
A joint initiative of the

State Coroner’s Office
&
Department of Human Services

Compiled by Lyndal Bugeja
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<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAP</td>
<td>American Academy of Pediatrics'</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>CPR</td>
<td>Cardio Pulmonary Resuscitation</td>
</tr>
<tr>
<td>CPSC</td>
<td>Consumer Product Safety Commission</td>
</tr>
<tr>
<td>CSC</td>
<td>Coronal Services Centre</td>
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<tr>
<td>DHS</td>
<td>Department of Human Services</td>
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<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>LCMS</td>
<td>Local Case Management System</td>
</tr>
<tr>
<td>MUARC</td>
<td>Monash University Accident Research Centre</td>
</tr>
<tr>
<td>NCIS</td>
<td>National Coroners Information System</td>
</tr>
<tr>
<td>NISU</td>
<td>National Injury Surveillance Unit</td>
</tr>
<tr>
<td>RMIT</td>
<td>Royal Melbourne Institute of Technology</td>
</tr>
<tr>
<td>SCO</td>
<td>State Coroner’s Office</td>
</tr>
<tr>
<td>SQL</td>
<td>Structured Query Language</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
</tr>
<tr>
<td>VAED</td>
<td>Victorian Admitted Episodes Database</td>
</tr>
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<td>VCFS</td>
<td>Victorian Coronial Facilitation System</td>
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<tr>
<td>VEMD</td>
<td>Victorian Emergency Minimum Dataset</td>
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<td>VIFM</td>
<td>Victorian Institute of Forensic Medicine</td>
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# Acknowledgements

## Steering Committee

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<tr>
<th>Name</th>
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<tr>
<td>Graeme Johnstone</td>
<td>State Coroner</td>
<td>SCO</td>
</tr>
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</tr>
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<td>MUARC</td>
</tr>
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</tr>
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<td>Rick Roberts</td>
<td>Principal Registrar</td>
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</tr>
<tr>
<td>Rowland Watson</td>
<td>Team Leader, Healthy Living Strategies</td>
<td>DHS</td>
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</table>

## General Acknowledgements

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<thead>
<tr>
<th>Name</th>
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<tr>
<td>Karen Ashby</td>
<td>VISAR Co-ordinator / Research Fellow</td>
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<tr>
<td>Kerry Johannes</td>
<td>Library Manager</td>
<td>VIFM</td>
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EXECUTIVE SUMMARY

An Injury Prevention Research Officer position, funded by the Public Health Group of the Department of Human Services (DHS), was established at the State Coroner's Office (SCO). The purpose of this position was to undertake a number of projects across a range of topic areas relating to unintentional injury death.

This current study examined unintentional deaths resulting from falls of children aged 0-14 years in Victoria between 1989 and 2002. The purpose of the study was to identify and examine the factors associated with fatal injury from falls. Of particular interest were issues such as the role of recreation / play, the relationship between fall height and injury and the location of the fall.

During the 14-year study period there were 26 deaths. An analysis of these deaths revealed that:

- 62% (n=16) were male;
- 42% aged 0-4 years (23% < 1 year and 19% 1-4 years); 27% aged 5-9 years; and 31% aged 10-14 years;
- 44% (n=11) occurred between 3:00-6:00 pm;
- 58% (n=15) occurred on weekends;
- 64% (n=17) occurred in the home;
- 46% (n=12) were engaged in leisure activities;
- 45% (n=9) of direct fall deaths occurred from a height between 1 and 3 metres; and
- ~70% (n=18) deaths resulted from a head injury.

It was found that fatal falls of children were rare events in comparison to all unintentional injury deaths and non-fatal fall injury. A review of the literature on non-fatal fall injury found that falls is the leading cause of emergency department presentations and hospital admissions in Victoria, Australia and in some overseas countries. Comparisons were made between fatal and non-fatal fall injury by age group and it was found that the circumstances surrounding both fatal and non-fatal falls varied according to the child's age and location.

Fatal falls of infants and young children primarily occurred in the home while they were sleeping, being cared for or were playing. In these cases, the fall height was often less than three metres and the child died from a head injury. Deaths of older children were more common in public spaces during informal recreation activities. In these cases the falls were from a greater height and also resulted in fatal head injuries.

