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This edition of Hazard reports on trampoline related injuries, with a particular focus on children. This article updates Hazard Edition 13 (1992) on trampoline related injury and provides an evidence base for an Australian safety Standard for trampolines. An update on the new Standard for shopping trolleys is also provided.

Trampoline Injuries**

*Clare Murphy**

Trampoline injury data in Australia and internationally indicates that many children are injured as a result of trampoline use. In Victoria alone, an average of 179 children (18.6/100,000) are hospitalised annually as a result of trampoline injury. Australian Bureau of Statistics data indicates that 8.6 % of all Victorian households have trampolines.

Children, represent 95% of hospitalised and 91% of emergency department (ED) presentations in Victoria for trampoline injury. Males and females are equally represented, and 78% of child trampoline injuries occur at home. Injuries are predominantly fractures and the region most often injured is the upper limb. Only two cases of spinal cord injury have been reported in Australia during the period 1986 to 1997. Falls up to and over one metre accounted for at least 60% and 13% respectively of trampoline related injuries presenting to emergency departments.

There are many contributing risk factors associated with trampoline use including exposure, age, misuse, poor quality equipment/design faults, improper siting of trampolines and lack of supervision.

Trampoline injury data has fuelled growing international concern regarding the potential injury risk associated with trampoline use, particularly for children, resulting in injury researchers in the United States calling for a ban on the manufacturing and sale of trampolines for private recreational use.

In contrast, Australian injury researchers propose the development of a voluntary Australian Standard to facilitate the design, behavioural and environmental changes required to reduce trampoline injuries. Such a development is considered appropriate due to the apparent effectiveness of the New Zealand Standard in stabilising an upward trend in injuries and the relatively low incidence of trampoline injuries in Australia, and the absence of calls for banning of other recreational activities with higher rates of injury.

Also in this edition
Shopping Trolley update
(page 12)
Injury surveillance data shows that falls from shopping trolleys is among the leading causes of head injuries to young children. In January 1999 Standards Australia published a new Standard for shopping trolleys (AS/NZS 3847.1:1999) which includes a requirement for child restraints. While the Standard is not mandatory, there appears to be increasing industry support for the introduction of safety restraints in shopping trolleys.

* *Clare Murphy is a Victorian Public Health Trainee funded by the Victorian Department of Human Services, auspiced by the North Western Health Care Network, on placement at MUARC for 4 months (October 1999 –February 2000).*
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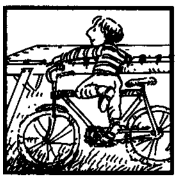
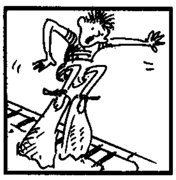
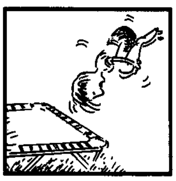


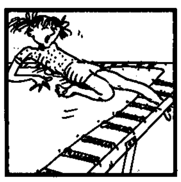
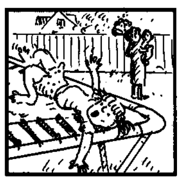

Introduction

Trampoline injury data in Australia and internationally indicates many children suffer trampoline related injuries and children, particularly aged 5-14, years are most at risk of injury (Appendix 1). Trampoline related injuries were ranked in Victoria as the ninth and nationally as the sixth most likely contributing factor in child sports and recreational injury (Routley, 1992; Finch et al, 1995). Internationally, data from the United States Consumer Product Safety Commission (US CPSC) rank trampolines as fourteenth in sports and recreational activities leading to child injury.

Children (0-14 years) represent 95% of hospitalised and 91% of emergency department (ED) presentations in Victoria for trampoline injury. Hence, this article focuses on injuries to children associated with trampolines given the relative infrequency of adult injury cases, ie. trampoline injury represents 0.3 % of all adult injuries that present to Victorian public hospital ED's. Little is known about differing patterns of use of trampolines in the US, Europe and Australia, although different emphasis on gymnastics as a sport for children and differing availability of private outdoor space may be expected to form the base for quite different patterns.

Victorian injury data reflects a similar pattern to international studies that have shown that children are more likely to use trampolines and to sustain injuries. Data on trampoline injuries is available from two Victorian sources covering all public hospital admissions (VIMD) and approximately 80% of statewide ED presentations (VEMD) (Details page 9). Exposure data is from the Australian Bureau of Statistics (ABS). There have been no trampoline related deaths recorded in Victoria in the period 1989 to 1995.

Exposure data

An ABS (1999a) survey of safety hazards in the home was conducted in Victoria in 1998.[1] The survey results indicated that 41,300 (17.6%) of Victorian households with young children, aged under 5 years, who were usual residents, had trampolines. Of all households in Victoria, 148,500 had trampolines (8.6%). It is not possible to calculate the exposure of the 5-14 year age group, except to suggest that trampolines counted in the household where 0-4 year olds live, may have been purchased for use by older children, and not intended for use by the younger age group. The survey found that the surface beneath or around playground equipment including, but not exclusively trampolines, was grass (16.2% of households), tan bark or mulch (each 1.3%) and earth or sand (each 1.1%), no further detail was provided for the remaining cases (ABS, 1999a). The previous 1992 ABS home safety survey did not include trampolines; therefore no comparison can be made.

Recent data from the Queensland Injury Surveillance Unit (QISU) estimated 400,000 trampolines nationally (Hockey & Horth, 2000).

The available literature reports that exposure to trampolines has correspondingly increased with the number of trampolines privately owned (Smith, 1998; Torg & Das, 1984; Smith & Shields, 1998; Furnival et al, 1999; Routley 1992). This appears to be reflected in the growing number of trampoline related injuries.

Availability

Trampolines are readily available through department stores, sporting goods outlets and from trampoline manufacturers and distributors. Prices (all in Australian dollars) range from $169 for a 40 spring Junior Trampoline (L 2.35 m. x W 1.6 m. x H 0.55m.) to $229 for an 82 spring Turbo Trampoline (L3.09 m. x W 1.93 m. x H 0.9 m.). Safety pads come as an optional extra but are strongly recommended by manufacturers. They range in price from $10 to $75. The author found one adult sized trampoline that came as a package and included safety pads for $249. Most trampolines are designed to take up to 100 Kg. (ie. children's sized trampolines), some state they can take 108 Kg. (ie the senior's trampoline).

Hospital Admissions (VIMD)

The Victorian Inpatient Minimum Database (VIMD) records hospital admissions for all Victorian public hospitals. Trampoline injury has only been reported on the VIMD since July 1996 when the E-code 'E884.9 – Other fall from one level to another' was modified to identify falls from trampolines (E884.5). There were 378 admitted patients with trampoline related injuries recorded on the VIMD over the 2 years July 1996 to June 1998. Children aged 0-14 years represented 95% of all admissions. Fifty-two percent were female. Most children (82%) had a length of stay less than 2 days. A further 17% were hospitalised for 2–7 days.

