skateboarding and scootering has been coupled with a marked increase in skateboard and scooter-related injury. Reasons for injury are several-fold, and include such aspects as: lack of use of protective safety equipment, environmental planning and design that is not conducent to child pedestrian safety, scooter/skateboard and skatepark design, user developmental maturity and riding skill and the policy and legislative context. Importantly, many of these factors are able to be addressed, enabling injuries to be prevented, or their severity reduced.

This position paper:

- describes the epidemiology of child skateboard and scooter injuries in New Zealand and internationally,
- identifies the positioning of skateboarding and scootering within a policy and legislative context,
- outlines interventions to reduce skateboard and scooter injuries for children,
- offers evidence based recommendations on safer skateboarding and scootering.

Skateboard and scooter-related child injury

Child skateboard and scooter injury in New Zealand

Skateboard and scooter-related hospitalisation data for the period 2007-2011, and mortality data for the period 2007-2009 for children aged 0-14 years were sourced from the Ministry of Health (MoH) national datasets by the Injury Prevention Research Unit (IPRU), University of Otago, and analysed by Safekids New Zealand.

International Classification of Diseases version 2010 (ICD-10) activity codes were used to identify skateboard and scooter injuries. Unlike other active transport modes, non-motorised kick scooters do not have a separate ICD-10 code, which may have resulted in the data extracted being an underrepresentation of the burden of scooter-related injury.

Data provided by IPRU included demographic data, and high level information on the type of injury sustained. Other datasets were sourced to provide further information on skateboard and scooter injury in New Zealand. A national dataset on skateboard fall-related hospitalisations for the period 2004-2012 for children aged 0-14 years was provided by the MoH, and a national dataset on scooter-related injury claims for the period 2008-2012 for children aged 0-14 was provided by the Accident Compensation Corporation (ACC). Data were analysed by Safekids New Zealand [9].

Child skateboard injury

A total of 725 children were hospitalised during the period 2007-2011 as a result of skateboard-related injuries. Overall, Māori and European males aged 10-14 years were the most commonly injured group, and the most common cause of their injuries was falls.

Children aged 10-14 years had the highest number of hospitalisations (76%); followed by children aged 5-9 years (23%). Males accounted for 87 percent of all skateboard hospitalisations, and 89 percent of hospitalisations for children aged 10-14 years, and 80 percent for children aged 5-9 years.

Nearly one quarter (23%) of skateboarding injuries requiring hospitalisation were experienced by Māori children, and 64 percent by New Zealand European children. (See Table 1).

The major cause of hospitalisation was falls, which equated to 93 percent of skateboard-related hospitalisations.

The main injury incurred was fracture (553, 76%), followed by internal organ injury (61, 8%), open wound (37, 5%) and superficial injury including contusion (17, 3%).

Complete data were not available for the type of skateboard injuries incurred, however MoH hospitalisation data for the 2004-2012 period for skateboard fall-related injuries showed that upper and lower limb fractures, and

Table 1: Skateboard injury hospitalisation by ethnicity and age, 2007-2011*

Ethnicity	Age group			Total
	0-4 years	5-9 years	10-14 years	0-14 years
Māori	≤ 3	50	118	170
Pacific	≤ 3	10	38	51
European	5	97	363	465
Asian	0	5	19	24
Other	0	≤ 3	7	8
Not stated	0	≤ 3	4	7
Total	10	166	549	725

*Values less than or equal to three have been suppressed.

head injuries were common injuries for children aged 0-14 years. Head injuries following falls off skateboards were most likely to be incurred by male European and Māori children aged 5-14 years, and Māori children living within areas of high socioeconomic deprivation (deciles 7-10). Overall, children living within areas of high socioeconomic deprivation (deciles 7-10) were more likely to incur injuries requiring hospitalisation following falls from skateboards than children living in other areas (deciles 1-6).

Fatality data were only available for 2007-2009, and during this period there were no skateboard-related child fatalities in New Zealand.

Child scooter injury

For children aged 0-14 years, there were 697 ACC scooter-related injury claims made in 2008, and 6474 claims in 2012.[1] (See figure 1). A total of 158 children were hospitalised during the period 2007-2011 as a result of scooter-related injuries. Overall, European males aged 10-14 years, and European males and females aged 5-9 years were the most commonly injured groups. The most common cause of their injuries was falls.

Children aged 10-14 years had the highest number of hospitalisations (50%), followed by children aged 5-9 years (42%), and children aged 0-4 years (8%).

Males comprised 73 percent of all scooter hospitalisations (ages 0-14 years), and 87 percent of hospitalisations in children aged 10-14 years. However, for the 5-9 year olds hospitalised with scooter-related injuries, 60 percent were male and 40 percent were female.

A total of 13 percent of scooter injuries requiring hospitalisation were experienced by Māori, 10 percent by Pacific children, and 72 percent by New Zealand European children. (See Table 2).

The major cause of hospitalisation was falls, which equated to 89 percent of scooter-related hospitalisations.

The main injury incurred was fracture (107, 68%), followed by internal organ injury (15, 9%), open wound (12, 8%) and superficial injury including contusion (9, 6%).

Complete data were not available for the type of scooter injuries incurred, however ACC data show that 80 percent of scooter-related injury claims for children during the 2008-2012 period were caused by a loss of balance or control, and 10 percent were due to collisions. Furthermore, the five most common types of scooter-related injury claims were for laceration (35%), soft tissue injury (35%), fracture/dislocation (16%), dental injury (10%) and concussion (2%). The three most common body regions injured were the upper limb (35%), lower limb (31%) and head and neck (29%).

Fatality data were only available for 2007-2009, and during this period there were no scooter-related child fatalities in New Zealand.

Figure 1: Child scooter-related ACC injury claims, 2008-2012

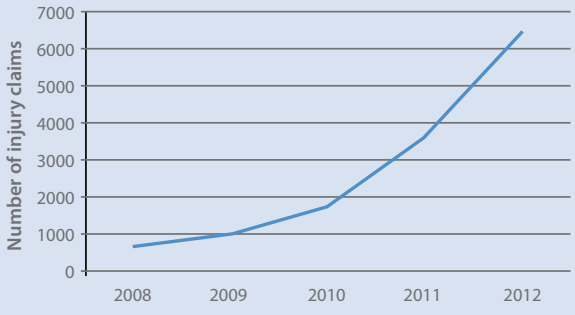


Table 2: Scooter injury hospitalisation by ethnicity and age, 2007-2011*

Ethnicity	Age group			Total
	0-4 years	5-9 years	10-14 years	0-14 years
Māori	≤ 3	8	9	20
Pacific	0	11	5	16
European	7	45	62	114
Asian	≤ 3	≤ 3	≤ 3	5
Other	0	2	≤ 3	≤ 3
Total	12	67	79	158

*Values less than or equal to three have been suppressed.