A number of prevention strategies were identified from the literature in relation to promotion of best practice, review of legislation and increases in child safety awareness. In addition to these strategies, the current study identified the need for infants to be placed in age appropriate sleeping devices to ensure they do not roll off adult sized beds or other furniture onto the floor, as it was demonstrated that a relatively short fall can be fatal for very young children.
INTRODUCTION

This report presents the findings of an examination of deaths of children aged 14 years and under that resulted from a fall in Victoria between 1989 and 2002. This report is part of a joint project of the Department of Human Services (DHS) and the State Coroner's Office (SCO) to investigate the causes of unintentional deaths of Victorians for the purposes of future injury prevention.

Previous Research

Australian

Steenkamp and Cripps (2001) conducted a study into fall-related death and injury among children aged 0-14 years in Australia. The aim of the study was to describe the epidemiology of fall-related injury among children using the following data sources:

- death data from the Australian Bureau of Statistics (ABS) for the period 1979-1998 (national data);
- hospital separations data from the Australian Institute of Health and Welfare (AIHW) for the period 1993/94 to 1997/98 (national data); and
- emergency department data from the Monash University Accident Research Centre (MUARC) for the period 1 July 1996 to 30 June 1998 (Victoria only).

The study also aimed to report on data issues in relation to the above-mentioned data sources.

Steenkamp and Cripps (2001) reported that childhood falls were rarely life-threatening, consisting of 1.1% (n=225 of 20,193) of unintentional fall deaths across all age groups in Australia between 1979 and 1998. It was also reported that unintentional falls accounted for 2.3% (n=9,974) of deaths from all external causes in children, making falls the sixth leading cause of death over the 20 year period (Steenkamp & Cripps, 2001). On average, this represented 11 deaths per year. Overall, it was found that males accounted for two thirds of the deaths (65.8%, n=148). One hundred and seven (47.6%) of the deaths occurred in the 0-4 year age group, 45 (20%) deaths occurred in those aged 5-9 years and 73 (32.4%) occurred in 10-14 year olds for the period 1979 to 1998 (Steenkamp & Cripps, 2001).

Steenkamp and Cripps (2001) found that in 45% of deaths, the mechanism of the fall was from one level to another and in 27% of deaths the mechanism of the fall was out of a building or other structure. Death rates for the States and Territories were found to be consistent with the national average. Over the study period it was found that death rates for falls in NSW, Victoria and Queensland decreased (Steenkamp & Cripps, 2001).

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In terms of non-fatal injury, falls were found to be the leading cause of hospitalisation among children in the category of injury and poisoning, accounting for 38% of all hospital admissions (Steenkamp & Cripps, 2001). While the 0-4 year age group accounted for the largest number of deaths, the 5-9 year age group accounted for the largest number of hospital admissions (40%, n=10,328 compared with 29% n=7,244 for 0-4 age group). The 10-14 year age group represented a similar proportion to the deaths (~31%, n=7,829). The most common injuries sustained were fractures to the radius and ulna. While it was found that head injuries (intracranial and skull fracture)
were common, Steenkamp and Cripps (2001) reported that the nature of injury was related to age, gender and the circumstances leading up to the fall.

Hospital emergency department data from Victoria illustrated that falls represented a large number of injury presentations. For the two-year study period, 42% of injury presentations were due to falls. The location of the fall differed between the age groups. For the 0-4 year age group, most injuries occurred at home (78%), compared with 47% for the 5-9 year age group. Fall height also differed according to age group where it was found that 0-4 year olds presented to emergency departments due to a fall from low height (~90%) where 5-9 year olds presented following high and other types of falls.

Across all levels of severity, Steenkamp and Cripps (2001) found that numbers and rates of falls were higher for males than females. This difference was most distinct in the 10-14 year age group, particularly in sports-related falls. Steenkamp and Cripps (2001) argued that these differences might reflect higher risk taking behaviour in males and higher participation rates in sports.

From the analysis of deaths, hospital admissions and emergency department presentations, Steenkamp and Cripps (2001) made the following findings:

- falls amongst children are numerous, but rarely life-threatening;
- a number of children had more serious outcomes following falls;
- the outcome of the injury sustained was associated with children's age and gender;
- the circumstances leading to injury were associated with age and gender; and
- the height of the fall was important to the injury outcome.