Almost three-quarters of admitted cases sustained upper limb injuries. Of the remaining injuries, 13% were to the head/face and 9% to the lower limbs. Fractures (80% of total), intracranial injury (9%) and open wounds (6%) were the most common injuries requiring hospital admission.

The estimated average annual cost of hospital treatment alone, based on Australian Diagnostic Related Groups (ANDRG's) (1996 Victorian cost rates, Health Solutions, 1997), for hospitalised trampoline injuries in Victoria is $262,000.

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[1] 1998 ABS Safety in the Home survey was a supplement to the ABS routine Labour Forces Survey within the Australian Monthly Population Survey (MPS).

Victorian hospital admission rate data can be compared with New Zealand (NZ) and US data on hospital admission rates from trampoline injuries. In the period 1990-95 the US reported an admission rate of 2.0 per 100,000 for persons aged 0-18 years per annum (pa). This compares with all-age admission rates of 9.3 per 100,000 pa in New Zealand (1988), and 4.1 per 100,000 pa in Victoria (July 1996 to June 1998) (Table 1).

Emergency Department Presentations (VEMD)

The Victorian Emergency Minimum Dataset (VEMD) is an ongoing surveillance collection of injury presentations to 25 Victorian public hospital emergency departments. VEMD data for the period October 1995 to October 1999 reported 1,496 trampoline related injury presentations, including those subsequently admitted, to the participating ED's. Most (90.5%) were aged less than 15 years (n = 1355), 8.5% were aged 20 plus (n = 120), and 1.4% failed to record the patient's age (n = 21). The peak age range for injury was 4-7 years (41% of child trampoline injuries) (Figure 1).

Trampoline related injuries accounted for 0.8% of all child ED presentations in the 4 year period. By comparison, trampoline related injuries accounted for only 0.03% of all adult emergency department presentations.

As for VIMD data, males and females had a nearly equal probability of sustaining a trampoline injury resulting in ED presentation. Males represented 50.3% of all ages and 49.2% of children who had trampoline injuries. This indicates an overall 1:1 ratio of males to females injured.

Injuries were more likely to occur on the weekend and during the summer months, particularly January (14% of total).

Trampoline injury rates, hospitalisation and ED presentation

Table 1

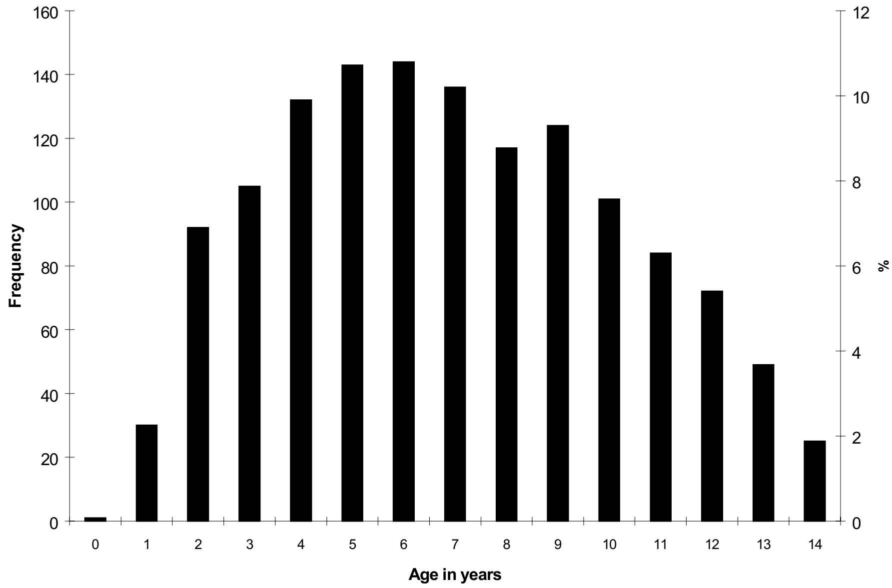
	Hospitalisation rates per 100,000		ED presentation rates per 100,000	
	Child (0-14)	All-age	Child (0-14 yrs)	All-age
Victoria (1996/98)	18.6	4.1	na	na
Queensland (1998-99)	na	na	158 (5-14 yrs)	na
United States (1990-95)	2.0 (0-18 yrs)			
(1998)			48.1 (0-4 yrs) 169.2 (5-14 yrs)	35.2
New Zealand (1988)	9.7 (0-4 yrs) 30.3 (5-9 yrs) 26.5 (10-14 yrs)	9.3		
(1989/90)			203.4 (0-4 yrs) 501.2 (5-14 yrs)	108

NB: See Appendix 1 for details of the studies from which these rate data were taken

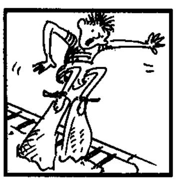
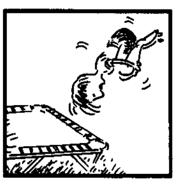
Identification of trampoline injury on the VEMD is reliant on a text search of the 100-character description of injury event variable for the text term "trampoline". As narrative quality is variable it is not possible to draw reliable conclusions as to changes in the rate of trampoline injuries recorded, as patterns may only be reflective of changes to the text data as the result of quality control efforts (Ozanne-Smith et al, 1999).

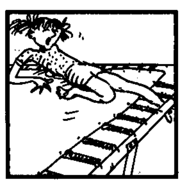
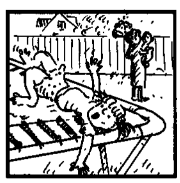
Child trampoline injuries by age, ED presentations, Victoria

Figure 1



Source: VEMD October 1995 to October 1999

An analysis of data from three major Melbourne metropolitan hospitals from which VISS collected data over a five year period (1989-1993), plus routine VEMD data available for 1996-1998, indicates a reduction in the reported cases of trampoline related injuries over the 9 year period, assuming the two data sets are comparable. The reasons for the decrease in reported injuries are not known, but may simply reflect the differences in the two surveillance systems.

Emergency department presentation rate data is unavailable for Victoria but is available for Queensland, NZ and the US (Table 1).

Seventy-eight per cent of VEMD reported child trampoline injuries occurred at home and a further 4% at a sports or recreational centre. Eighteen per cent of cases did not specificy the location where the injury occurred.

