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Product-Related Child Fall Injury

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Product-Related Child Fall Injury

by

Joan Ozanne-Smith • Irene A. Brumen

Monash University

Accident Research Centre

Contents

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Glossary

CAPFA - Child Accident Prevention Foundation of Australia (Kidsafe)

E-code - External cause of injury code

ELVIS - Extended Latrobe Valley Injury Surveillance (general practitioner data)

GATT - General Agreement on Tariffs and Trade (GATT) Standards Code or GATT agreement currently known as the World Trade Organisation (WTO) Agreement on Technical Barriers to Trade

ICD-9 CM codes - International Classification of Diseases; Revision 9

MUARC - Monash University Accident Research Centre

NISU - National Injury Surveillance System

NMDS - National Minimum Data Set

VIMD - Victorian Injury Minimum Database

VISS - Victorian Injury Surveillance System

VSCO - Victorian State Coroner's Office

Executive summary

This study identified a wide range of issues and products specifically involved in child falls and proposes a number of strategies to improve our understanding of the problem and to prevent and control fall injuries that are related to consumer products. The methods used in this investigation included:

- an examination of available Victorian data on injury deaths, hospital admissions, hospital emergency department presentations and general practice presentations to obtain an overview of the size and nature of the product-related child fall injury problem;
- a review of published and unpublished literature on product involvement in child fall injuries which was used to develop a countermeasures matrix; and
- a review of countermeasures which was used to develop an hierarchy of countermeasures based on evidence of their effectiveness which formed the basis for the recommendations in this report.

The report highlights the extraordinary amount of action required to systematically address the data, research, implementation and evaluation issues that are pertinent to reducing product-related child falls. It confirms the very poorly developed state of product safety research and development in Australia and identifies the scope and the strategies for improvement.

Key findings

From the data analysis

- the product most frequently involved in fall-related injury deaths is the swimming pool.
- the products most frequently involved in fall-related injury across most levels of severity are 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 statistically significant overall increase over the period July 1987 - June 1994, with significant increases also noted in the under one year and the 10-14 year age groups.
- there was a higher proportion of children who fell more than one metre in the group of children admitted to hospital, indicating that these fallers sustained more serious injuries.
- overall, 49% of all child fall injuries occurred in the home; educational settings were the second most frequent location for falls (19%).
- the main injury resulting from child falls was fractures, 38% of which were of the radius/ulna. Although concussion was the fifth most frequent type of injury, it rated highest in terms of severity (45% hospital admission rate).
- the available data showed that radius/ulna injuries were associated with playground equipment in 30.5% of cases where product involvement was known. Head injuries were predominantly associated with bicycles (13.8%), playground equipment (11.5%) and chairs/beds (11.7%).

From the literature review

These products are identified in the literature as substantially implicated in child falls:

Nursery furniture- *babywalkers, cots, cribs and cradles, prams and strollers, highchairs, change tables, porta-chairs, bouncinettes (exercisers) and car restraints.*

Household furniture- *bunk beds, conventional beds, chairs and stools, tables, benches, coffee tables, sofas and couches.*

Structural features of the home- *steps and stairs, balconies, concrete and other flooring, domestic architectural glass, bathtubs and showers.*

Playthings, sports equipment and sports activities- *toys, bicycles and tricycles, bicycle child carrier seats, horseriding, swimming pools and spas, skating (rollerskates, skateboards, rollerblades/in-line skates, ice skating) and playgrounds (general, climbing apparatus and monkey bars, slides, swings, seesaws, trampolines and mini-trampolines).*

Miscellaneous- *shopping trolleys, ladders and step ladders and footwear.*

The findings from the published research are tabulated in Chapter 3. A large volume of published and unpublished literature was accessed and a selection of 159 of the articles that were examined are referenced in this report.

From the review of countermeasures

The results of the review of available countermeasures in terms of effectiveness is included as a matrix in Chapter 4. Only 50 countermeasures and strategies were identified as "proven" and these covered only 20 products or product types. Approximately 335 other countermeasures were classified as having "good potential for prevention", based on scientific or accepted theoretical principles, and were included in the countermeasure matrix.

There were no studies of benefit/cost ratios in relation to product-related child fall interventions reported in the literature. Such studies are a necessary precursor to widespread implementation of interventions but are a longer-term priority at this stage.

Recommendations

Product-related fall injury is a complex problem. Countermeasures should be multi-faceted and geared towards reducing the likelihood of falling, increasing the use of protective devices and improving the safety features in the design of products and the environment. An intersectoral approach is required as responsibility for action lies with a range of government departments and authorities.

General recommendations

- Establish a national consumer product safety commission to fund, co-ordinate, facilitate, drive and enforce product safety research and implementation and to co-ordinate product safety imperatives with national and international trade policies.
- Implement a product safety directive placing responsibility for product safety on manufacturers, importers, retailers and any others with an interest in products in the marketplace.
- Monitor the effectiveness of the Trade Practices Act in improving product safety and product-related injury reduction and amend it, where necessary, to provide more protection to consumers.
- Establish an intersectoral National Injury Prevention Taskforce to advise government and to drive, co-ordinate and facilitate the child fall injury prevention action plan within the context of the broader implementation of national and state injury prevention strategies.
- Establish an exposure database to centralise available information regarding the prevalence of hazardous and protective products, and other exposure measures as they become available.