Steenkamp and Cripps (2001) concluded that it was necessary to target fall-related injury research and interventions. The following fall-related action areas were proposed:

- furniture / nursery items (e.g. nursery furniture, beds, bunk beds, chairs, tables, and baby walkers);
- recreation / sports (e.g. small wheeled equipment, bicycles, play equipment, sport and sport activities);
- structural aspects of the environment (i.e. stairs and steps for 0-4 and 5-9 year olds); and
- other (i.e. falls from heights resulting in death)

Steenkamp and Cripps (2001) also concluded that it was necessary to monitor the work being undertaken in specific areas of fall-related injury and how such work is progressing. The impact of fall-related injury with more severe outcomes needs to be assessed and the data available for monitoring the incidence of fall-related injury can be improved.

The National Injury Prevention Plan: Priorities for 2001-2003 (the Plan) was prepared by the National Injury Prevention Advisory Council (NIPAC) for implementation by Australian Governments and the non-government sector (Strategic Injury Prevention Partnership (SIPP), 2001). The Plan aimed to decrease the incidence, severity, mortality and morbidity associated with injury in Australia and identified four priority areas for immediate action:
• falls in older people;
• falls in children;
• drowning and near drowning; and
• poisoning among children.

Falls in children was chosen as a priority as they represent a substantial burden of injury and cost to the health system (SIPP, 2001). In addition there is evidence to suggest that many childhood falls are preventable and proven interventions exist that are likely to reduce the incidents and severity of falls (SIPP, 2001).

SIPP (2001) reported that unintentional falls were the leading cause of hospitalisations in Australia, representing 38% of all injury cases in the 0-14 year age group in 1996/97. Falls were also responsible for 11 deaths of 0-14 year old children in Australia during 1997. The main locations for falls among children are at a home (49%) and at places for recreation and sport (29%) (SIPP, 2001).

SIPP (2001) identified factors involved in the occurrence of falls and fall injuries. These include: children's physical, cognitive and social development; the physical environment; and product design. Factors found to be prevalent in fall injury cases presenting to Emergency Departments included:

• 0-4 years:
  - nursery furniture;
  - falls on the same level;
  - falls onto furniture; and
  - falls down stairs.

• 5-14 years:
  - playground equipment;
  - bicycles;
  - sport;
  - bunk beds and other furniture;
  - trampolines;
  - in-line skates;
  - roller skates; and
  - skateboards.

In relation to interventions and strategies SIPP (2001) reported that product safety standards, promotion of standards and safe practices have proven effective in improving safety outcomes. Other strategies identified by SIPP (2001) included:

• review legislation that impacts on the safety of children;
• improve and strengthen product and environmental design and standards;
• increase child safety awareness through promotion and educational activities;
• develop interventions targeted at children's stage of development;
• include child safety competencies in education and training of child care and education workforce;
• implement risk management strategies in care settings;
• respond to special needs communities such as rural and remote, indigenous, disable and culturally and linguistically diverse backgrounds
- improve knowledge in fall prevention and falls management training and education for those who work with children; and
- organisational changes in sport such as improved environments and modified rules.

Ashby and Corbo (2000) conducted a study into injuries from child falls in Victoria. It was reported that unintentional falls were the leading cause of non-fatal child injury, representing 41% of all child hospital admissions and 42% of emergency department (ED) presentations. Non-fatal falls were also the leading cause of child injury hospital admissions nationally, with more than 23,000 admissions recorded in 1996/97.

The overview profiled child falls in Victoria utilising databases at three levels of severity: all deaths from the Victorian Coroner's Facilitation System (VCFS); all public hospital admissions from the Victorian Admitted Episodes Database (VAED); and approximately 80% of state-wide public hospital emergency department presentations from the Victorian Emergency Minimum Dataset (VEMD) (Ashby & Corbo, 2000). Exposure data was obtained from the Australian Bureau of Statistics (ABS) Home Safety Survey of 1999 and the Monash University Accident Research Centre (MUARC) (Ashby & Corbo, 2000).

Fall-related death data was extracted from the VCFS for the period July 1989 to June 1995. Cases were selected by the event leading to injury codes for falls and a text search of narratives for the terms "fall, fell, trip, slip and stumble" (Ashby & Corbo, 2000). The definition utilized included falls involving transport and drowning. Fifty-eight deaths were identified from the VCFS, which represented 11% of all child deaths. Seventy-five percent of the deaths were of children aged 0-4 years. The most common causes of deaths were:
- drowning (43%, n=25);
- other (e.g. horse, cliff, tree, motorcycle, roof and window) (24%, n=14); and
- run-over (tractor/trailer & motor vehicle) (21%, n=12).