Fractures represented 36% of all child trampoline injury resulting in ED presentation, sprains and strains 22% and open wounds 12%. The remaining injuries included superficial wounds, injuries to muscles and tendons and intracranial injury (Table 2). Of the fractures, 78% involved the upper limbs, predominantly the forearm and elbow, and 19% the lower limbs, predominantly the lower leg. The remaining 3% involved the face, neck, and lower back and unspecified body regions.

Trampoline related injuries were almost twice as likely to involve the upper limbs as any other part of the body (Figure 2).

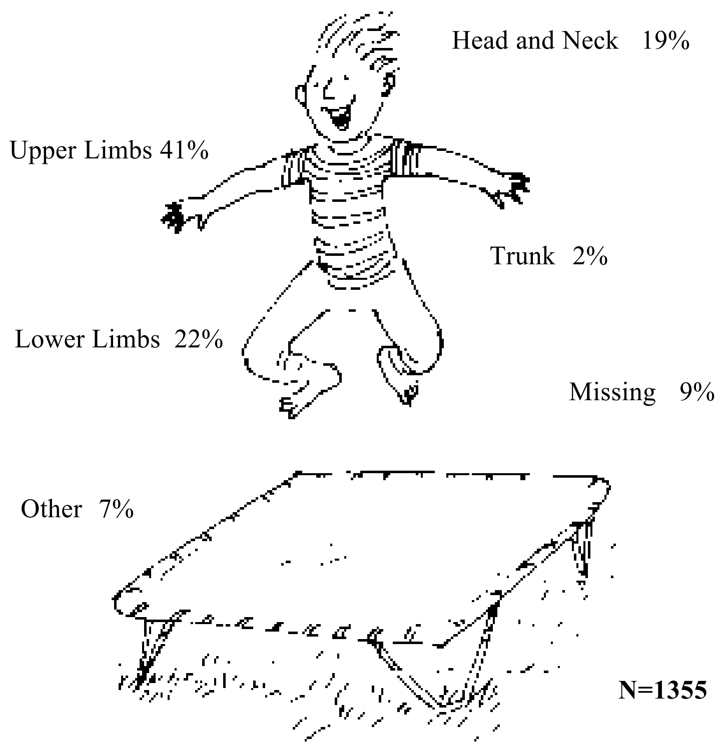
The majority of injured children (83%) were discharged home. Of this group, 58% (n = 642) were given appointments for medical review. Sixteen percent of VEMD cases required hospital admission.

Child trampoline injuries by nature of main injury, ED presentations, Victoria **Table 2**

Type of Injury	N	% of total	% requiring admission*
Fractures, excludes teeth	488	36	36.1
Sprain or strain	303	22	0.7
Open wound, excludes eye	167	12	5.4
Superficial, excludes eye	91	7	0
Injury to muscle or tendon	61	5	1.6
Intracranial injury	29	2	20.7
Dislocation	19	1	26.3
Injury of unspecified nature	44	3	9.1
Dental injury	10	0.7	30
Other specified nature of injury	27	2	22.2
Missing/invalid	116	9	13.7
Total	**1355**	**100**	**16.8**

Source: VEMD October 1995 to October 1999
** Admission criteria for the VEMD include admission to a hospital ward, admission to the ED and transfer to another hospital.*

Child trampoline injuries by body region, ED presentations, Victoria **Figure 2**



Source: VEMD October 1995 to October 1999

Comparing the VEMD admissions and VIMD data reveals the degree to which the reported VEMD data underestimates the actual number of trampoline injured children who required admission to hospital. The degree of this discrepancy is shown in Table 3.

Causes of injury

Falls up to and over one metre accounted for at least 60% and 13% respectively of trampoline related injuries. Striking an object or being struck by another person contributed 9% of VEMD reported child injuries. Table 4 contains detailed information relating to cause of child trampoline injury.

Examination of VEMD trampoline fall narratives indicated that the majority come under two categories - falls off the trampoline (61% of total injuries), and falls while on the trampoline (28%). VEMD patterns of both trampoline falls and all cause trampoline injuries parallels that reported in Queensland by Hockey and Horth (2000). VEMD text narratives vary in the degree of detail about the circumstances of injuries with 95% of the falls off, and 80% of falls while on, the trampolines lacking specific detail as to the mechanism of injury.

For those cases where details of the injury circumstances were available a number of factors contributing to the occurrence and severity of injury were identified. Falls off trampolines were made increasingly perilous by the proximity of hard, sharp or impervious objects (2% of falls from trampolines) eg. *"Lacerated occipital head, fell from trampoline onto bricks"* or *"fall from trampoline onto cricket stumps, penetrating wound"*.

Frequently, a fall while on the trampoline that would otherwise have been benign resulted in an injury when the child landed on the frame or springs (20% of falls on trampolines) eg. *"Fell straddling frame of trampoline"* or *"Possible fracture toe jammed in trampoline springs"*, or fell through a split trampoline mat (1%) eg. *"Playing on trampoline when mat split and fell to ground"*.

Child VEMD and VIMD trampoline injury requiring hospital admissions, Victoria — Table 3

Hospital admission details	VEMD admissions*	VIMD
Average reported number of children admitted to hospital per annum	63	179
Type of injury	74% fractures 6% open wound 4% intracranial injury	80% fractures 9% intracranial injury (not skull injury) 6% open wound
Body region injured	60% upper limbs 14% lower limbs 6% head/neck/face	74% upper limbs 9% lower limbs 7% face (excl. eye) 6% head 0.3% spine/back
Location	69% at home 16% unspecified/missing	60% unspecified location 34% at home
Length of hospital stay	NA	82% <2 days 18% 2-7 days 0.3% 31+ days

Source: VEMD 1997 & 1998, VIMD July 1996 to June 1998.
** Admission criteria on the VEMD include admission to a hospital ward, admission to the ED and transfer to another hospital.*

Child trampoline injuries by cause, ED presentations, Victoria — Table 4

Mechanism of injury	N	% of total	% requiring admission
Falls up to 1 metre	814	60	16.3
Falls over 1 metre	172	13	24.4
Struck by/collision with a person or object	116	9	7.8
Other specified external cause	75	5	12.0
Unspecified cause	28	2	14.3
Cutting/piercing object	17	1	11.8
Missing/invalid	133	9	21.8
Total	**1355**	**100**	**16.8**

Source: VEMD October 1995 to October 1999

Injuries resulted from attempting manoeuvres such as tricks or during mounting and dismounting (4% of total), eg. *"Somersaulting on trampoline, landed on head, injury to neck"* or *"Tried to climb onto trampoline whilst standing on a bike. Bike slipped out from under him"*.

Sharing the trampoline with others provide risks for collision and may cause either the trampoliner to fall on or from the trampoline (4%) eg. or *"Playing on trampoline and another child landed on arm"*.