Specific recommendations

Playgrounds and forearm fractures - a systems approach

Because there are gaps in research that impinge on the choice of strategies, a staged approach is recommended

Stage 1

- Commission a controlled study to determine the critical fall heights by age for reductions in forearm fractures. Because of the wide implications, it is considered necessary to validate the research findings on critical fall heights reported from New Zealand by Chalmers (1995) before widely implementing countermeasures.
- Conduct a controlled study to determine the effectiveness of undersurfacing on reducing playground equipment-related upper limb injuries.
- Conduct an exposure study to determine the amount of time children spend on each type of playground equipment and on playground equipment above 1.5 metres fall height to determine the relative risk associated with each type of equipment using corresponding injury data.
- Conduct a research study to determine the effectiveness of wrist guards in preventing child wrist fractures.
- Develop and implement simple consensus measures for best practice performance-based guidelines for playground safety.

Stage 2

- Conduct a benefit/cost analysis to determine a strategy for replacing playground equipment of non-conforming height (determined from the research in *Stage 1*) which compares a phasing out strategy to one which promotes active replacement.
- Develop a generic standard for fall heights based on the New Zealand research findings (Chalmers 1995), if findings confirmed and refined for age groups by Australian research.
- Develop a new Australasian playgrounds standard based on the interim guidelines and *Stage 1* research, which refers to the generic standard on fall heights.

- Mandate and enforce the new standards in public playgrounds, schools, children's service regulations (Regulations 81 and 97), and playgrounds in commercial premises.

Safe home design - a systems approach

The primary recommendation is that a systems approach to safe home design be adopted, which focuses on transferring safety design features routinely into new homes and home renovations. These features are identified in the Australian Standard (*Guidelines for Safe Housing Design (AS 4226)*, August 1994) and incorporated in Kidsafe and community safety display homes (e.g., City of Hume in Victoria, Noarlunga in South Australia).

- Increase the number and accessibility of safety designed display homes.
- Further develop and promote safe home design packages for standard home designs (some progress has been made by Kidsafe/Archicentre).
- Integrate safety design components into tertiary courses for home builders and designers.
- Integrate safety design and safety package concepts into courses currently offered for home buyers.
- Reduce the marginal additional cost for a safety design features package by means of sales tax reductions, increased market share to complying builders or other incentives.
- Develop and promote a safety accreditation scheme for new homes in consultation with key stakeholders.
- Investigate incorporating into the Australian Building Code a requirement for the installation of slip resistant baths and slip resistant flooring in bathrooms in new and renovated homes.

Child restraint regulation and promotion

Falls from nursery furniture constitute approximately 15% of injuries presenting to hospital emergency departments in the first year of life (Ozanne-Smith 1992).

- Develop and implement regulations requiring 5-point child restraints to be fitted to nursery furniture, including high chairs, prams and strollers, and attachment points for restraints to shopping trolleys. This could be achieved by the development and implementation of a generic mandatory standard or product specific standards.
- Devise and implement education campaigns regarding the correct installation and restraint use in motor vehicles.

Protective helmets

- Develop and promote guidelines for best practice helmet use in various settings (eg., the broader use of bicycle helmets for adventure sports, where appropriate).
- Implement education campaigns to promote bicycle helmet wearing in off-road locations.
- Enforce bicycle helmet laws.
- Further develop, evaluate and implement (to the extent possible), a universal helmet which can be used across a range of activities where the risk of head injury is high

Compliance with Standards

- Pending the implementation of mandatory standards (or product bans), encourage retailers to stock and consumers to purchase products conforming to voluntary standards (e.g. nursery furniture, bunk beds and ladder standards) or to safety designs supported by research (pending their incorporation into standards).

Review progress

Disseminate the countermeasure review widely, update the recommendations regularly and review progress towards implementation

Additional data, research and implementation recommendations

Injury data

- Include a product involvement code in injury data systems for death, hospital admissions and presentations and general practice data to enhance surveillance for new, ongoing and previously unidentified hazards.
- Widely implement level one data collections in health care settings using the NMDS (Injury Surveillance) and develop a sampling frame for more detailed (level 2) data, with the potential for in-depth follow-up studies on particular issues.
- Ensure that product involvement (including brand name) information is recorded, to the extent possible, on injury surveillance forms and in the text description in electronic NMDS injury surveillance collections and coronial data systems.
- Implement quality control programs to monitor and control data quality by means of feedback,

training of collectors and other methods as required

- Expand E-code classifications to cover more types of falls

Analytic research

Analytic research, particularly based in the disciplines of epidemiology and biomechanics, is required to assist the design of new interventions.

- Conduct follow-up studies to investigate the mechanism of injuries associated with high risk products such as beds, chairs, stools and tables to see whether these products require modification, redesign or other countermeasures.
- Conduct controlled studies to address the circumstances surrounding falls and the factors contributing to the fall, for example, a case-control study to compare the characteristics of household stairs that are involved in child fall injuries to household stairs where there is no or low involvement.
- Conduct relative risk studies where comparisons of different product designs are possible to inform future prevention strategies e.g., porta-chairs versus standard high chairs (requires exposure data) and ramps versus other locations for skateboarding.
- Determine the proportion of children under three years of age who sleep in conventional beds, determine relative risks of beds and cots at various ages (e.g., 12, 18, 24 and 30 months of age) and investigate the need for an intermediate bed design between cots and conventional beds.
- Carry out stability testing of loaded supermarket trolleys (including child passengers) to inform future design considerations.
- Determine the relative risks associated with various playing surfaces for sports and recreational activities.