Fall-related hospital admissions for the period July 1992 to June 1998 were extracted from the Victorian Admitted Episodes Dataset. During the six-year period there were 26,650 children hospitalised as a result of a fall. The highest number of hospitalisations occurred in the 5-9 year age group, almost 40% of which were due to a fall from playground equipment.

There were approximately 69,883 child fall presentations to participant emergency departments between January 1996 and December 1999. This represented 40% of all child injuries presented during the four-year period. Eighty-four percent of the falls recorded on the VEMD were low falls (i.e. same level) and 12% were over 1 metre.

The most common injuries sustained as a result of a fall by age group were: <1 year olds intracranial injury (17.3%); 1-4 year age group open wound (31%); 5-9 year age group fracture (39.9%); and 10-14 years fracture (36.8%). Across all age groups fracture was the most common injury (31.3%) followed by sprain/strain (17.5%) and open wound (16.5%). For all age groups the home was the most common location of fall-related injury presentations representing 51.1%. Other locations for the older age groups included educational for 5-9 year olds (25.4%) and 10-14 year olds (23%) and area for sport and recreation for 10-14 year olds (24.6%).
Ashby and Corbo (2000) reported that injury causation varied across age groups and were influenced by environmental, developmental, sociological and behavioural factors. It was also reported that products were mostly involved in fall-related injury. VEMD data is summarised in Table 1.