Other injuries resulted from incorporating the trampoline in other forms of play. These included playing football, swinging from trees or clotheslines, running into the trampoline frame and lifting or moving the trampoline eg. *"Bouncing on trampoline on a bike"* or *"Fractured tibia/fibula (right) after jumping on trampoline with flippers"* or *"Swung off clothes line and hit head on trampoline"*. Other injuries were not related to the child being on the trampoline eg. *"Fell into trampoline pit"* or *"Trampoline standing up on side against wall, fell at home striking child on head"*.

Risk factors for injury

There are many contributing risk factors associated with trampoline use identified in the available literature. These include exposure, age, risks attributed to misuse, poor quality equipment/design faults, improper siting of trampolines and lack of supervision. Key issues follow:

Age

The majority of injured persons are aged less than 20 years (Smith, 1998; Hume et al. 1996), particularly less than 15 years (Larson, 1995; Smith and Shields, 1998; Furnival et al, 1999; Woodward, 1992). Children are at greater risk of injury than adults when exposed to situations with potential for transfer of large amounts of energy, due to developmental considerations such as immature judgement, coordination and strength. In addition, children are less likely to be able to judge the degree of risk and their capacity to manage that risk.

Injury data from the US shows an increase in trampoline related injury in children less than 15 years of age from 13 per 100,000 pa in 1990 to 35.2 per 100,000 pa in 1998 (Smith, 1998; AAP, 1999; CPSC, 1999).

Equipment

The quality of the trampoline equipment ie. size and maintenance of mat, the absence of safety padding over the springs and frame, set up and use of the equipment all contribute to both the risk and the severity of injury.

Ultraviolet light causes trampoline mats to deteriorate rapidly, however, this is not always obvious and mat replacement is delayed until after fraying or tearing has occurred.

Improper siting of trampolines, either too near solid structures eg. fences, sheds, trees, or over non-impact absorbing surfaces and the proximity of obstacles such as bricks or cricket stumps all make falls from trampolines increasingly perilous.

A number of researchers recommend that trampolines be positioned over a pit not less than 1 metre deep to reduce fall heights (Hockey & Horth, 2000; Hume, Chalmers & Wilson; Routley, 1992). Deep pits however may introduce unwanted hazards associated with having a large hole in the back yard, and the degree of difficulty associated with digging the pit.

The greater the height achieved when bouncing, the greater the energy. Greater heights eg. 5 metres, are achieved on trampolines in gymnasiums and recreational centres as the result of better maintenance practices. Silver et al (1986) found that trampolines in playgrounds and private backyards were generally poorly maintained and children bounced to approximate heights of 0.3 metres and were therefore less likely to sustain cervical spine injuries.

Physiological effects

Trampolining has been reported to have the potential to cause blackouts, dizziness and disorientation, all of which contribute to trampoline falls and injuries (Hammer et al, 1981; Torg & Das, 1984). Fatigue, stress, loss of concentration and carelessness also add to the potential for injury (AAP, 1999).

Supervision

The use of spotters, who can be other children, ensures that the user is always made aware of their position on the mat so that they do not move too close to the edge of the mat, towards the springs, frame or fall off the trampoline. A contrary argument claims that the centre of the mat is in fact the most dangerous part of the mat to use, as bouncing in the centre of the mat achieves the greatest height and maximises the force and impact of each jump. However, even in the presence of trained trampoline instructors, injuries can occur (Leivens, 1999). An adult supervisor, who has knowledge of trampoline safety, provides greater opportunity for injury prevention (AAP, 1999).

Skill and experience

Injuries have been attributed to attempting manoeuvres beyond one's skill level, before the fundamentals of trampolining have been mastered.

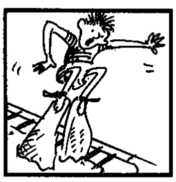
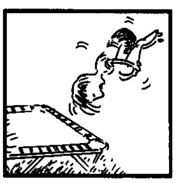
Sharing a trampoline

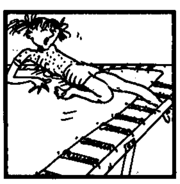
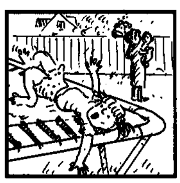
Only one person should use the trampoline at a time, multiple users risk collision and are in danger of causing the other user to fall on or from the trampoline. Multiple persons on a trampoline constitute a misuse of the trampoline (Woodward, 1992).

Discussion

The VEMD shows that for every reported hospital admission (N=228) there are at least 5 ED presentations (presentation to the ED and not admitted, and presentations to the ED and admitted being mutually exclusive). Hume et al. (1996) report that in NZ for every 1 hospital admission there are approximately 12 ED attendances. In Victoria the number of injuries presenting to general practitioners is unknown.

Trampoline related cervical spine injuries have been reported in the US and Denmark (AAP, 1999; Torg & Das, 1984; Silver et al, 1986; Hammer et al,

1982). In the US, a survey by the National Athletic Injury/Illness Reporting System (NAIRS) showed that between 1973 and 1975, permanent paralysis from spinal cord injuries resulted more frequently from trampoline injuries (n = 15) than from any other gymnastic sports and, next to football, trampolines were found to be the highest cause of permanent paralysis (Torg & Das, 1984). In Germany 25 cases of cervical quadriplegia due to trampoline and mini trampoline injuries were reported between 1967 and 1977. Only two spinal cord injuries have been reported to the Australian Spinal Cord Injury Register (ASCIR) during the 1986 to 1997 period, both patients were aged over 18 years. One injury was sustained when lifting the trampoline, the other occurred while using the trampoline.

Trampoline related injury data has fuelled growing international concern regarding the potential injury risk associated with trampoline use, particularly for children. In the US the all age ED presentation rate of trampoline injury has shown a 140% increase from 13/100,000 in 1990 to 31.5/100,000 in 1996 (AAP, 1999). The 1998 data shows a further increase in the ED presentations to 35.2 per 100,000 pa (CPSC, 1999). Injury researchers in the US have called for a ban on the manufacture and sale of trampolines for private recreational use (Smith, 1998), all paediatric use (Furnival et al, 1999) and all recreational, educational and competitive gymnastics (Torg & Das, 1984). These proponents for banning privately owned and used trampolines believe there is no evidence that increased adult supervision, the use of spotters, ensuring trampolines are at ground level, or padding the springs decreases the incidence of injury. They argue that other recreational activities, including gymnastics, can provide children with the same opportunity for enjoyment and physical benefits, but in a safer environment (Smith, 1998; Furnival et al, 1999; Torg & Das, 1984; Smith & Shields, 1998).