Exposure studies

Exposure studies would contribute to the development of a national exposure database and assist with the choice of countermeasures and target populations for the implementation of preventive measures.

- Conduct surveys at regular intervals to ascertain exposure to hazardous and protective products - similar to that undertaken in the ABS Home Safety Survey in Victoria and NSW in 1992. Comprehensive studies are required which include many products such as glass-topped coffee tables with and without safety glass, coffee tables in households with young children, in-line skates, trampolines, babywalkers, and steps and stairs. These surveys would also establish trends in injuries over time.
- Undertake exposure studies to determine the contribution of reduced exposure (by comparison with available baseline data) to the reduction of injuries to bicyclists, and to monitor the rate of helmet wearing.

Evaluation studies

Evaluation studies are required to monitor the effectiveness of countermeasures and implementation methods.

- Conduct evaluation studies to assess the efficacy of these countermeasures: safety glass performance in reducing fall and other domestic architectural glass injuries; the implementation of the 1991 safety glass regulations; equestrian protective equipment under different circumstances of riding; and protective equipment for roller skating, roller-blading and skateboarding.
- Undertake evaluation studies to assess compliance with voluntary and mandatory standards.
- Document the implementation of interventions as the basis for impact evaluation e.g. progress towards the withdrawal of babywalkers from sale in stores.
- Evaluate the content and impact of English language and non-English language safety information that is distributed at the point of sale to consumers, provided by product distributors to retail staff or distributed by other methods such as child safety centre educational programs.

Injury reduction measures

Regulation/standardisation

- Streamline processes for the development and implementation of generic and vertical standards for product safety, including the introduction of iterative processes.
- Mandate standards, where it is necessary to achieve compliance e.g., horse riding helmets in public places.
- Explore other means of achieving compliance with standards e.g., bunk bed standard, such as consultation with manufacturers, importers and retailers and raising public awareness.

- Encourage the upgrading of products to comply with new standards.
- Adopt quality overseas standards where no Australasian standards exist e.g., high chairs (British) and possibly babywalker stability (British).
- Develop Australian standards for high risk products where no relevant standards are available, such as shopping trolleys.
- Update Australian standards to incorporate new research findings.
- Ensure that imported products are tested to Australian safety standards.

Consumer and industry education

- Promote safety awareness and education campaigns for the products most implicated in falls, particularly where products designed to prevent falls are available e.g., 5-point shoulder harness, prams and strollers designed with continuous handles and with parcel trays underneath.

Chapter 1 - Introduction

1.1 Rationale

This study was commissioned by the Commonwealth Department of Human Services and Health as an initial step towards addressing two priority areas in the national goals and targets for injury prevention and control: consumer safety and fall injury among children. These two injury issues were identified as priorities for action at the national and State levels in *Better Health Outcomes For Australians: National Goals, Targets and Strategies for Better Health Outcomes into the Next Century (Commonwealth Department of Human Services and Health, 1994).*

Falls are the leading cause of injury to children in Australia (*Better Health Outcomes for Australians*, 1994; Routley & Valuri, 1993). The Australian Consumers' Association estimated from National Injury Surveillance data that, each year, between 280,000 and 560,000 children suffer injuries related in some way to consumer products (cited in Moller, 1994).

The responsibilities of consumer safety agencies are described in *Better Health Outcomes for Australians* (1994) as:

> '[by means of a collaborative and well-informed approach] to upgrade standards for products, to develop more effective methods of instituting best design practice, to identify products that need redesigning and to facilitate redesign, to control any adverse consequences of international trade agreements and deregulation, and to inform consumers of the risks associated with products' (p 220).

1.1.1 Overview of child fall injuries

In the national goals and targets for injury prevention and control child falls in the domestic environment and in playgrounds are identified as priority areas for injury prevention interventions (*Better Health Outcomes for Australians*, 1994). NSW hospital admission data were used to set baselines for targets. It was estimated that, for the financial year 1991/92, the rate of fall injuries for 0-4 year olds was 550/100 000, and the rate for 5-9 year olds was 634/100 000 (*Better Health Outcomes for Australians*, 1994). The target is to reduce the hospital admission rate that results from falls to children aged 0-4 and 5-9 by 10% by the year 2000 (*Better Health Outcomes for Australians*, 1994). Consequently, this report focuses on these age groups, although the review extended to children under 15 years of age.

The nature of children's falls (including the activity being undertaken at the time of the fall, the location, the body part injured and the type and mechanism of injury) varies according to the age and, hence, the developmental stage of the child. The domestic environment is the major location of fall injuries resulting in hospital admission for children aged 0-4 years; the playground (in child-care centres, kindergartens, schools and commercial areas) predominates for children aged 5-9 years admitted to hospital (Carey V, 1993 cited in *Better Health Outcomes for Australians*, 1994). According to Victorian Injury Surveillance System (VISS) data for 1989-1993, falls in the 10-14 year old age group mainly occurred in the educational setting.

An earlier Australian report (Nutbeam et al., 1993) highlighted the need for action to reduce nursery furniture-related injuries to infants aged less than one year. It is estimated from VISS data that falls comprise 62% of nursery furniture-related injuries to children aged less than three years (Routley & Valuri, 1993).

1.2 Context

1.2.1 Background

The size of the consumer product-related injury problem is difficult to estimate as data collection is poorly developed. In 1989 the Australian Consumers Association (ACA) estimated from National Injury Surveillance data that, each year, between 940 000 and 1.86 million Australians suffer injuries related to products (cited in Moller 1994). Moller (1994) projected European and United States costings onto these figures and estimated that product-related injury to all age groups cost Australia about $2.8 billion each year.