**TABLE 1**
Product-related fall injuries by product, age group, injuries and recommendations (from Ashby et al. (2000))

<table>
<thead>
<tr>
<th>Product</th>
<th>n</th>
<th>Age Group and (rank out of 10)</th>
<th>Injuries</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recreation Items</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>- Bicycles</td>
<td>4,351</td>
<td>- 5-9 (1) - 10-14 (1)</td>
<td>fracture (arm) - open wound</td>
<td>- promote helmets - check bike safety - monitor helmet laws - improve helmet design</td>
</tr>
<tr>
<td>- In-line / roller skating</td>
<td>1,414</td>
<td>- 5-9 (5) - 10-14 (2)</td>
<td>fracture (arm)</td>
<td>- promote use of PPE* - ensure PPE fits - lessons for novices</td>
</tr>
<tr>
<td>- Skateboards</td>
<td>517</td>
<td>10-14 (6)</td>
<td>fracture (arm)</td>
<td>- modify wheels for novices - promote use of PPE - lessons for novices</td>
</tr>
<tr>
<td><strong>Furniture</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Chairs / stools</td>
<td>1,205</td>
<td>- &lt; 1 (8) - 1-4 (1)</td>
<td>open wound - intracranial injury</td>
<td>- discourage play on chairs - use of stable chairs</td>
</tr>
<tr>
<td>- Conventional beds</td>
<td>1,032</td>
<td>- &lt; 1 (1) - 1-4 (3)</td>
<td>open wound - superficial injury - intracranial injury</td>
<td></td>
</tr>
<tr>
<td>- Bunk beds</td>
<td>581</td>
<td>- 1-4 (9) - 5-9 (7)</td>
<td>fracture (arm) - intracranial injury</td>
<td>- mandate AS/NZS 4220:1994 - restrict use of top bunk to older children - restrict use of conventional beds to children over 3 years - minimize gaps and spaces in bunks to AS/NZS - avoid sharp edges and protrusions on bunks - no removable ladders - discourage play on bunk beds</td>
</tr>
<tr>
<td>- Table / bench / counter</td>
<td>1,028</td>
<td>- &lt; 1 (3) - 1-4 (2)</td>
<td>open wound - superficial injury - intracranial injury</td>
<td>- install corner protectors - safety glass on tables - place furniture in low traffic locations - do not place children on benches - discourage play on benches</td>
</tr>
<tr>
<td><strong>Nursery furniture</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>- Industry / regulators</td>
<td></td>
<td></td>
<td></td>
<td>- point of sale information - restraint standard - develop Australian Standards where missing - mandate current voluntary standards where compliance is low - promote compliance to standards - improve design for strollers</td>
</tr>
<tr>
<td>- Consumers</td>
<td></td>
<td></td>
<td></td>
<td>- choose products that meet standards - look for &quot;Safe Baby&quot; tag - don't leave babies on change tables - use five point harness in strollers and high chairs - avoid heavy items on stroller handles - only use baby walkers that comply with US</td>
</tr>
<tr>
<td>- Nursery furniture</td>
<td>860</td>
<td>- &lt; 1 (2,4,6,9,10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playground equipment</td>
<td>ASTM standard</td>
<td>Trampolines</td>
<td></td>
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<td>---------------------------------------------------------</td>
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<tr>
<td>n=6,584 (VAED)</td>
<td>- avoid bouncers on elevated surfaces</td>
<td>adoption of US ASTM F381:99 as a voluntary</td>
<td></td>
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</tr>
<tr>
<td>n=3,819 (VEMD)</td>
<td>- use lifts to transport children in prams and strollers</td>
<td>Australian safety standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 5-9 (2,6,8,9)</td>
<td>- develop safety standard</td>
<td></td>
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<tr>
<td>- fracture (arm)</td>
<td>- develop installation and maintenance guide</td>
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<tr>
<td></td>
<td>- reduce maximum fall height to 1.5 metres</td>
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<td></td>
<td>- use impact absorbing surfaces for fall zones</td>
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<td></td>
<td>- inspect and maintain equipment and surface</td>
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<tr>
<td></td>
<td>- encourage best practice for maintenance and</td>
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<tr>
<td></td>
<td>management of playground equipment</td>
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<tr>
<td></td>
<td>- supervise children on playgrounds</td>
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<tr>
<td>Stairs/ steps</td>
<td>installation of stair guards</td>
<td></td>
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</tr>
<tr>
<td>n=6,225 (VAED)</td>
<td>- minimise change in floor level for new homes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=1,204 (VEMD)</td>
<td>- use non-slip edging</td>
<td></td>
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<td></td>
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<tr>
<td>- &lt; 1 (5)</td>
<td>- install sensor lights at top of stairs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 1-4 (7)</td>
<td>- vertical balustrades to resist climbing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 5-9 (10)</td>
<td>- fracture, head injury, open wound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 10-14 (9)</td>
<td>- play modified versions of sport</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sports</td>
<td>- match children on height and weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=1,491 (VAED)</td>
<td>- inspect playing fields</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=2,837 (VEMD)</td>
<td>- encourage use of PPE</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- 10-14</td>
<td>- coaches have Level 1 accreditation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- sprains / strains</td>
<td>- personal protective equipment (PPE)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- fracture (arm)</td>
<td></td>
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</tbody>
</table>

* personal protective equipment (PPE)

Ashby and Corbo (2000) concluded that behavioural and environmental changes are required to reduce these injuries. Key strategies and tasks recommended to the Commonwealth included:

- promotion of best practice;
- review of legislation;
- increase child safety awareness; and
- ensure that child safety competencies are included in education and training of the childcare and education workforce.

Clapperton, Ashby and Cassell (2003) examined the 2001 injury profile in Victoria at three levels of severity: deaths; hospital admissions; and emergency department presentations. Death data was obtained from the Australian Bureau of Statistics mortality unit record, hospital admissions data was obtained from the Victorian Admitted Episodes Database (VAED), and emergency department presentations data was obtained from the Victorian Emergency Minimum Dataset (VEMD).

Clapperton et al. (2001) reported that in 2001 there were 1,638 injury deaths, 93,208 injury hospital admissions (excluding re-admissions) and 189,735 emergency department injury presentations. Children aged 0-14 years represented 36 of the 1,638 injury deaths, 13,401 of the 93,208 injury hospital admissions and 49,070 of the 189,735 emergency department injury presentations.

Transport was found to be the major cause of injury deaths of children (n=17 of 36) across all age sub-groups in 2001 (Clapperton et al. (2001). Falls were the leading cause of child injury hospital admissions across all age sub-groups, representing 6,048 of the 13,401 admissions during 2001. Falls were also found to be the leading cause of child injury emergency department presentations across all age sub-groups in 2001, representing 19,854 of 49,070 presentations.
From this analysis Clapperton et al. (2001) recommended that:

- a strategic plan for injury prevention in Victoria be developed and implemented;
- further data analysis be undertaken on the major causes of injury identified to identify factors not captured, such as:
  - activities (work, sport and recreation);
  - location (work, home, farm);
  - product involvement; and
  - monitoring trends over time for specific injury types.
- data collection agencies address the issue of missing data.