Recommendations and guidelines for use

- Trampolines should be considered as sports or gymnasium equipment, rather than viewed as play equipment.
- While some experts recommend that trampolines should only be located in gymnasiums or trampoline centres where there is supervision by trained professionals, this recommendation must be treated with caution since the greater heights achieved on gymnasium trampolines have been linked with cervical (neck) injuries (Silver, Silver & Godfrey, 1986).
- If parents strongly desire a backyard trampoline, the following recommendations should be followed:

Backyard, recreational use

Environment
- Provide a fence of not less than 1.5 metres in height to prevent unsupervised access. Clearance of 2.5 metres around the trampoline is necessary so that, should a user fall from the trampoline they do not land on the fence. Fencing should follow the recommendations for swimming pool or spa fencing that include self locking, self latching gates (Australian Standard 1993 swimming pool safety – fencing for swimming pools. AS 1926:1993)
- Clear the area around the trampoline of obstacles such as concrete, bikes or rocks
- Provide a loose fill, impact attenuating surface such as tan bark for a distance of 2.5 metres around the trampoline; surfacing should be 20 cm deep (Australian and New Zealand Standard for Playground Surfacing – Specifications, requirements and test methods. AS/NZS 4422: 1996)
- Cover the steel frame and springs of all trampolines with safety pads
- Ensure trampolines are secure so young children are unable to handle or move them

Practice – trampoline owners
- Regularly check the condition of the trampoline for tears, rust or detachments and weakening related to sun exposure
- Use backyard trampolines only with the strict supervision of an adult
- Ensure the presence of spotters to warn the trampoline user if they are moving off centre of the mat
- Avoid distracting trampoline users

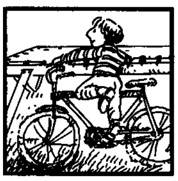
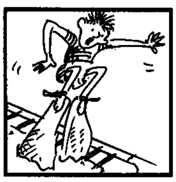
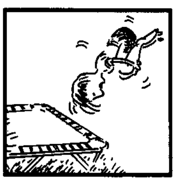
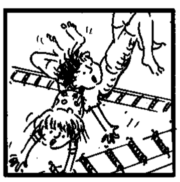
Practice – trampoline users
- Do not attempt or allow somersaults. Inverted manoeuvres should only be attempted under trained adult supervision
- Ensure only one user is on the trampoline at any one time
- Keep to the centre of the mat and face the end of the frame when trampolining. Focus eyes on the trampoline as this will help control the bounce
- Avoid climbing under the trampoline when it is likely to be used
- Climb on and off the trampoline rather than jumping on or off

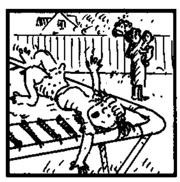
Professional/Instructional

- Use a harness for difficult tricks and manoeuvres, and only those achieving an appropriate skill level should attempt such tricks and manoeuvres
- Follow a program of progressive learning
- Use full sized trampolines
- Place mats on the ground around the trampoline
- Ensure that there is only one person on the trampoline at a time

Above recommendations adapted from the available literature, particularly Routley (1992) and Larson & Davis (1995) and the Australian Gymnastics Foundation.

The International Society for Child and Adolescent Injury Prevention (ISCAIP) recently proposed a draft policy statement that calls for a ban on the manufacturing and sale of trampolines. ISCAIP argues that trampolines are inherently dangerous despite design, environmental or behavioural modifications outlined in Standards for trampolines, and represent a known risk to children who are more likely than adults to use trampolines. In addition, children are less able to judge the element of risk, identify their own ability to manage the risk, or make an informed decision about their options.

Standards for trampolines are in place in the US, NZ, Britain, Europe, Germany and South Africa. Researchers at the NZ Injury Prevention Research Unit in Dunedin conclude that it is sufficient to have Standards for trampolines as opposed to banning. Their research showed an increase in the all-age rate of hospital admission due to trampoline related injuries from 3.1 per 100,000 in 1979 to 9.3 in 1988 (Chalmers, Hume & Wilson, 1994; Hume, Chalmers & Wilson, 1996). Despite this initial increase, Chalmers states (personal communication, 1999) that the admission rate for trampoline related injuries in NZ has plateaued in recent years at approximately 9-10 per 100,000 all age admissions per year (note: this rate exceeds the US hospitalisation rate of 2 per 100,000 persons (<=18 years) pa (Smith, 1998) see Table 1). The reluctance of the NZ researchers to support a ban on trampolines is influenced by a number of factors. These include the relatively low incidence rate of trampoline related injuries, the apparent effectiveness of the existing Standard in stabilising the upward injury trend, the few cases of serious head or neck injury, the growing popularity and recognition of trampolining as a sport, and the strict use of appropriate countermeasures. As an adjunct to the NZ Standard, recommendations have been made against the use of trampolines as play equipment (Hume, Chalmers & Wilson, 1996).

Regulation

The development of an Australian Standard is proposed to facilitate the design, behavioural and environmental changes required to reduce trampoline injuries. Such a development, as opposed to a ban, is considered appropriate due to the relatively low incidence of severe trampoline injuries, and incidence of moderately severe injuries requiring hospitalisation (4.1 per 100,000 persons pa and 18.6 per 100,000 children (0-14 years) pa) in Victoria.

As with trampolines, injuries associated with, for example, bicycles, playground equipment and horse riding can potentially result in severe and life threatening injuries. However, bans have not been recommended. The consequences of such injuries include hospitalisation, long term care and a potential negative impact on quality of life. Victorian hospital admission (VIMD) average annual rates for injuries associated with these other recreational activities for children (0-14 years) in the period 1996-1988 were 69.5, 15.5 and 109 per 100,000 respectively. While no calls are made by local or international injury researchers to ban these recreational activities, recommendations are made for use of protective equipment, behavioural modifications, development of Standards and public education and awareness.

Banning of the manufacture and sale of trampolines does not address the problem of the trampolines already in suburban back yards. Similarly, safety education and raised public awareness alone do not address the issue of availability, appropriateness and adequacy of either warnings or instructions accompanying trampolines, or the recommendation for mandatory trampoline padding at the time of sale. Standards set out technical specifications or other criteria necessary to ensure that a material or method will consistently do the job it is intended to do and, while voluntary Standards have little legal weight, they set minimum practice requirements (www.wssnet/WSSN/gen_info.html).

In 1997, a NZ Standard for trampolines was developed, based on the US ASTM F381:95 Standard for trampolines, including a number of amendments. A plateauing of trampoline injuries in NZ (1988-1996) is attributed to the development and implementation of this trampoline Standard.