[1] Factors such as low reporting of an emerging injury issue, and possible reporting of the injury in alternative categories, must be taken into consideration when interpreting injury claim trends.

Child skateboard and scooter injury internationally

Demographics

A review of the international literature revealed similar demographic trends for both skateboard and scooter-related injuries. For instance, skateboard-related injuries were found to be most common in male children aged between 10-14 years [5, 7, 10-13].

For scooter-related injuries the most common age of occurrence was between 9-11 years, though a broad range was observed (2-14 years) [7, 10, 14-18]. Both genders were found to be similarly affected by scooter-related injuries, [10, 18] however a number of studies found injuries to be more common for males [7, 8, 14, 17, 19, 20].

Place of injury

The most common places of injury cited for skateboards include roads and recreational areas [12, 21, 22], whereas scooter injuries are reported to occur in a variety of places: home, public and private roads, school grounds and sports fields [15, 16, 19, 23].

Mechanism of injury

Internationally, and in line with New Zealand data, falls are the most common mechanism of injury for both skateboard and scooter-related incidents. In addition, falling onto an outstretched hand is a common mechanism of skateboard and scooter-related upper extremity injury [7, 18, 21, 24].

Falls from skateboards may differ by place of injury, with skatepark related falls being due to loss of balance whilst travelling at speed or attempting tricks, whereas falls occurring on streets were due to a loss of balance or uneven ground [25]. Falls from scooters tend to occur from standing or lower height, and common preceding actions include scootering on uneven ground, downhill, braking, making turns, striking a stationary object or losing balance [10, 14, 18, 26, 27]

Collisions involving motor vehicles are a serious reported mechanism of injury for both skateboard and scooter riders [12, 17, 28, 29]. Two studies reported that approximately a quarter of skateboard and scooter-related hospitalisations were following collision with a motor vehicle [12, 17].

Type of injury

Injuries incurred from the use of skateboards and scooters are relatively similar [14, 21], and range from abrasions and lacerations to fractures, internal organ injury, severe head trauma and death [12, 23]. Fractures to the upper extremities, and head and facial injuries are the most common injuries incurred [7, 10, 12, 19].

Skateboard-related injury

Prominent injuries for skateboarders include fractures and sprains, particularly of the wrist, forearm or ankle, and head injuries [5, 12, 16, 28, 30]. Analysis of five years of National Trauma Databank data in the USA indicated that approximately three of every ten emergency department presentations with a skateboard-related injury involved a traumatic brain injury, and one in 10 presentations involved a severe traumatic brain injury [31]. Fractures are a common form of skateboard-related injury, and tend to be significant, for example the bone penetrates through the skin or goes through the growth plate [7, 25]. Fractures where the bone penetrates the skin are nineteen times more likely in skateboard-related presentations than other presentations [7]. Research from the USA suggests that skateboard injuries may differ by age, with children aged less than 10 years having a higher incidence of upper extremity fractures, compared with children aged 10-16 years who had a comparatively higher incidence of traumatic brain injury [31].

Scooter-related injury

Several factors contribute to the inherent instability of scooters, increasing their risk of causing child injury:

- The small frontal wheel size, closeness of the two wheels under the narrow footplate and lack of suspension limits reactive steering capacity, resulting in steering control being rapidly lost when an uneven surface is encountered [32].
- The standing and forward leaning posture associated with the design of scooters creates a high center of gravity [6, 32]. Leaning forward to make a turn increases the capacity to fall forward off the scooter [32].
- By using one foot to kick, the scooter can easily tip over towards the standing foot, which is unable to counterbalance if the weight is transferred too far over [32].
- The lightweight design of scooters, and low-friction polyurethane wheels enable significant speeds to be reached on smooth surfaces [7, 33], yet braking capacity is limited, particularly when travelling downhill.

Fractures, particularly of the upper extremity, are the most common type of scooter-related injury [8, 16, 21, 34]. Head and facial injuries are a further prominent injury incurred [5, 16, 23, 27, 34]. Handlebars pose an added risk for scooter riders that can result in significant abdominal, neck and dental trauma [6, 27, 35-37], however these outcomes are rare [17]. Sustained holding of handlebars while falling may increase the risk of complex forearm fractures [38]. Midfoot fracture dislocations and sprains are a further, although infrequent injury associated with the use of one foot to pivot and brake the motion of scooter [39]. Paediatric emergency department presentations suggest that scooter injuries may differ by age: head and facial injuries were more common in scooter riders aged less than 8 years, and fractures were more common in riders older than 8 years [26]. A combination of developmental age and a higher centre of gravity for younger children, and riding faster and attempting jumps and tricks for older riders may contribute to these injury patterns [26].

Injury severity

The actual burden of scooter and skateboard-related injuries is unknown as the majority of injuries may not require hospitalisation [6]. The severity of injury depends on:

- location of the injury - injuries that occur on roads have greater severity [12],
- mechanism of the injury - motor vehicle collisions result in injuries of higher severity [17]
- use of protective equipment - helmet and elbow, knee and wrist guards can reduce the severity of injury [31, 40].

A study of children presenting to a pediatric traumatic brain injury clinic found that of all pediatric brain injuries seen, including sport and non-sport related traumatic brain injury, those incurred when skateboarding were significantly more severe with headaches and cognitive impairment being more likely [41]. In addition, a cross sectional study utilising 10 years of National Trauma Registry data in the USA found that skateboard riders tend to have more severe injuries compared with roller skaters and in-line skaters, and skateboarders had Injury Severity Scores (ISS) that tended to lie between 4-15 [12]. Estimates of scooter injury severity, using mean ISS range from 2-8 [17, 18].

New Zealand legislation and requirements

NZ policy framework

Safer Journeys, New Zealand's Road Safety Strategy 2010-2020, provides strategic direction for transport priorities in New Zealand [42]. It's vision of "a safe road system increasingly free of death and serious injury" (p. 3) acknowledges the preventability of transport related deaths and injury [42]. The need for an overarching safe system approach is also identified, and incorporates four key goals: safe roads, safe speeds, safe vehicles and safe road use. Priority areas are also given, and include safe walking and cycling, which in its broader sense encompasses safe skateboarding and scootering.