Consumer product safety can be broken down into four focus areas:

- ensuring that products are not defective and do not fail;
- ensuring that products are manufactured according to safe design;

- ensuring that products are manufactured for appropriate purposes; and
- ensuring that products are used correctly by consumers.

Little is known about the extent of injury related to the last two areas (Nutbeam et al., 1993), though indications from injury surveillance data suggest that they are only a small component of all product-related injuries.

According to Moller (1994)

> 'the major focus in Australia over the last six years has been on the implementation of mechanisms for dealing with hazardous products and the issue of product liability, rather than on the maintenance and implementation of Australian standards, and the enforcement of mandatory standards' (p144).

More rigorous Australian research, based on the collection of product-related injury and death data, is required to identify hazardous products and to justify the mandating of Australian standards. Ozanne-Smith (1994) states that adequate data collections and rate data are lacking in the research and development of product safety in Australia.

The *Better Health Outcomes for Australians* report (1994) highlights two major approaches to addressing product safety:

- the development and enforcement of minimum standards for industry to abide by, so ensuring the protection of consumers from less zealous manufacturers, distributors and retailers; and
- the creation of an environment where industry is motivated to optimise consumer safety in product development which would help ensure that industry strives to undertake research, education and health promotion aimed at the development of safer products.

Both approaches are needed if injury reduction targets are to be met.

1.2.2 Political context

A number of changes in direction for product safety in Australia and overseas have been seen in recent years. The integration of European countries into the European Economic Community (EEC) resulted in moves to harmonise standards and similar developments have occurred in Australia, between the States and between Australia and New Zealand. The shift to horizontal standards for product safety and pressures to remove mandatory standards that act as non-tariff barriers to trade also impact on this context. Within the current political environment that favours deregulation, innovative methods are required to maintain or progress from the status quo in consumer product safety.

The Trade Practices Act at the Commonwealth level and similar laws in the individual States and Territories give governments in Australia the power to ban or recall hazardous products and to mandate safety standards, labelling and consumer information requirements. The implementation of these laws and other regulatory measures to protect the consumer has become more complex and difficult since Australia signed the WTO Agreement on Technical Barriers to Trade (formerly known as the GATT agreement, March 1992), agreeing not to use technical regulations, standards or testing and certification schemes as barriers to trade.

1.2.3 A unified international approach to product safety

An international approach to consumer safety is supported by Europe and the United States (Moller, 1994) and this trend is also emerging in Australia. Australia recently formed closer international ties for product safety, affiliated with the Asia-Pacific Economic Cooperation (APEC) agenda and forged a closer economic arrangement with New Zealand on the joint development of voluntary and mandatory standards for product safety.

1.3 Definition of product-related falls

According to the European Economic Community (EEC) General Product Safety Directive (GPSD) (COM(90)259) which was implemented in June 1994, product safety can be defined in very broad terms and incorporates both goods and services (new, used, or reconditioned) which have been placed on the market for consumption (Page et al., 1993). It should be noted that the Directive excludes antiques and second-hand products where consumers have been informed of their previous use and safety status. The GPSD was devised to unify laws relating to product safety between states so as to remove barriers to trade and encourage free trade between member economic communities. This ensures that once a product is deemed safe by the Directive, another member state cannot restrict access to that product on safety grounds. Furthermore, the Directive ensures that all those who come into contact with the product

are protected by pre- and post-marketing controls. As the range of products on the Australian market largely matches that of Europe and the United States, and there is a general move to adopt generic and international standards, the EEC definition of consumer product is applied in this report.

Under this definition consumer products include:

- items in public places for use by consumers
- industrial products used by consumers in domestic settings or public facilities
- work clothes that are not confined exclusively to use at work
- constructional features of buildings, whether permanently installed in buildings or not
- domestic and public buildings themselves
- money
- food, including harvested agricultural products made available to the consumer
- domesticated animals in a domestic or publicly accessible setting
- non-indigenous animals to which the public have legitimate access
- cultivated plants in a private or publicly accessible setting
- artificial sources of ignition and materials ignited
- man-made features of the environment accessible to the public
- private transport vehicles and Public Service Vehicles
- fireworks
- component parts of products and instructions

(Page et al., 1993; p3-4).

The definition is very broad and excludes only products which are natural features of the environment or products that individuals produce for personal consumption, i.e., not for commercial purposes. Examples of the latter are paintings, knitting and woodwork.

The GPSD notes that a safe product is:

> 'one which does not present an unacceptable risk by virtue of its composition, use, wrapping, presentation and labelling, conditions of assembly, maintenance or disposal, instructions and direct or indirect effects on or with other products'
>
> (Page et al., 1993; p1).

Given that products are not always used according to their intended purposes (e.g., children using chairs to climb and stand on) the Directive also covers any use of the product that can be 'reasonably foreseen by a responsible and competent producer'. In this respect it is the responsibility of the producer to warn or guard against any reasonably foreseeable use of the product (Page et al., 1993).