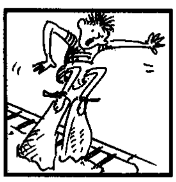
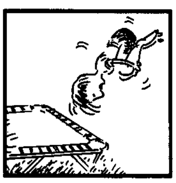
It is proposed that Australia adopt the 1999 version of ASTM F381:99 (which includes some but not all of the NZ Standard amendments), and that this new Standard should incorporate the remaining NZ amendments. In the current climate of harmonisation of Australian and NZ Standards, this should be a relatively simple process. The ASTM and NZ Standards clearly state appropriate design, environmental and behavioural countermeasures to limit the risk and severity of injury eg. width of pads which adequately cover the suspension system and testing of padding to impact peak force. One issue for further consideration is the inclusion of a ladder as part of the integral structure of the trampoline.

A voluntary trampoline Standard provides the opportunity for industry to make necessary changes to future practices to maximise safety of trampolines without prohibitive expense to either the industry, the consumer or Standards Australia. A Standard would also act as a guide to owners to retrofitting safety features to existing trampolines.

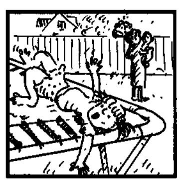
Additional factors which could be considered by a Standards committee are the functional characteristics of trampolines and the interaction between the size and weight of the user and making a distinction between domestic and sports trampolines in relation to bounce heights, size, mats and springs.

Public education and safety awareness are key elements of the introduction and enforcement of a Standard for trampolines. The profile of trampolining as a sport will soon be raised when trampolining becomes an official sport at the 2000 Sydney Olympic Games and hence this profile could be opportunistically used to raise support for a trampoline Standard.

Because of the lag time to implement a voluntary Standard and conforming trampolines to be in place, an educational program should be targeted at improving the safety of existing trampolines. The effectiveness of a voluntary Standard and the market place in reducing trampoline injuries should be monitored. If it is ineffective, a mandatory Standard and further attention to safe design should be considered.





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Acknowledgments

Karen Ashby for assistance with this article, Voula Stathakis for data extraction and Maria Corbo for background research.

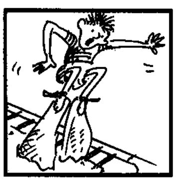
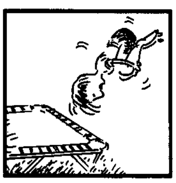
Database descriptions

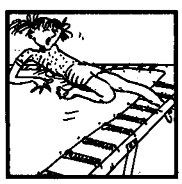
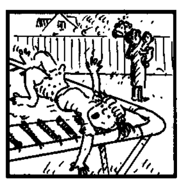
• ***Victorian Emergency Minimum Dataset (VEMD)***

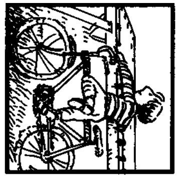
The electronic VEMD records details of injuries treated at the emergency departments of 25 major public hospitals (see page 15). The total number of cases on the database to February 2000 was approximately 711,000. For most hospitals the period 1996-99 is covered. The injury variables collected include injury cause, location, activity, nature of main injury, body region, human intent and a narrative describing the injury event. VEMD hospitals represent approximately 80% of statewide emergency department presentations. However, a MUARC study found that the VEMD captured only 82% of possible VEMD presentations. The data provided to MUARC does not include all ED presentations, only injury specific cases. Hence it is not possible to analyse any VEMD data which may have been re-categorised to a non-injury grouping. Trampolines are identified from the text narrative. A survey of 4 sites found descriptive narratives complete and useful in only 14.1% of narratives (Ozanne-Smith, Ashby, Stathakis and Chesterman, 1999).

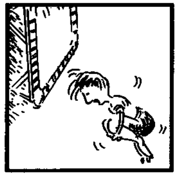
• ***Victorian Inpatient Minimum Database (VIMD)***

The VIMD contains information on admissions to Victorian hospitals over an 11 year period – July 1987 to June 1998, however trampoline injury has only been identifiable since July 1996. For most of the period covered, the data was collected by Health Computing Services Victoria under the direction of Human Services Victoria. Detailed information on hospital admissions, from admission to discharge, is collected. The information on the nature of injury is based on the diagnosis by physicians. MUARC has access to those records which involve injury and poisoning. In this and earlier editions of *Hazard* admission data based on the ICD 9 version of coding has been used. However, from July 1998 ICD version 10 has been applied in hospitals.



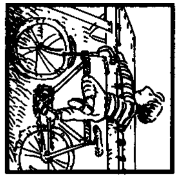


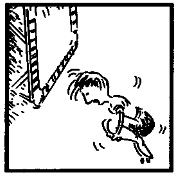


Trampoline related injury data sources

Source and date	Study design	Sample size	Location at time of injury	Types of injury	Body region injured	Severity of injury	Mechanism of injury
Victorian Emergency Minimum Dataset (VEMD) Oct 1995-Oct 1999	ED presentation surveillance data to 25 public hospitals in Victoria	n=1355 children < 15 yrs, represents 0.81% of all child injuries n=120 adults, represents 0.025% of all adult injury	78% home 13% missing or unspecified 4% sports/rec. centre 5% other	36% fractures (78% of the upper limb) 22% sprains/strains 12% open wounds	41% upper limb 22% lower limb 19% head/neck	83% discharged home (58% required medical follow up) 16% admitted (77% were for fractures)	60% falls < 1 metre 13% falls > 1 metre 9% struck or collision with another person
Original Victorian Injury Surveillance System Database (VISS) 1989-1991 **Routley, 1992**	ED presentation surveillance data to 7 campuses of 5 public hospitals in Victoria	N=452 children<15 yrs	84% home 4% school	37% fractures 20% sprains/strains 15% cuts or lacerations	40% upper limb 26% lower limb 23% head	15% admitted (70% for fractures, 7% for concussion)	31% falls< 1 metre 21% falls > 1 metre
Victorian Inpatient Minimum Database (VIMD) July 1996 to June 1998	Statewide public hospital admission surveillance data in Victoria	N= 358 children 0-14 yrs N= 20 adults 15-84 years Hospitalisation rates*: All age 4.1 0-14yrs 18.6 *Rates per 100,000 pa	60% unspecified 34% Home	80% fractures 9% intracranial inj. (no skull fracture) 6% open wound	74% upper limb 13% head/face 9% lower limb 0.3% spine/back	Length of hospital stay: 82% <2 days 18% 2-7 days 0.3% 31+ days	
Princess Margaret Hospital (PMH) for Children Western Australia 1998	ED injury presentation surveillance data at PMH, estimated to treat 45% of paediatric WA injury related admissions	N=152 for 0-14 yrs old, represents 1.5% of all child injury					
Queensland Injury Surveillance Unit (QISU) 1998 to 1999 **Hockey & Horth, 2000**	ED presentations in 13 Queensland hospitals	ED presentation rates*: 5-14 yrs 158 *Rates per 100,000 pa	93% home	40% fractures (mostly arm) 24% sprains/strains 11% open wounds	35% forearm/elbow 19% head/face	19% admitted	More than ¾ falls
Dutch Injury Surveillance System (LIS), Netherlands 1992-1996	Representative sample of injury presentations from 16 Dutch hospital ED's	n=78 children injured	69% sports hall/gym 4% playground 2% rec/holiday accommodation 1% home				
Home Accident Surveillance System including Leisure activities (HASS and LASS), United Kingdom 1997	ED presentation surveillance data at 18 UK hospitals	Count Nat. Est. HASS 68 1,340 LASS 296 5,834					