To support the implementation of the strategy a Safer Journeys Action Plan 2011-2012 was developed, and an updated plan is currently in progress [43]. Several elements of the plan support safer skateboarding and scootering, for example:

- reducing vehicle speeds on roads used frequently by pedestrians through the adoption of lower speed limits in urban areas, and treatments at high-risk urban intersections
- providing safe and convenient routes for pedestrians especially to and from work and school
- integrating land use and transport planning to provide for all modes of transport in safe and efficient ways [43]

Legislation and standards

The Land Transport (Road User) Rule 2004 defines skateboards and scooters as wheeled recreational devices:

– *"means a vehicle that is a wheeled conveyance (other than a cycle that has a wheel diameter exceeding 355 mm) and that is propelled by human power or gravity; and*

– *includes a conveyance to which are attached 1 or more auxiliary propulsion motors that have a combined maximum power output not exceeding 300 W" [44].*

Road User Rule requirements are very similar for wheeled recreational devices and pedestrians. Skateboards and scooters should be ridden in pedestrian space, and use pedestrian crossings. With regard to sharing pedestrian space, the Road User Rule requires wheeled recreational devices to *"give way to pedestrians and drivers of mobility devices"* [44]. Importantly, while the Road User Rule requires bicyclists to wear helmets, there is no legal requirement for users of wheeled recreational devices to do so.

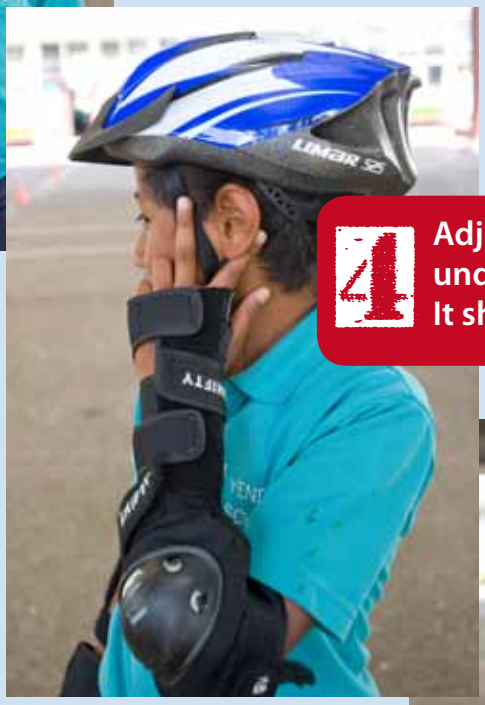
Aspects of product safety for skateboards and scooters are covered under voluntary sections of the Australian/New Zealand *Safety of Toys* standard (AS/NZS ISO 8124.1:2010) [45]. This standard classifies skateboards and scooters as toys, and covers several aspects of skateboard and scooter design to ensure product safety – particularly maximum load and braking capacities. Importantly, the standard includes the use of warning labels regarding the need for wearing protective equipment whilst riding, recommending the use of *"protective equipment such as a helmet, wrist-pads, knee-pads and elbow-pads"* [45]. Furthermore, warnings are required to include the maximum weight for use, and other instructions for use including "not to use the product on roads where motorized traffic can be expected" [45]. This standard is currently in the process of being updated. Whilst the Australian/New Zealand standard should be sufficient, other standards can also be looked to by the commercial sector to guide product safety for skateboards and scooters including the British standard for roller sports equipment [46, 47], and the American standard for non-powered scooters (ASTM F2264) [48].

New Zealand currently does not have a mandatory or voluntary standard for skate park design. To ensure skate parks provide a safe recreational space for users, Local Authorities utilise the American Society for Testing and Materials (ASTM) standard F2480-06 (2012): Standard Guide for In-ground Concrete Skatepark for guidance.

The 2-4-1 Rule on wearing safety helmets – It's a good deal!

Wearing helmets correctly is easy – just remember 2-4-1:

2 The helmet should be no more than two fingers above your eyebrow.



4 Adjust the straps just under your ear. It should form two Vs.

1 No more than one finger should fit over the chin strap.

Interventions to reduce injuries to child skateboarders and scooter riders

Protective equipment and supervision

The preventable nature of skateboard and scooter-related injury, through the appropriate use of protective equipment, appears as a recurring theme within the international literature. Equipment suggested as essential to the prevention of skateboard and scooter-related injury includes helmets and knee and elbow pads; wrist guards are a further essential for skateboarders.

Helmets

Evidence of helmet effectiveness in the prevention of skateboard and scooter-related injury is limited. However, analysis of 5 years of National Trauma Databank data in the USA revealed that helmet use was an independent protective factor associated with a lower incidence of severe head injury in skateboarders [31]. There is strong evidence from the child cyclist injury prevention literature that cycle helmets are effective in reducing head, brain and facial injuries among children [49].

Given the benefits of helmet use for reducing the incidence and severity of traumatic brain injury, it is highly concerning that the international literature has continued to find low use of helmets amongst users of skateboards and scooters [6, 10, 14, 15, 17, 21, 23, 25, 26, 50-52]. For instance, in an 18 month prospective study of scooter injury presentations to a Melbourne Australia emergency department, only 17.7% of the 62 children presenting had been wearing a helmet at the time of injury, and none of the three children presenting with head injury had been wearing a helmet [15]. Furthermore, an observational study in Texas USA found that of 841 children observed riding either bicycles, skates, skateboards or scooters only 14.3 percent of skateboarders and 11.5 percent of scooter riders were wearing helmets, and incorrect helmet use was observed in approximately one fifth of skateboard riders and 53.3 percent of scooter riders [51]. A similar observational study conducted in Toronto Canada also found that scooter riders had the lowest use of helmets (33%) [50].

Helmet legislation

A number of authors recommend the need for helmet legislation and enforcement to support helmet use in skateboarders and scooter riders [5, 40, 50]. For example, the American Academy of Pediatrics released recommendations in 2002 including that all children using skateboards or scooters should use an approved and correctly worn helmet [5]. In line with this, many jurisdictions have now adopted legislation requiring mandatory helmet use for users of small wheeled objects, including skateboards and scooters [53].

Elbow and knee pads

A large number of injuries experienced by skateboarders and scooter riders affect their extremities, therefore protecting these areas with elbow and knee pads is valuable. Evidence of the effectiveness of these interventions stems from similar modalities, such as in-line skating, where skaters not using elbow pads have been found to have almost 9.5 times the risk of incurring an elbow injury compared to skaters wearing elbow pads [54]. Several studies have advocated for the use of elbow and knee pads to prevent injury in skateboard and scooter riders [11, 14, 16, 22]. Furthermore, use of elbow and knee pads by skateboarders and scooter riders is a recommendation of the American Academy of Pediatrics [5]. In addition to recommending use of elbow and knee pads, the Queensland Injury Surveillance Unit recommends skateboarders use ankle braces, gloves, and mouth guards to provide the greatest protection from injury [40].