Ozanne-Smith and Brumen (1996) conducted a study into product-related child fall injury. The aims of the study were to identify products that contributed to falls among children in the domestic environment and playgrounds. Five major datasets were analysed to determine the nature and extent of product-related fall injuries, including identification of the products involved, fall height, injury severity, type, body part affected and the location of injury event (Ozanne-Smith & Brumen, 1996). These datasets were:

- Victorian State Coroner's Office mortality data;
- Victorian Inpatient Minimum Dataset (VIMD) hospital admissions data;
- Victorian Injury Surveillance System (VISS) Emergency Department data;
- Extended Latrobe Valley Injury Surveillance (ELVIS) General practitioner data; and
- National Injury Surveillance Unit (NISU) data to determine differences from Victorian data.

During the three-year period from 1 July 1989 to 30 June 1992, 43 fall-related deaths of children were recorded in the Victorian State Coroner's Office database. Twenty-seven of these deaths were identified as being product related. Seventy-four percent of the deaths were of males, 71% were of children in the 1-4 year age group and 14% were of children aged less than one year. The swimming pool was the product most associated with child product-related fall deaths, accounting for 63% of deaths. Falls from tractors/trailers accounted for 15% and cars accounted for 11%.

Products most frequently involved in fall-related injury across the severity levels were:

- playground equipment;
- stairs and steps;
- bicycles;
- football;
- chairs and stools;
- nursery furniture;
- skates and skateboards,
- conventional beds; and
- fences/fence posts/poles.

The rate of fall injuries to children aged under 15 years resulting in hospitalisation in Victoria showed a significant increase over the period July 1987 to June 1994, with
noticeable increases in the under one year and the 10-14 year age groups. Forty-nine percent of all child fall injuries occurred in the home, followed by the educational settings (19%). Ozanne-Smith and Brumen (1996) concluded that there was an extraordinary amount of action required to thoroughly address the data, research, implementation and evaluation issues identified from their study, which were pertinent to reducing product-related child falls. The results of the study also highlighted the poorly developed state of product safety research and development in Australia and identified the scope and potential strategies for improvement.

**Overseas**

Saluja, Brenner, Morrongiello, Haynie, Rivera and Cheng (2004) examined the issue of caregiver supervision as a strategy to prevent injury in children. Saluja et al. (2004) argued that inadequate supervision is commonly reported as a contributing factor to childhood injury however, no study had examined the relationship between supervision and injury, and progress in the area was limited due to definitional, conceptual and measurement issues.

Saluja et al. (2004) proposed a hierarchy of supervision strategies consisting of attention (visual and auditory), proximity (touching, within reach, beyond reach) and continuity (constant, intermittent, absent) as a conceptual model to measure caregiver supervision (Table 2).

**TABLE 2**

<table>
<thead>
<tr>
<th>Dimensions of caregiver supervision as proposed by Saluja et al. (2004)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attention</strong></td>
</tr>
<tr>
<td>Engagement / Interaction with child</td>
</tr>
<tr>
<td>Visual</td>
</tr>
<tr>
<td>- Focal</td>
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<tr>
<td>- Peripheral</td>
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<tr>
<td>Auditory</td>
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<tr>
<td>- Focal</td>
</tr>
<tr>
<td>- Peripheral</td>
</tr>
<tr>
<td>- Peripheral</td>
</tr>
</tbody>
</table>

It is argued that the dimensions of attention, proximity and continuity define supervisory behaviours and that supervision increases as the dimensions increase (Saluja et al., 2004). The authors also contend that when defining "adequate supervision", other circumstantial factors should be considered, such as:

- developmental stage of the child;
- hazards present in the environment; and
- type of injury to which the child is most susceptible.

Other factors that require consideration are related to caregiver supervision in the context of other injury prevention behaviours such as hazard reduction / elimination and education (Saluja et al., 2004). Saluja et al. (2004) state that caregiver decision making regarding the use of injury prevention strategies is related to their risk perception and more broadly the social, familial, cultural, community and environmental context.