1.4 Aims and objectives

1.4.1 Aims

The aims of the project are:

- to identify specific products (including structural features of the home) which contribute to falls among children in the domestic environment and in playgrounds; and
- to develop a methodology to systematically address the issues identified in the review

1.4.2 Objectives

The objectives of the project are:

- to analyse data on childhood falls using hospital admission (including trend analyses over time), injury surveillance, general practice (to the extent possible) and coronial data;
- to review literature focusing on published literature on the prevention of domestic and playground product-related childhood falls, including the effectiveness of countermeasures;
- to review relevant Australasian and overseas standards;
- to review informed sources including work in progress, international consultation and advances in the development of relevant generic standards;
- to develop and apply a classification system for the effectiveness of interventions (both countermeasures and implementation strategies), including benefit/cost ratios to the extent possible;
- to determine potential benefits from countermeasures for other family members, particularly older persons;
- to identify products and intervention strategies in need of further analytic study and design appropriate research protocols to systematically address the major issues identified; and
- to co-ordinate the work of this project with national and state /territory strategies.

1.5 Methods

Information on products associated with child fall injuries and their prevention was obtained from a number of sources, including local and international literature searches, data analyses, and local, interstate and international consultation with key injury personnel working in the area of child injury prevention and product safety. To the extent possible, information on exposure to hazardous products and to protective products was also reviewed.

1.5.1 Local and international consultation

The First National Conference on Injury Prevention and Control presented an opportunity to consult relevant injury prevention and consumer safety personnel. Key overseas and local personnel were surveyed on their past and current research in the child falls area and follow-up phone calls were made to obtain more information on work in progress. Attendances at the ECOSA Third International Conference on Product Safety Research and the Nordic/Dutch Product Safety Seminar held in Amsterdam in March 1995 provided valuable opportunities to consult European and Scandinavian authorities on product safety. Furthermore, visits to the Consumer Safety Institute in the Netherlands and ICE Ergonomics in the U.K. provided information on international progress in product safety research and access to relevant informal literature.

1.5.2 Data analysis

More complete data on injuries at all levels of severity are available for Victoria than for other Australian States. For this report five major datasets were analysed to determine the epidemiology of product-related child falls:

- 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
- National Injury Surveillance Unit data to determine differences from Victorian data.

The ten products most frequently associated with child falls were ranked using data from each of the databases (i.e. for each level of severity) and a summary chart was produced which depicted the products implicated in child falls by frequency and injury severity. The methods of analysis and detailed results are presented in Chapter 2.

1.5.3 Literature review

A Medline search was undertaken using keywords that were broad enough to capture a wide range of references relating to product safety, including the political and economic context for product safety. In addition, a literature search of published and unpublished product safety research relating to child falls was undertaken at the Documentation Centre of the Consumer Safety Institute in the Netherlands.

Information on relevant Australian and international standards was obtained from a number of sources, i.e., the literature review, consultation with expert personnel, and the Standards Australia library. Up-to-date information about Australian Standards was obtained from the *Catalogue of Australian Standards and Other Products 1995*. With regard to European Standards, a search of relevant products identified from data analyses and the literature review was undertaken by Standards Australia, and the resultant information was analysed manually for references to Standards that addressed child fall injuries. A limitation of the database prevented the keyword "falls" being used to narrow the search. Because of time and resource constraints, this procedure was limited to European Standards. North American Standards are listed only if they were extracted from the literature review.

The literature review is presented in several parts. The major sections are: summary tables of studies which identify associations between products and child falls (Chapter 3); a comprehensive matrix of countermeasures categorised by effectiveness (Chapter 4); and a review of relevant Standards (Appendix 4). Recommendations derived from the literature and from the review process are presented in Chapter 5.

1.5.4 Development of the countermeasures matrix

The countermeasures matrix in Chapter 4 was based on information from the literature and the results of local and international consultation. The matrix provides an analysis of the countermeasures available for each major product identified from both injury data and the literature, and implementation strategies where described. In addition, information is provided about proven countermeasures, those with good

potential for success based on scientific principles, and those not yet proven or proven unsuccessful. This section of the report also includes research in progress and strategies which are currently being developed to address product-related child falls.

1.5.5 Development of recommendations and implementation strategies

The recommendations in Chapter 5 systematically address the injury issues raised in this report. They were developed from the review of injury data, countermeasures, existing standards, and implementation strategies.

Chapter 2 - Data analysis

2.1 Introduction

A number of data sources were utilised to obtain an overview of product-related fall injuries to children. The analyses that follow utilised death data recorded in the State Coroner's Office database, hospital admissions data recorded in the Victorian Inpatient Minimum Dataset and Victorian Injury Surveillance System databases, emergency department presentations recorded in the Victorian Injury Surveillance System and National Injury Surveillance Unit databases, and general practice data recorded in the Extended Latrobe Valley Injury Surveillance database. Information on each of the databases is included in the appropriate section below.

Analyses were undertaken to determine the extent and nature of product-related fall injuries. This included identification of the products involved, fall height, injury severity, type, body part affected and the location of injury event.

Population denominators for rate calculations were derived from the 1986 and 1991 censuses conducted by the Australian Bureau of Statistics. Estimates, based on methods used by Langlois et al (1992) and Watt (1995), were made for the intervening and post-census years.

2.2 Deaths (Victorian Coroners' Facilitation System)

Currently, the major source of detailed information on fatal injury is the database of the Victorian State Coroner's Office (VSCO). In the past, information generated by coroners was not well organised and computerised files of coroners' investigations are rare anywhere in the world. However, under a pilot program in Victoria, data from coroners' investigations are being computerised. Information on unnatural deaths that occurred between 1 July 1989 and 30 June 30 1992 is published and is also available on disk.