Wrist guards

Wrist fractures are a common injury experienced by skateboarders. Several studies have demonstrated a link between the use of wrist guards and the reduced risk of wrist fractures. A comparison of in-line skaters who had injured their upper extremities or head compared with those who had injured other body regions, found that those who did not wear wrist guards had 10 times the risk (OR 10.4, 95% CI 2.9–36.9) of obtaining a wrist injury compared with skaters who wore wrist protection [54]. Given the similarity of skateboard and in-line skating mechanisms of injury, use of wrist guards is strongly recommended by various authors [7, 24, 31].

The benefits of wrist protection for scooter users are uncertain. For instance, Brudvik et al advocate for the use of wrist guards to prevent wrist fractures, stating that many of the injuries observed in their two year prospective study could have been prevented through the use of wrist guards [10]. However, wrist guards may reduce ability to grip and steer scooters accurately, thereby increasing the potential for harm, though research undertaken into the impact of wrist guards on scooter maneuverability remains inconclusive [24]. Several studies have therefore suggested that wrist guards not be recommended for use with scooters until such time as further more comprehensive research on the implications of use on scooter steering has been undertaken [7, 16].

Reasons for low use of helmets and other protective equipment

Several reasons for low use of helmets and other forms of protective equipment are apparent. Focus groups conducted by ACC and Safekids New Zealand with New Zealand children aged 8-14 years found that key reasons for using protective equipment whilst skateboarding were parental influence and personal concern for safety [55]. Reasons for low use of safety gear included personal image and peer acceptance; children stated they would look 'geeky' and 'uncool' and would be teased if they wore safety gear. Further reasons expressed were discomfort – protective equipment made them feel hot and sweaty and restricted their movement – and cost, particularly of helmets; children from one focus group stated they would wear helmets if cheaper helmets looked as 'cool' as the more expensive varieties.

In addition, the literature notes the influence of peer pressure and social media in reinforcing either a positive or negative conception regarding the use of protective equipment. For example, Zalavaras et al quote from a skateboard magazine, which states that *"pads make you look like a dork"* [7]. In contrast, Schieber and Oslon suggest involving youth in discussions regarding addressing the skateboarding safety culture, and seek their assistance in creating innovative solutions [56].

Supervision

Children do not have the same sensory, neuromuscular or cognitive capacities as adults, making them vulnerable when attempting to identify pedestrian hazards or assess critical road crossing factors such as motor vehicle speed and distance, or their own physical abilities. Consideration of child developmental maturity is particularly relevant for children aged less than 10 years using skateboards and scooters [5]. Children aged less than 10 years have a high centre of gravity, and limited motor skills, which can predispose them to imbalance and fall; furthermore, their underdeveloped cognitive skills can place them in unnecessary harm [23]. For instance, a variety of perceptual and cognitive skills need to be sufficiently developed and coordinated to enable pedestrian safety, including: comprehensive visual searching and hearing skills, making judgments regarding vehicle speed and distance, combining information from multiple directions, maintaining attention, processing competing information, making decisions regarding safe routes and crossing places and co-ordinating perceptions into well timed actions [57, 58]. Given the complexity of negotiating these skills, children aged less than 10 years should be supported by adults to ensure their safety [58-60]. To reduce the inherent vulnerability of children in the pedestrian environment the American Academy of Pediatrics recommends close supervision of children riding skateboards and scooters to encourage safer use and prevent injury [5].

Skateboard and scooter safety

- Always wear a correctly fitting helmet that meets an approved safety standard
- Always wear elbow and knee pads
- Always wear wrist guards when skateboarding
- Actively supervise children riding skateboards and scooters
- Skateboard carefully in pedestrian areas, and use pedestrian crossings

Engineering solutions to enable safe pedestrian space

Skateboarding and scootering are considered pedestrian activities in New Zealand [44, 61], therefore provision of safe pedestrian environments is essential to the ability of children to skateboard and scooter safety. Ensuring pedestrian spaces are safe for children should be integral to roadway and urban design, rather than an afterthought of construction [62].

Several measures can be undertaken to improve the safety of urban and rural built environments to enhance child pedestrian safety. For instance, the Ministry of Transport recommends that liveability should be incorporated into urban planning and design to make pedestrian and road spaces more welcoming, safe and usable [1]. A safe systems approach is also recommended, which incorporates actions at multiple levels (engineering, education and enforcement) to reduce risks to pedestrians, such as ensuring the integrity and suitability of the physical environment, and proactively addressing the behaviour of road users, pedestrians and others to encourage safe shared space practices between all transport modes. For instance, addressing driver behavior at intersections, pedestrian crossings, and driveways, and encouraging greater visibility of driveways for pedestrians through infrastructural design and modification may improve the safety of pedestrian space by reducing the risk of motor vehicle – child collision. Integral to any of these solutions is recognising the inherent capabilities, but also vulnerabilities of children in the pedestrian environment. Several key actions to promote safer environments for child pedestrians, particularly during travel between home and school include: safe pedestrian surfaces and crossings, speed restrictions and traffic calming [63]. The provision of safe skate parks is a further action, which may improve the safety of child skateboarders [5].

Skate parks

Skate parks may offer a means to separate skateboarders from motor vehicle and pedestrian traffic, enable closer caregiver supervision, and offer an environment where use of helmets and other safety equipment can be more easily regulated [5]. There is limited research into the effectiveness of skate parks in reducing serious skateboarding injury. However, a recent study found that use of skate parks was independently associated with a lower incidence of severe head injury [31]. The influence of skate park design on injury also requires further investigation. A prospective case series of individuals injured at a skate park in California, found that a significantly greater number of injuries presenting to the emergency department occurred in skate park areas involving ramps and bars, compared with half-pipe and gully areas, leading the authors to conclude that skate park design can influence patterns of skateboarding injury [64]. Given knowledge of the safety benefits of separated space for child pedestrian and cycle safety [65], it would appear appropriate to support the recommendation of the American Academy of Pediatrics that skate parks offer a safer haven for skateboarding, particularly away from other traffic risks. However, until further international and New Zealand research is undertaken into this area, skate parks should not be promoted as safe havens in and of themselves, as supervisory, legislative, engineering and behavioural elements likely interact to create a complex picture of injury associated with skate park use [66].