National public hospitalisation and mortality data (Ministry of Health Information Service), New Zealand 1979-1988 **Chalmers et al. 1994**	Descriptive epidemiology study of trampoline related injury and hospital admission.	n= 2098 admissions Age / Frequency / Rate* 0-4 yrs 247 9.7 5-9yrs 818 30.3 10-14yrs 787 26.5 15-19yrs 157 5.1 All age hospitalisation rates*: 1979 3.1 1988 9.3 *Rates per 100,000 pa	71% home 12% school 8% park 5% public building 4% holiday place	68% fractures 12% intracranial 6% sprains 4% contusions 3% open wounds	53% upper limb 22% lower limb 16% head 7% trunk	2 deaths – both <20 yrs, disabled, in residential care and unsupervised when injured. Possibly struck frame. Length of hospital stay: 42% for 1 day 17% for 2 days 41% for 3 or more days	92% all injuries were falls 80% falls off trampoline 5% collisions 3% over exertion
Dunedin Hospital Emergency Department Presentations May 1989 to April 1990 **Hume et al. 1996**	ED presentations to a large city hospital identified via searching free text descriptions of hospital records	n=114 95% aged <20y.o. 0.5% of ED presentations All-age ED presentation rate*: 108 *Rates per 100,000 pa		40% sprains/strains 22% fractures 17% lacerations 10% contusions	46% lower limb 22% head/neck 17% upper limb	3% admitted 27% treated, further medical review required 62% treated no further treatment	33% falls from one level to another 11% collisions
NEISS Data Highlights – 1998, **Consumer Product Safety Review 1999**	Representative sample of injury presentations from 101 hospital ED's across the US	n=2,424 Estimated ED rates* 1998: 0-4 years 35.2 5-14 years 169.2				1.4% admitted	
National Electronic Injury Surveillance System (NEISS) 1991-1996, Consumer Product Safety Commission (CPSC) 1996, and National Paediatric Trauma Registry (NPTR) July 1988 to June 1996 **US American Academy of Pediatricians (AAP) 1999**	Representative sample of injury presentations from 101 hospital ED's across the US (NEISS & CPSC) Trauma cases treated in a set of paediatric trauma centres or children's hospitals with a paediatric trauma unit (NPTR)	All age ED presentation rate*: 1990 13.0 1996 31.5 Child (0-18yrs) hospitalisation rate: 1990-1995 2.0 *Rates per 100,000 pa	NEISS: 65% Home (1991) 54% Home (1996)	NEISS: 40% sprains/strains 30% fractures 13% contusions and abrasion 11% lacerations 6% other	NEISS: 45% lower limbs (mainly sprains & strains) 30% upper limb (mainly fractures) 14% head/face	NEISS: 2% admitted, of these 90% were fractures CPSC: 6 deaths 1990-1996	
University of Utah School of Medicine and Primary Children's Medical Centre, Salt Lake City, Utah, US November 1990 – November 1997 **Furnival et al. 1999**	Retrospective medical record review of all paediatric trampoline injuries presenting to ED	n=727	99% home 1% school/gym	Children who fell off trampolines were more likely to have fracture than other injury. RR=1.34, p=0.0007		17% admitted, 9 to Intensive Care Mean hospital stay =2 days 19% admissions> =3 days	66% falls on trampoline 28% falls off trampoline 16% tricks and manoeuvres 4% imaginative mechanisms
Canadian Hospital Injury Reporting and Prevention Program (CHIRPP) 1996	ED presentation surveillance data to 16 hospitals across Canada (10 paediatric and 6 general hospitals)	n=393 60% injured were male	69% home 12% school 6% sports facility 2% camping ground	42% fractures 28% sprain/strain 20% bruise or contusion 3% cut/laceration 2% dislocation	19.3% ankle 13.7% forearm	9.4% admitted 45.5% seen in ED and discharged home 43.3% discharged home, required medical follow up	42% falls/landed hard while on trampoline 21.4% >1 person on trampoline 17.6% fell off trampoline 9% collision







Shopping trolley update: The Australian/ New Zealand Standard AS/NZS 3847.1:1999

Wendy Watson[1]

In January last year, Standards Australia published a new Standard for shopping trolleys (AS/NZS 3847.1:1999). The objective of the Standard is "to provide manufacturers, retailers and others with minimum design, safety and performance requirements for shopping trolleys for carrying goods while ensuring a level of protection against injury" (Pontoni, 1997).

While anyone who has had to use a supermarket trolley has experienced problems with manouveurability, one of the major issues relating to shopping trolleys is the risk of injury to children. The Monash University Accident Research Centre has estimated that, in Australia, there are at least 1,000 injuries associated with shopping trolleys in children aged 0-4 years annually. Of these, some 180 are hospitalised.

Injury surveillance data shows that falls from shopping trolleys are among the leading causes of head injuries to young children. About half of these were serious injuries such as concussion and fractures (CPSC, 1997). Hospital emergency room data from the United States also indicates that, while there has been a decline in other hazard patterns associated with shopping trolleys over the years (probably due to better design), there has been a significant increase in the estimated number of fall injuries between 1985 and 1996 (CPSC, 1997).

Carrying small children in the seating provided for that purpose in shopping trolleys is hazardous without proper restraints. US data indicates that 51 percent of all falls from shopping trolleys occur from the seat provided. Consequently, at least two US States, Texas and New York, require shopping cart manufacturers to equip every new cart sold and distributed in their state with safety straps.