Fall deaths were extracted from the VSCO database for the period 1 July 1989 to 30 June 1992 using E-coded breakdown events ('what went wrong') and a text search of all narratives including any reference to falls, slips, trips or stumbling, e.g., *"Deceased fell through the door opening of a tractor, and was crushed by a wheel"*. This combination of methods yielded a more comprehensive dataset than the use of E-codes alone.

In the three-year period, 43 fall deaths to children under 15 years of age were recorded, 27 of which were product related. Males were disproportionately represented and accounted for 74% of all product-related child fall deaths. The peak age group for product-related fall deaths was children aged 1-4 years (71% of deaths), followed by children aged less than one year (14% of deaths).

Table 1: Product-related fall deaths of children under 15 years of age. Victorian State Coroner's Office, July 1989 - June 1992

Product implicated	N
Drowning	17
- swimming pool	8
- bore hole/channel /irrigation/sewerage	3
- rubbish bin	2
- bathtub	1
- boat	1
- fell from fence into irrigation	1
- unknown	1
Tractor / trailer	4
Car	3
Bike	1
Bed	1
Horse	1
Total product-related fall deaths	**27**

As shown in Table 1, the swimming pool was the product most associated with child product-related fall deaths accounting for 63% of these deaths. Falls from tractors/trailers and from cars accounted for 15% and 11% of the product-related fall deaths respectively.

2.3 Hospital admissions (Victorian Inpatient Minimum Database)

The Victorian Inpatient Minimum Database (VIMD) holds information on all public hospital admissions for the period July 1986 to June 1994. Monash University Accident Research Centre also holds, for research purposes, a subset of VIMD records which has been selected by ICD-9 E-codes (external cause of injury). Each case is described by a range of variables, but information on the injury event itself is limited.

2.3.1 Overview of child fall hospital admissions

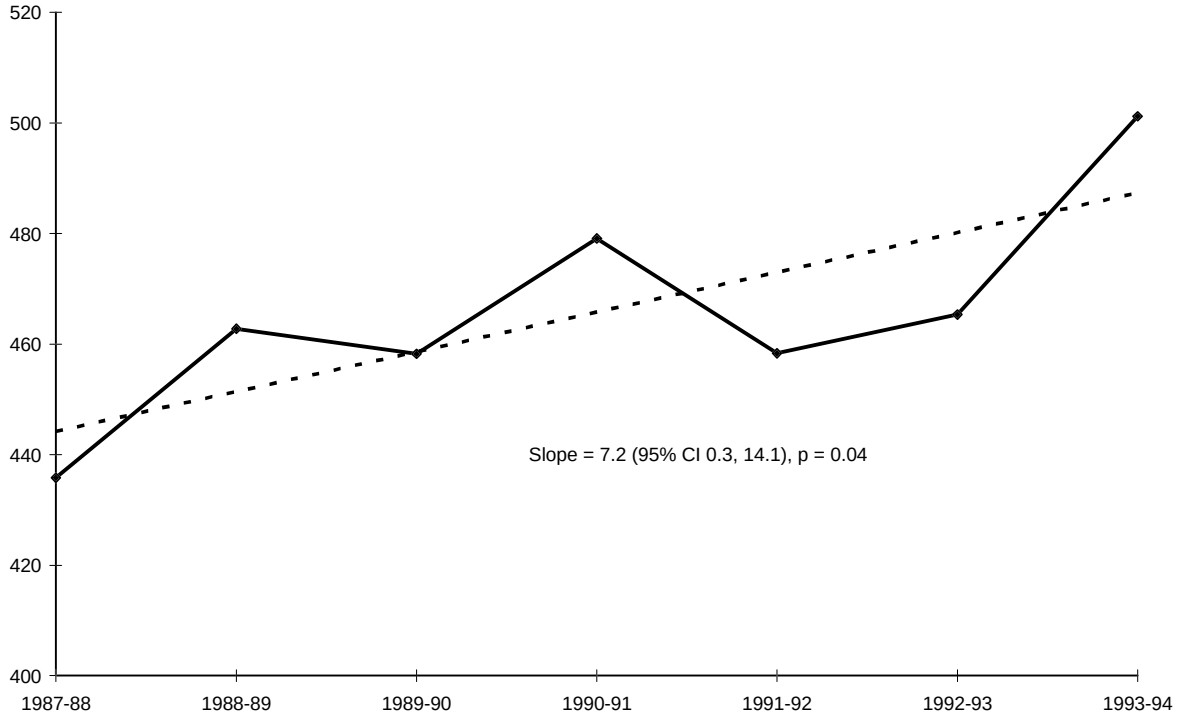
A total of 29,341 children under 15 years of age were admitted with fall-related injuries to Victorian public hospitals during the period July 1987 to June 1994. The overall male to female ratio was 1.59. Although the frequency of fall-related injury admissions was higher for males in every age group (0-4, 5-9 and 10-14 years), taken as a proportion of admissions within each gender group, females in the younger age groups (0-4 and 5-9 years) were more likely to be admitted to hospital.

Children in the 5-9 year age group accounted for 43.3% of child fall admissions in 1993/94. Hospitalisation rates were also highest among the 5-9 year age group, for both males and females. The admission rates for males were higher than those for females in all age groups except for children aged under one year. The difference between male and female admission rates increased with age (Table 2).