Child pedestrian space

To enhance the safety of children using skateboards and scooters, safe pedestrian space must be available to children. This is particularly important in areas of high child pedestrian traffic around schools, and also in areas without effective traffic calming features, which in New Zealand includes many urban and rural schools that are situated on or near main roads or highways [63]. Many scooter and skateboard incidents result from riding on rough or uneven surfaces [14, 21, 26], therefore ensuring that footpaths are smooth, and well maintained is an essential component of enabling safer pedestrian environments [61] to reduce the risk of skateboard and scooter-related injury. A New Zealand review of school journey safety reported that wide footpaths with protection from roadside vehicles, coupled with footpath maintenance improve a child pedestrian's sense of safety on the school journey [63]. Furthermore, a New Zealand investigation of

walkability found factors affecting perceptions of safety also included: degree of physical separation between pedestrians and vehicles, traffic volume and speed, vehicle mix and driveway access frequency and volume [67]. Infrastructural design and modification that enables greater driveway visibility for child pedestrians and motor vehicles alike may improve the real and perceived safety of child pedestrians. Engineering solutions to improve pedestrian safety should reflect child developmental capabilities and limitations. Crossing places that are understandable and safe for school aged children to use are one example of developmentally appropriate solutions. Crossings particularly well suited to children include school patrolled kea, zebra and controlled intersection crossings [63, 68].

Restriction of motor vehicle speed through lower speed zones is supported by the Safer Journeys Road Safety Strategy [42], and has been shown to reduce child pedestrian injury [65, 69]. The introduction of 20mph (32 kph) speed zones in the United Kingdom resulted in an average 9mph (14 kph) reduction in vehicle speed, and reduced the number of fatal child pedestrian incidents by seventy percent [70]. Reducing speed from 45 kph to 35 kph increases a pedestrians chance of survival from 50% to 90% [71]. To reduce child pedestrian injury the World Health Organization therefore recommends 30 kph speed limits around all schools [71]; several local authorities in New Zealand have adopted 30 or 40 kph school speed zones at peak child pedestrian travel times [42].

Traffic calming is a complimentary solution to lower speed zones that can involve developmentally appropriate infrastructure and design features to normalise reduced motor vehicle speeds, enhance awareness of other transport modes and encourage acknowledgement of the importance of child pedestrian space. Examples of traffic calming strategies include slowing traffic with speed bumps, visual changes such as road surface treatments, redistributing traffic by creating one way streets and changing the road environment with features such as trees [72, 73]. Importantly, traffic calming solutions targeted to areas of socioeconomic deprivation may reduce inequalities in child pedestrian injury [74]. Area-wide traffic calming solutions reduce the incidence of child pedestrian injury, are cost effective and appear promising for child skateboard and scooter riders [62, 68].

Other interventions

Community interventions

Community interventions that involve community development approaches, advocacy and programmes to improve awareness, lead to reductions in child pedestrian injury [65, 75]. A systematic review of the literature on child pedestrian injury prevention programmes found that programmes involving community coalitions, and enabling communities to develop a sense of ownership of the injury issue and its potential solution resulted in significant reductions in child pedestrian injury of 45-54 percent [76]. Furthermore, community initiatives to enhance pedestrian safety may be beneficial in facilitating the repetition of pedestrian safety messages; repetition of messages is recommended to prevent loss of pedestrian skills knowledge and behavioural change over time [77].

Skills training

A correlation may exist between degree of experience in using skateboards and scooters and the occurrence of injuries [13, 21, 32]. Engaging children in skateboard and scooter skills training is a possible means to increase child awareness of hazards, use of protective equipment and skills to enable safer riding. While there is some evidence that cycling skills training programmes may improve rider knowledge and behavior [65], overall the pedestrian and cycling literature suggests limited benefit from skills training [65, 77]. Although scooter safety programmes have been implemented internationally and more recently in New Zealand, there is no evidence of the effectiveness of such programmes in the literature in regards to improving knowledge and skills, or reducing risk taking behaviours and injuries. Current road safety programmes, and the New Zealand experience of scooter training could provide insight into training effectiveness through further research and evaluation. Furthermore, programmes that increase understanding of the need for protective equipment, while improving peer social acceptability of protective equipment use may be useful.

Safekids New Zealand recommendations

Safekids New Zealand recommends that the following interventions are supported to reduce the risk of injury and death to child skateboarders and scooter riders.

Helmets

Appropriately fitted helmets save lives and reduce the severity of brain injury and facial injury. Wearing a correctly fitted helmet when skateboarding or scootering will help to reduce the number of head and facial injuries experienced by children. Safekids New Zealand recommends that all children wear an appropriately fitted helmet that meets an approved safety standard when riding a skateboard or scooter, whether they are commuting to school, riding recreationally or attempting tricks. Safekids New Zealand encourages schools to adopt a policy that children riding skateboards or scooters to school must wear a helmet. Members of schools and other community groups are encouraged to role model helmet wearing when skateboarding or scootering, and to advocate for the use of helmets in their communities. Informed by legislative action internationally, Safekids New Zealand recommends the development of helmet regulation for skateboards and scooters.

Protective equipment

Wearing elbow and knee pads when skateboarding or scootering can prevent or reduce the severity of injury to the upper and lower limbs. Safekids New Zealand recommends that all children wear elbow and knee pads when riding a skateboard or scooter, whether they are commuting to school, riding recreationally or attempting tricks. Safekids New Zealand also recommends that caregivers ensure children wear elbow and knee pads. Members of schools and other community groups are encouraged to role model elbow and knee pad use when skateboarding or scootering, and to advocate for the use of elbow and knee pads for child skateboarders and scooter riders in their communities.

Wearing wrist guards when skateboarding can prevent, or reduce the severity of injury to the upper limbs. Safekids New Zealand recommends that all children wear wrist guards when riding a skateboard, and that caregivers ensure children wear wrist guards. Members of schools and other community groups are encouraged to role model wrist guard use when skateboarding, and to advocate for the use of wrist guards for child skateboarders in their communities.

Skate park design

Skate parks enable children to be separated from motor vehicle and pedestrian traffic, enable closer caregiver supervision, and offer an environment where use of helmets and other safety equipment can be more easily regulated. Ensuring that skate park design incorporates best practice design principles, including injury prevention, while at the same time enabling children to engage in risk taking behaviours, is important. Safekids New Zealand recommends that an Australian/New Zealand voluntary standard for skate park design is developed, which incorporates design features that enable safe use of a variety of devices, including skateboards, scooters and other small wheeled recreational devices. A skate park standard could also include provision of areas for caregivers to supervise children, and highlight the need for careful planning regarding the geographical placement of the park to ensure safe access for children. Safekids New Zealand recommends that New Zealand research is undertaken into the design, placement and community health and social impact of skate parks. Safekids New Zealand encourages schools, community groups and other organisations to advocate for a voluntary skate park standard for child skateboarders and scooter riders in their communities.