The risk of falling from a conveyance varies with the child's developmental stage with the peak age for theses injuries between one and three years (Ashby, 1995). Babies who are unable to sit up unaided should not be placed in child seats but in a reclining "baby capsule" type of carrying facility with appropriate means of preventing them from rolling out (eg velcro waist restraint). Babies, capable of sitting unaided (from around 8 months) but yet unable to stand require, at minimum, a means of preventing them from rolling about in the child seat (an easily adjustable waist strap attached to the seat behind the child at a height above the waist which prevents sideways movement). For babies and children who are able to stand or walk (those most at risk), the most effective restraint is a full shoulder harness (as specified in the Australian Standard, AS 3747-1989 : Harnesses for use in prams, strollers, and high chairs), which prevents the child from standing up in the seat.

A full safety harness provides an effective restraint for children at all stages of development from about 8 months to about age 3-4 years. While such a requirement was considered too prescriptive for the Standard, it seemed reasonable that a minimum performance Standard should be applied. A performance Standard sets out what a product is required to do without prescribing the details of how it is to be achieved, allowing scope for innovation in design. The Standards Committee has included in the Australian/New Zealand Standard, a requirement that a shopping trolley with a child carrying facility provide "an integral means of restraining a child in the child carrying facility". From about 8 months of age then, a harness that prevents the child from moving about or standing up in the seat is necessary.

While the Standard is not mandatory, there appears to be increasing industry support for the introduction of safety restraints in shopping trolleys. Recent developments in safety restraints designed specifically for shopping trolleys have overcome some of the retailers' earlier objections. Current designs are durable, easily fitted and cleaned, weather and theft resistant and easily adjustable.

A recent industry seminar (Ausmart International, 1999) also highlighted the need for a total safety program in this area. It provided information on legal duties and obligations of retailers in regard to shopping trolley safety, the selection of an appropriate harness, the provision of warnings on the shopping trolley and in the store and the need for an ongoing, documented maintenance program. It also highlighted the need for employee education as well as promoting awareness and safe behaviour in consumers.

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[1] *Wendy Watson is a Monash University Accident Research Centre Research Fellow*

Special Acknowledgments

Professor Terry Nolan founded the Victorian Injury Surveillance System (VISS) in 1988, at the Royal Children's Hospital, Melbourne. As VISS Director, Terry developed regional child injury surveillance, based in four Melbourne paediatric and general hospitals. Terry attracted funding to develop the system, implemented the child collection and established its utility by immediately solving child injury problems identified from the data. Further development of an all age injury surveillance system was entrusted to MUARC in 1990.

Since then, Terry has continued to provide expertise, sound advice and advocacy as Assistant Director (child injury) of VISS and as a member of the VISS Executive and the *Hazard* editorial board. He will step down from these formal roles from March 2000, although he maintains an active interest in child injury prevention.

It is a tribute to Terry's vision that the original VISS objectives remain relevant in the year 2000 and beyond. VISS is extremely grateful for these many years of invaluable support and commitment.

Virginia Routley coordinated the VISS output functions from her appointment in 1991 until early 2000. She has applied skill and wisdom to ensuring that relevant injury data and information have been disseminated to those who can best use it for injury prevention, particularly government, the health and education sectors, industry and the media. In addition, she has completed applied research studies within VISS to underpin designs to prevent motor vehicle exhaust gassing suicides and in adult poisoning epidemiology. Following her recent completion of requirements for her Masters of Public Health, Virginia is leaving VISS to focus on her injury prevention research interests, though still at MUARC. Karen Ashby, who will replace Virginia as VISS coordinator, has developed high level skills and knowledge under Virginia's excellent leadership.

Database of expertise in product safety & safe product design goes 'on-line'

The Victorian Office of Fair Trading and Business Affairs and the Victorian Department of Human Services has commissioned the Monash University Accident Research Centre to establish an electronic, Australia-wide database of persons and organisations with expertise in consumer product safety and safe design of products. Included in the database are national and international experts with knowledge in, for example: children's toys; buildings; electrical appliances; medical equipment; medications/drugs and motor vehicles/parts. The database is aimed at government, industry, researchers and all others involved in the design of consumer products, the setting of Standards, quality control, "accident" investigation and injury research and prevention.

To search the database or to add your name, please point your browser to
http://www.general.monash.edu.au/muarc/cps/prodsafe.htm

MUARC News

PREVENTING WOMEN'S INJURIES IN THE HOME IN VICTORIA
(MUARC Report No. 158)
Erin Cassell, Joan Ozanne-Smith

This report documents the size and pattern of women's injury in the home in Victoria at all levels of severity and discusses the epidemiology of the major causes: falls, self-inflicted injury, accidental poisoning, cutting and piercing injury, assaultive injuries, hit/struck/crushed injuries and burns and scalds. A range of specific countermeasures are proposed for each of these injury problems including design modification to the home and domestic equipment, action by Standards Australia and government regulatory bodies, the development and promotion of protective equipment and safer behaviours in the home, transfer of safe practices from the workplace to the home, and community and school education and safety promotion projects.

Report can be obtained from MUARC @ $20 per copy. Phone: (03) 9905 4371; email: muarc.enquire@general.monash.edu.au; or MUARC website:
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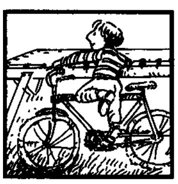
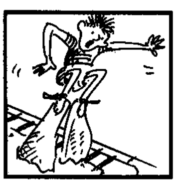
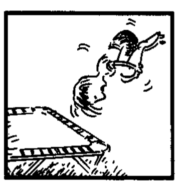



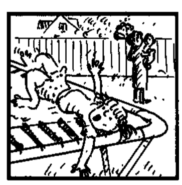

General Acknowledgements

Participating Hospitals

From October 1995
Austin & 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
The Northern Hospital
Royal Children's Hospital
St Vincents Public Hospital
Wangaratta Base Hospital
Warrnambool & District Base Hospital
Western Hospital
Williamstown Hospital
Wimmera Base Hospital

From November 1995
Dandenong Hospital

From December 1995
Royal Victorian Eye & Ear Hospital
Frankston Hospital

From January 1996
Latrobe Regional Hospital

From July 1996
Alfred Hospital
Monash Medical Centre

From September 1996
Angliss Hospital

From January 1997
Royal Melbourne Hospital

Coronial Services

Access to coronial data and links with the development of the Coronial's Services statistical databse are valued by VISS.

National Injury Surveillance Unit

The advice and technical back-up provided by NISU is of fundamental importance to VISS.

How to Access VISS Data:

VISS collects and tabulates information on injury problems in order to lead to the development of prevention strategies and their implementation. VISS analyses are publicly available for teaching, research and prevention purposes. Requests for information should be directed to the VISS Co-ordinator or the Director by contacting them at the VISS office.

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Monash University WEB SITE Accident Research Centre

Recent issues of *Hazard*, along with other information and publications of the Monash University Accident Research Centre, can be found on our internet home page:

http://www.general.monash.edu.au/muarc

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