Bull, Agran, Gardner and Laraque (2001) conducted a review of data from the United States (US) Consumer Product Safety Commission (CPSC) to examine the epidemiology of falls from heights (windows, roofs and balconies) in children in
in order to develop strategies for prevention. Bull et al. (2001) reported that each year in
the US, falls is the leading cause of non-fatal injury in children (defined as 15 years
and under) and approximately 140 children die as a result of injuries sustained from a
fall. It was also reported that fatalities result from falls from great height (greater than
6.7 metres or 22 ft) or when the head of the child impacts a hard surface (Bull et al.,
2001).

The data analysed from the CPSC consisted of approximately 4,700 children
examined in emergency departments from falls from windows during 1993. It was
found that 90% fell from the first and second stories and 45% had serious injuries
(fractures, internal injuries, intracranial haemorrhages). It was also found that the
surface where the child landed and the degree to which the fall was broken impacted
on the severity of the injury sustained. From the analysis seven major
recommendations were formulated. These were:

1. pediatricians should give anticipated guidance about prevention of falls from
heights to parents of children who live in multiple-story dwellings;
2. pediatricians should advocate for community-wide programs to encourage the
use of window guards;
3. the American Academy of Pediatrics (AAP) and local pediatricians should
work with manufactures of windows and window guards to encourage them to
develop and make more widely available additional products that can prevent
falls and allow egress in fires;
4. legislation requiring landlords to install releasable window guards or window
stops above the ground floor in multiple-story dwellings where children live
should be developed;
5. building codes should ensure that balconies, decks, porches, bleachers, roofs,
and fire escapes have railings with vertical openings not greater than 4 inches;
6. local communities and recreation departments should develop strategies to
reduce the number of children playing in dangerously high places; and
7. whenever possible, grass or shrubbery should be planted at the bases of tall
buildings to soften the impact surface (Bull et al., 2001).

Other overseas literature focused on the debate surrounding fall height and nature and
extent of injury in the context of falls being unintentional or inflicted. Reiber (1993)
in a study examining fatal fall case reports and previous literature explained that there
are two viewpoints on the subject. One, (the most prevalent viewpoint) is that short
distance falls rarely cause serious injury or death and the other, that short distance
falls have a significant potential for death, (Reiber, 1993). Part of Reiber's (1993)
study included an examination of 19 deaths of children less than six years of age who
allegedly suffered a short distance fall (less than 1.6 metres). Following an analysis of
these deaths, Reiber (1993) grouped the cases as follows:

- evidence of homicidal assault (n=14, 74%);
- inconsistency between history and injury (n=3, 15.5%); and
- consistency between history and injury (n=2, 10.5%).

The two clearly unintentional short fall deaths in Reiber's (1993) study were of
children under two years of age. One fell 1.5 metres from a top bunk onto carpeted
floor, which resulted in intracranial injury with no skull fracture. The second child fell
backwards 0.6 metres from a rocking chair, which also resulted in intracranial injury with no skull fracture. Reiber (1993) also reported from all the cases that less than one third (n=6) of the deaths involved a skull fracture and in 79% (n=15) the landing surface was carpet.

Reiber's (1993) reviewed literature that examined "major injury - major fall" and "major injury - short fall". Reiber (1993) reported that there was conflict in the literature, which resulted from differing methodologies used to examine childhood fall injury and deaths. Despite this, there were two major points of consensus amongst the studies reviewed, which were:

- presence of skull fracture alone is not evidence of non-accidental trauma;
- lack of major non-head trauma in short falls.

Reiber (1993) concluded that circumstantial factors such as fall height, landing surface and age should be considered in cases of childhood fall injury deaths. However, cases presenting with a history of an unintentional short-fall resulting in skull fracture, major head and body injury and retinal haemorrhage should be treated as questionable.

**Aims**

The aim of the current study was to identify and examine the factors associated with fatal and non-fatal injury from falls among children aged 0-14 years. Of particular interest were issues such as the role of unstructured recreation or play, the relationship between fall height and injury and the location of the fall.

**Definitions**

For the purposes of the current study a fall was defined in accordance with Wolf, Barnhart, Kutner, McNeely, Coogler, Xu, and Atlanta FICSIT Group (1996) as:

"unintentionally coming to rest on the ground, floor, or other lower level"

A distinction was also made between short distance falls and falls from a greater height. A short distance fall was defined in accordance with Plunkett (2001) as a fall of less than three metres.