Safe child pedestrian space

To reduce the risk of skateboard and scooter-related injury, pedestrian spaces should be safe for children. Safekids New Zealand recommends that areas where children skateboard and scooter regularly, such as school journey routes, should be prioritised for engineering actions to improve child safety. It is recommended that engineering actions on school routes should include installation of pedestrian crossings suitable for children, improvements to and maintenance of footpath integrity, greater driveway visibility, 30 kph lower speed zones, and traffic calming solutions such as self-explaining roads. To promote equity, Safekids New Zealand recommends that engineering actions are prioritised to areas with high Māori and Pacific child populations. Communities are encouraged to advocate for actions to improve the safety of child pedestrian space for skateboard and scooter users.

The most severe injuries experienced by children using skateboards and scooters involve motor vehicles. Members of schools and other community groups are encouraged to enhance awareness of pedestrian space as the safest place to ride skateboards and scooters, and to role model the appropriate use of skateboards and scooters in pedestrian space.

Appendix 1: Position paper literature review methods

Searches of electronic databases were undertaken by Safekids New Zealand staff, and a University of Auckland librarian.

Searches were performed using various combinations of the following terms: child; children; skate; skateboard; castor; wave; snake; scooter; kick; push; unpowered; unmotorised; non motorised; injury; injuries; wounds and injuries; fracture; bone; accident; accidental fall; transportation; play; accident prevention; prevention control.

Articles and reports were included in the position paper if published from 2000 onwards, or earlier if seminal references.

Articles and reports were assessed in regards to their:

- Currency – how the document could build on and support existing information held by Safekids,
- Source – potential sources of information were identified and prioritised, including academic databases and sources of unpublished literature,
- Reliability and validity – all materials collected were critically reviewed, ensuring they were obtained from credible sources and were appropriate to the project's purpose, and
- Coverage and relevance – ensured by assessing that materials included in the review were appropriate to the project's purpose.

Documents were excluded that did not include children. Priority was given to literature from countries with similar pedestrian environments and policy contexts to New Zealand, such as Australia, Canada, UK and USA.

Reference lists of relevant papers were also searched to identify further documents of relevance.

Appendix 2: Data analysis methods

Skateboard and scooter-related hospitalisation data for the period 2007-2011, and mortality data for the period 2007-2009 for children aged 0-14 were sourced from the Ministry of Health data collections by the Injury Prevention Research Unit (IPRU), University of Otago [9], and analysed by Safekids New Zealand.

Skateboard and scooter hospitalisation data were filtered as follows:

- primary diagnosis of injury (International Classification of Diseases version 2010 (ICD-10) codes in the range of S00-T78)
- first admissions only
- child was admitted at least overnight
- child was discharged alive

Skateboard or scooter use was found by searching the following activity codes

- U663 = skateboarding,
- U664 = scooter riding (includes folding non-motored scooter and all other non-motored scooters)

Data were then categorised by age, gender, ethnicity and external cause of injury.

Mortality data were searched for deaths where the deceased was recorded as using a skateboard or scooter near the time of death.

The MoH skateboard fall-related injury dataset for the period 2004-2012 for children aged 0-14 years was cleaned by eliminating duplicates, and analysed by Safekids New Zealand.

Accident Compensation Corporation (ACC) skateboard and scooter-related injury claim data for the period 2008-2012 were provided by ACC, and analysed by Safekids New Zealand. Analysis into body regions was done as follows:

- head and neck included: head (except face), face, eye, nose, ear, neck, back of head vertebrae
- upper limb included: shoulder, upper and lower arm, elbow, hand/wrist, finger/thumb
- lower limb included hip, upper leg, thigh, knee, lower leg, ankle, foot, toes

Mechanism of injury data were sorted by the highest number of claims, and reported under the titles provided by ACC.

References

1 Ministry of Transport, *Raising the profile of walking and cycling in New Zealand: a guide for decision makers*, Wellington, New Zealand, Ministry of Transport: 2008.

2 Chillón, P., Evenson, K.R., Vaughn, A. and Ward, D.S., "A systematic review of interventions for promoting active transportation to school" *International Journal of Behavioural Nutrition and Physical Activity*, 2011, 8(10): 1-17.

3 Lubans, D.R., Boreham, C.A., Kelly, P. and Foster, C.E., "The relationship between active travel to school and health-related fitness in children and adolescents: a systematic review" *International Journal of Behavioural Nutrition and Physical Activity*, 2011, 8(5): 1-12.

4 Litman, T.A., "Economic value of walkability" *World Transport Policy & Practice*, 2004, 10(1): 5-14.

5 American Academy of Pediatrics Committee on Injury and Poison Prevention, "Skateboard and scooter injuries" *Pediatrics*, 2002, 109(3): 542-543.

6 Baumgartner, E.N., Krastl, G., Kuhl, S. and Filippi, A., "Dental injuries with kick-scooters in 6- to 12-year-old children" *Dental Traumatology*, 2012, 28(2): 148-152.

7 Zalavras, C., Nikolopoulou, G., Essin, D., Manjra, N. and Zionts, L.E., "Pediatric fractures during skateboarding, roller skating, and scooter riding" *The American Journal of Sports Medicine*, 2005, 33(4): 568-573.

8 Mankovsky, A.B., Mendoza-Sagaon, M., Cardinaux, C., Hohlfeld, J. and Reinberg, O., "Evaluation of scooter-related injuries in children" *Journal of Pediatric Surgery*, 2002, 37(5): 755-759.

9 Unpublished Injury Prevention Research Unit (IPRU) data: child (0-14 years) skateboard and scooter-related injury hospitalisation 2007-2011, and mortality 2007-2009, University of Otago, Dunedin, New Zealand. Unpublished Ministry of Health (MoH) data: child (0-14 years) skateboard-related hospitalisation 2004-2012, Ministry of Health, Wellington, New Zealand. Unpublished Accident Compensation Corporation (ACC) data: child (0-14 years) scooter-related injury claims 2008-2012, Accident Compensation Corporation, Wellington, New Zealand, 2012.

10 Brudvik, C., "Injuries caused by small wheel devices" *Prevention Science*, 2006, 7(3): 313-320.

11 Schieber, R.A., Branche-Dorsey, C.M. and Ryan, G.W., "Comparison of in-line skating injuries with rollerskating and skateboarding injuries" *Journal of the American Medical Association*, 1994, 271(23): 1856-1858.

12 Osberg, J.S., Schneps, S.E., Di Scala, C. and Li, G., "Skateboarding: more dangerous than roller skating or in-line skating" *Archives of Pediatrics and Adolescent Medicine*, 1998, 152(10): 985-991.