Table 2: Fall injuries (total) rates per 100 000 for children under 15 years of age. Public Hospital Admissions, July 1993 - June 1994

Age group	All rate /100 000	Male rate /100 000	Female rate /100 000
Under 5 years	403	452	350
Under 1 year	254	254	253
1-4 years	440	502	375
5-9 years	643	760	520
10-14 years	460	610	302

Figure 1: Fall injuries (total), rates per 100 000 and trend for children under 15 years of age. Public Hospital Admissions, Victoria, July 1987 - June 1994



The rate of fall injuries to children aged under 15 years showed a statistically significant increase over the study period (Figure 1), with significant increases in the under 1 year and the 10-14 year age groups. Trends were not significant for children aged 1-4 years and 5-9 years. The increase in the 10-14 year age group was associated with a 24.3% increase in playground equipment falls from 1992/1993 to 1993/94. It is possible that increases from 1992/93 are, at least in part, the result of the introduction of casemix funding which may have changed the admission policy and coding practices in some of the hospitals.

By comparison, analysis of VISS Latrobe Valley Regional Hospital injury admission frequency data for children aged 10-14 years did not show the sudden rise in injury admissions noted above, during the 1993/94 or 1994/95 financial years. In the Latrobe Valley, fall-related injury admissions decreased from 1991/92 to 1993/94, before rising slightly in 1994/1995.

2.3.2 Identification of product-related falls

The ICD 9-CM E-codes (the classification system used in hospitals) for fall injuries only provide limited data on products related to falls. Whether or not a product is involved in a child fall injury was not known in 62% of the child fall injury cases extracted from the VIMD. The product categories in the E-code classification system are also very broad eg., chair/bed.

An additional limitation exists in that many fall injuries are coded into other categories of injury. For example, a fall into a swimming pool is more likely to be coded as a drowning/near-drowning even though the factor first leading to the event was a slip or fall into the pool. Consequently, the identification of product-related child falls in VIMD is incomplete. Conversely, cases involving other persons or environmental factors (ie, no product involvement) cannot be identified and removed. For VIMD data to become more useful for product safety research, E-codes which directly identify product involvement need to be introduced.

As shown in Table 3, the limited data available indicated that playground equipment and chairs/beds were the products most associated with child fall injury hospital admissions of children under 15 years of age. These products accounted for 24.5% and 8.1%, respectively, of fall injury admissions for the period July 1987 - June 1994. Age-specific differences in product involvement are suggested. Fall injuries associated with chairs/beds predominated in the under one year and 1-4 year age groups (accounting for 26.4% and 18.0% of fall injury admissions in these age groups respectively), whereas playground equipment-related falls predominated in the 5-9 and 10-14 year age groups (accounting for 36.2% and 15.3% of fall injury admissions in these age groups respectively).

Table 3: Product-related fall injury frequencies for children under 15 years of age. Public Hospital Admissions, July 1987 - June 1994

	Age Group (years)									
Fall	**<1**		**1-4**		**5-9**		**10-14**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Playground equipment	7	0.7	1,262	18.3	4,596	36.2	1,338	15.3	7,203	24.5
Chair/bed	250	26.4	1,244	18	660	5.2	226	2.6	2,380	8.1
Building/structure	0	0	189	2.7	256	2	210	2.4	655	2.2
Stairs/steps	51	5.4	285	4.1	161	1.3	151	1.7	648	2.2
Ladders/scaffolds	0	0	74	1.1	79	0.6	38	0.4	191	0.7
Swimming pool	0	0	2	0	14	0.1	71	0.8	87	0.3
Product involvement not known	639	67.5	3,858	55.8	6,944	54.6	6,736	76.8	18,177	62
Different level, other	*374*	*39.5*	*1,365*	*19.7*	*2,339*	*18.4*	*1,369*	*15.6*	*5,447*	*18.6*
Same level/slip/trip/stumble	*83*	*8.8*	*1,194*	*17.3*	*2,018*	*15.9*	*2,086*	*23.8*	*5,381*	*18.3*
Fracture, cause unspecified	*76*	*8*	*228*	*3.3*	*657*	*5.2*	*842*	*9.6*	*1,803*	*6.1*
Same level/collision in sport	*3*	*0.3*	*22*	*0.3*	*210*	*1.7*	*818*	*9.3*	*1,053*	*3.6*
Other falls/unspecified	*103*	*10.9*	*1,049*	*15.2*	*1,720*	*13.5*	*1,621*	*18.5*	*4,493*	*15.3*
Total (N/%)	**947**	**3.2**	**6,914**	**23.6**	**12,710**	**43.3**	**8,770**	**29.9**	**29,341**	**100**

Because of the inadequacy of the coding system alluded to earlier, product involvement is identified in only 38% of VIMD fall injury cases. By comparison, an analysis of VISS hospital admissions data indicated that 80.6% of all child falls were product-related. If this proportion of fall injuries on the VIMD database was product-related, then an estimated 3 378 children are admitted to hospital each year in Victoria for a product-related fall, an average annual rate of 375 product-related falls per 100 000 population.

2.3.3 Playground equipment

The rate of playground equipment fall injuries has increased significantly since 1987/88. The rate of playground-related injuries for children under 15 years of age was 126 per 100 000 in the financial year 1993/94 (Figure 2). Over the five-year study period, playground equipment was associated with 28.3% of falls for females and 22.2% for males. Males had a higher average annual rate of playground equipment fall injuries than females, for all 5-year age groups under 15 years of age.

2.3.4 Bicycle and horse riding injuries

Separate analyses were undertaken on bicycling and horse riding product groupings since most injuries in them are fall-related (as found for VISS admissions, Ozanne-Smith & Sherry, 1990; Williams & Ashby, 1995).