13 Lovejoy, S., Weiss, J.M., Epps, H.R., Zionts, L.E. and Gaffney, J., "Preventable childhood injuries" *Journal of Pediatric Orthopedics*, 2012, 32(7): 736-742.

14 Chapman, S., Webber, C. and O'Meara, M., "Scooter injuries in children" *Journal of Paediatrics and Child Health*, 2001, 37(6): 567-570.

15 Fong, C.P.H. and Hood, N., "A paediatric trauma study of scooter injuries" *Emergency Medicine*, 2004, 16(2): 139-144.

16 Powell, E.C. and Tanz, R.R., "Incidence and description of scooter-related injuries among children" *Ambulatory Pediatrics*, 2004, 4(6): 495-499.

17 Gaines, B.A., Shultz, B.L. and Ford, H.R., "Nonmotorized scooters: a source of significant morbidity in children" *The Journal of Trauma*, 2004, 57(1): 111-113.

18 Adeboye, K. and Armstrong, L., "Pattern and severity of injuries in micro-scooter related accidents" *Emergency Medicine Journal*, 2002, 19(6): 571-572.

19 Griffin, R, Parks, C.T, Rue III, L.W and McGwin Jr, G, "Comparison of severe injuries between powered and nonpowered scooters among children aged 2 to 12 in the United States" *Ambulatory Pediatrics*, 2008, 8(6): 379-382.

20 Griffin, J.M., Fuhrer, R., Stansfeld, S.A. and Marmot, M., "The importance of low control at work and home on depression and anxiety: do these effects vary by gender and social class?" *Social Science & Medicine*, 2002, 54(5): 783-798.

21 Schalamon, J., Sarkola, T. and Nietosvaara, Y., "Injuries in children associated with the use of nonmotorized scooters" Journal of Pediatric Surgery, 2003, 38(11): 1612-1615.

22 Forsman, L. and Eriksson, A., "Skateboarding injuries of today" *British Journal of Sports Medicine*, 2001, 35(5): 325-328.

23 Levine, D.A., Platt, S.L. and Foltin, G.L., "Scooter injuries in children" *Pediatrics*, 2001, 107(5): e64-e64.

24 Cassell, E., Ashby, K., Gunatilaka, A. and Clapperton, A., "Do wrist guards have the potential to protect against wrist injuries in bicycling, micro scooter riding, and monkey bar play?" *Injury Prevention*, 2005, 11(4): 200-203.

25 Sheehan, E., Mulhall, K.J., Kearns, S., O'Connor, P., McManus, F., Stephens, M. and McCormack, D., "Impact of dedicated skate parks on the severity and incidence of skateboard-and rollerblade-related pediatric fractures" *Journal of Pediatric Orthopaedics*, 2003, 23(4): 440-442.

26 Montagna, L.A., Cunningham, S.J. and Crain, E.F., "Pediatric scooter-related injuries" Pediatric Emergency Care, 2004, 20(9): 588-592.

27 Kubiak, R. and Slongo, T., "Unpowered scooter injuries in children" *Acta Paediatrica*, 2003, 92(1): 50-54.

28 Kyle, S.B., Nance, M.L., Rutherford Jr, G.W. and Winston, F.K., "Skateboard-associated injuries: participation-based estimates and injury characteristics" *The Journal of Trauma*, 2002, 53(4): 686-690.

29 Tu, Y., *Toy-related deaths and injuries. Calendar Year 2011*, Bethesda, USA, , Consumer Product Safety Commision: 2012.

30 Cassell, E. and Clapperton, A., "Preventing injury in sport and active recreation" *Hazard*, 2002, 51(Winter): 1-18.

31 Lustenberger, T., Talving, P., Barmparas, G., Schnüriger, B., Lam, L., Inaba, K. and Demetriades, D., "Skateboard-related injuries: not to be taken lightly. A national trauma databank analysis" *The Journal of Trauma*, 2010, 69(4): 924-927.

32 Abbott, M.B., Hoffinger, S.A., Nguyen, D.M. and Weintraub, D.L., "Scooter injuries: a new pediatric morbidity" *Pediatrics*, 2001, 108(1): e2-e2.

33 Levine, D., "All-terrain vehicle, trampoline and scooter injuries and their prevention in children" *Current Opinion in Pediatrics*, 2006, 18(3): 260-265.

34 Parker, J.F., O'shea, J.S. and Simon, H.K., "Unpowered scooter injuries reported to the consumer product safety commission: 1995–2001" *The American Journal of Emergency Medicine*, 2004, 22(4): 273-275.

35 Mezhir, J.J., Glynn, L., Liu, D.C. and Statter, M.B., "Handlebar injuries in children: should we raise the bar of suspicion?" *The American Surgeon*, 2007, 73(8): 807-810.

36 Barrett, E., "Management of a traumatic tracheal tear: a case report" *American Association of Nurse Anesthetists Journal*, 2011, 79(6): 468-470.

37 Dhillon, G.K., Gulati, A. and Sherman, J., "Micro-scooter induced dental trauma: a case report" *Dental Traumatology*, 2005, 21(4): 226-228.

38 Kiely, P.D., Kiely, P.J., Stephens, M.M. and Dowling, F.E., "Atypical distal radial fractures in children" *Journal of Pediatric Orthopaedics B*, 2004, 13(3): 202-205.

39 Bibbo, C, Davis, W.H and Anderson, R.B, "Midfoot injury in children related to mini scooters" *Pediatric Emergency Care*, 2003, 19(1): 6-9.

40 Inoue, N., Barker, R. and Scott, D.A., *Injury bulletin 105: skateboard injury*, Queensland, Australia, Queensland Injury Surveillance Unit (QISU): 2009.

41 Valino, H. and McArthur, D., "Sports-related brain injuries in a pediatric TBI clinic" *Journal of Neurotrauma*, 2011, 28(6): A78.

42 Ministry of Transport, Safer Journeys: New Zealand's Road Safety Strategy 2010-2020, Wellington, New Zealand, Ministry of Transport: 2010.

43 Ministry of Transport, *Safer Journeys Action Plan 2011-2012*, Wellington, New Zealand, Ministry of Transport: 2011.

44 New Zealand Government, *Land transport (road user) rule 2004 (SR 2004/427)*, Wellington, New Zealand, New Zealand Government: 2004.

45 Standards Australia and Standards New Zealand, *AS/NZS ISO 8124.1:2010, Australian/New Zealand, Safety of Toys, Part 1: Safety aspects related to mechanical and physical properties (ISO 8124-1:2009, MOD)*, 2010.

46 British Standards Institution, *Roller sports equipment. Push scooters. Safety requirements and tests methods (BS EN 14619:2005)*, British Standards Institution: 2005.

47 International, British Standards, *Roller sports equipment. Skateboards. Safety requirements and tests methods (BS EN 13613:2009)*, 2009.

48 American Society for Testing and Materials, *ASTM F2264 - 09a Standard consumer safety specification for non-powered scooters*, Pennsylvania, United States, American Society for Testing and Materials: 2009.

49 Thompson, D.C., Rivara, F.P. and Thompson, R., *Helmets for preventing head and facial injuries in bicyclists*, Cochrane Database of Systematic Reviews: 2009.

50 Page, J.L., Macpherson, A.K., Middaugh-Bonney, T. and Tator, C.H., "Prevalence of helmet use by users of bicycles, push scooters, inline skates and skateboards in Toronto and the surrounding area in the absence of comprehensive legislation: an observational study" *Injury Prevention*, 2012, 18(2): 94-97.

51 Forjuoh, S.N., Fiesinger, T., Schuchmann, J.A. and Mason, S., "Helmet use: a survey of 4 common childhood leisure activities" *Archives of Pediatrics and Adolescent Medicine*, 2002, 156(7): 656-661.

52 Anderson-Suddarth, J.L. and Chande, V.T., "Scooter injuries in children in a midwestern metropolitan area" *Pediatric Emergency Care*, 2005, 21(10): 650-652.

53 Bicycle Helmet Safety Institute, *Helmet laws for bicycle riders*, http://www.helmets.org/mandator.htm Accessed October 14, 2012.

54 Schieber, R.A., Branche-Dorsey, C.M., Ryan, G.W., Rutherford Jr, G.W., Stevens, J.A. and O'Neil, J., "Risk factors for injuries from in-line skating and the effectiveness of safety gear" *New England Journal of Medicine*, 1996, 335(22): 1630-1635.

55 Safekids New Zealand and Accident Compensation Corporation, *Skateboard safety gear project report*, Auckland, New Zealand, Safekids New Zealand, Accident Compensation Corporation: 2007.

56 Schieber, R.A. and Olson, S.J., "Developing a culture of safety in a reluctant audience" *Western Journal of Medicine*, 2002, 176(3): e1-e2.

57 Thomson, J., Tolmie, A., Foot, H.C. and McLaren, B., *Child development and the aims of road safety education* London, England, HMSO: 1996.

58 Schwebel, D.C., Davis, A.L. and O'Neal, E.E., "Child pedestrian injury. A review of behavioral risks and preventive strategies" *American Journal of Lifestyle Medicine*, 2012, 6(4): 292-302.

59 Roberts, I., "Adult accompaniment and the risk of pedestrian injury on the school-home journey" *Injury Prevention*, 1995, 1(4): 242-244.

60 Livingston, D.H., Suber, I., Snyder, D., Clancy, S.F., Passannante, M.R. and Lavery, R.F., "Annual pediatric pedestrian education does not improve pedestrian behavior" *The Journal of Trauma*, 2011, 71(5): 1120-1125.

61 New Zealand Transport Agency, *Pedestrian planning and design guide*, Wellington, New Zealand, New Zealand Transport Agency: 2009.

62 Peden, M.M., *World report on child injury prevention*, Geneva, Switzerland, World Health Organization: 2008.

63 Wigmore, B., Baas, C., Wade, W. and Baas, P., *School journey safety: a comparative study of engineering devices. Research Report 271*, Wellington, New Zealand, Land Transport New Zealand 2006.

64 Everett, W.W., "Skatepark injuries and the influence of skatepark design: a one year consecutive case series" *The Journal of Emergency Medicine*, 2002, 23(3): 269-274.

65 MacKay, M., Vincenten, J., Brussoni, M., Towner, E. and Fuselli, P., *Child safety good practice guide: Good investments in child injury prevention and safety promotion - Canadian edition*, Toronto, Canada, The Hospital for Sick Children: 2011.

66 Vaca, F., Mai, D., Anderson, C.L., Fox, J.C. and Ferrarella, N., "Associated economic impact of skatepark-related injuries in Southern California" *Clinical Medicine & Research*, 2007, 5(3): 149-154.

67 Abley, S., *Walkability Scoping Paper*, Christchurch, New Zealand, , Abley Transportation Consultants. New Zealand Transport Authority: 2005.

68 Towner, E, Dowswell, T, Mackereth, C and Jarvis, S, *What works in preventing unintentional injuries in children and young adolescents? An updated systematic review*, Newcastle, National Health Service: 2006.

69 Steinbach, R., Grundy, C., Edwards, P., Wilkinson, P. and Green, J., "The impact of 20 mph traffic speed zones on inequalities in road casualties in London" *Journal of Epidemiology and Community Health*, 2011, 65(10): 921-926.

70 Webster, D.C. and Mackie, A.M., *Review of traffic calming schemes in 20 mph zones, TRL Report 215*, Berkshire, UK, Transport Research Laboratory: 1996.

71 World Health Organization, *Road traffic injuries. Fact sheet No 358*, Geneva, Switzerland, World Health Organization: September 2012.

72 Charlton, S.G., Mackie, H.W., Baas, P.H., Hay, K., Menezes, M. and Dixon, C., "Using endemic road features to create self-explaining roads and reduce vehicle speeds" *Accident Analysis & Prevention*, 2010, 42(6): 1989-1998.

73 Bunn, F., Collier, T., Frost, C., Ker, K., Roberts, I. and Wentz, R., *Area-wide traffic calming for preventing traffic related injuries*, Cochrane Database of Systematic Reviews 2009.

74 Jones, S.J., Lyons, R.A., John, A. and Palmer, S.R., "Traffic calming policy can reduce inequalities in child pedestrian injuries: database study" *Injury Prevention*, 2005, 11(3): 152-156.

75 Harborview Injury Prevention and Research Center, *Best practices. Child pedestrians*, Washington, USA, Harborview Injury Prevention and Research Center: 2001.

76 Turner, C., McClure, R., Nixon, J. and Spinks, A., "Community-based programmes to prevent pedestrian injuries in children 0–14 years: a systematic review" *Injury Control and Safety Promotion*, 2004, 11(4): 231-237.

77 Duperrex, O., Roberts, I. and Bunn, F., *Safety education of pedestrians for injury prevention*, Cochrane Database of Systematic Reviews: 2003.

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Safekids New Zealand
PO Box 26-488
Epsom, Auckland 1344
New Zealand

Ph: +64 9 630 9955
Fx: +64 9 630 9961

www.safekids.org.nz