An analysis of child bicycle-related injuries revealed that the rate of these injuries decreased over the study period, however the decrease was not statistically significant (p=0.24). Falls accounted for approximately 77% of horse riding-related emergency department presentations by children (Williams and Ashby, 1995). The peak age group for horse-related injury was 10-14 years. The rate of horse-related injuries decreased steadily in the 5-14 year age group from 1987/88 to 1992/93, although the trend downwards was not statistically significant (p=0.35) (Watt, 1995).

2.3.5 Nature of injury - product-related fall admissions

Data relating to the types of products implicated in fractured radius/ulna (forearm fractures) and head injuries are available from Victorian public hospital admissions data recorded in the VIMD database from the N-codes (diagnosis of injury) associated with the E-codes. These supplementary data are presented in Table 4 to assist the identification of potential areas for intervention. Fractures to the radius/ulna and head injuries are over-represented in fall injuries since, in total, radius/ulna fractures accounted for 3.6% of all fall injuries resulting in hospital admission, whereas head injuries accounted for 1.9% of all fall injury hospital admissions.

Figure 2: Trend in fall injuries (total) from playground equipment for children under 15 years of age. Public Hospital Admissions, Victoria, July 1987 - June 1994

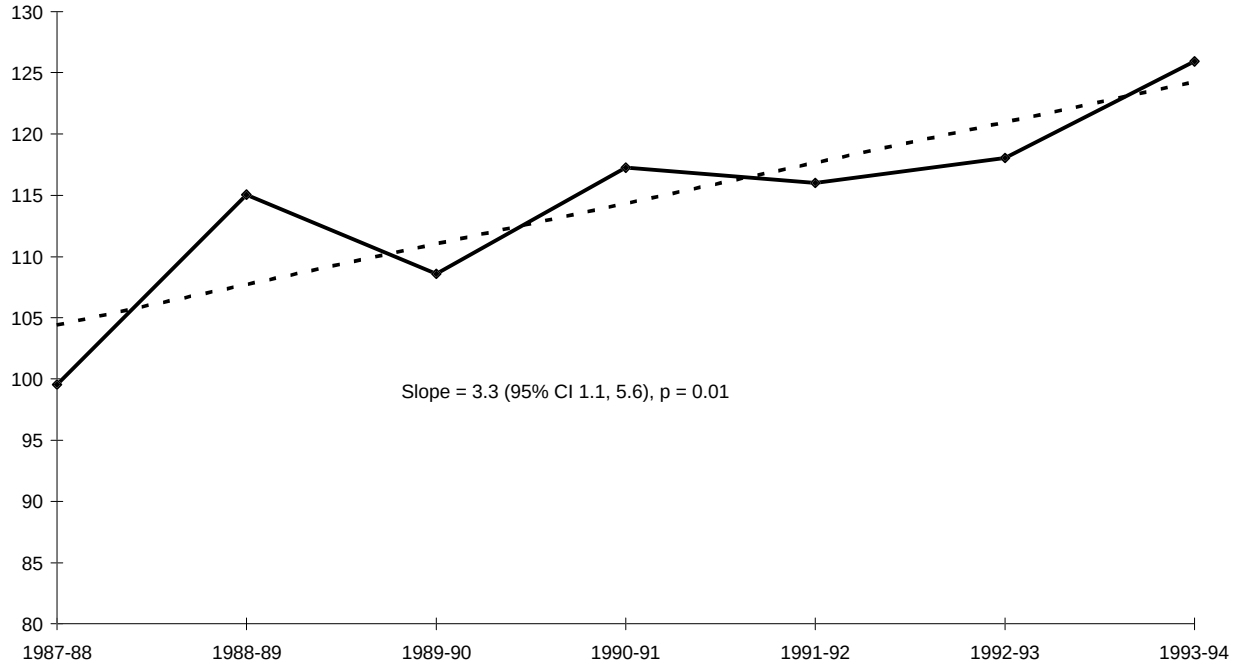


Table 4: Frequency and percentage of fall injuries resulting in fractured radius/ulna or head injuries to children under 15 years of age. Public Hospital Admissions, Victoria, July 1987 - June 1994

Product (E-code)	Radius/Ulna		Head Injury	
	N	%	N	%
Playground equipment	4,340	30.5	853	11.5
Bicycles/pedal cycles	986	6.9	1,019	13.8
Chairs/beds	707	5	867	11.7
Buildings/structures	222	1.6	250	3.4
Stairs/steps	149	1	272	3.7
Ladders/scaffolds	71	0.5	63	0.9
Swimming pool	2	0	33	0.4
Product involvement not known	7,744	54.5	4,029	54.5
- slip/trip	*2,250*	*15.8*	*1,045*	*14.1*
- other fall from different level	*2,235*	*15.7*	*1,762*	*23.9*
- collision in sport	*492*	*3.5*	*175*	*2.4*
- fracture, unspecified	*936*	*6.6*	*30*	*0.4*
- other falls/unspecified	*1,831*	*12.9*	*1,017*	*13.8*
Total	**14,221**	**100**	**7,386**	**100**

Although product involvement was not known for more than half of the radius/ulna injuries and head injury diagnoses, the available data showed that radius/ulna injuries tended to be associated with playground equipment, whereas head injuries were associated with bicycles, chairs/beds and playground equipment.

2.4 VISS data overview

The Victorian Injury Surveillance System (VISS) began its paediatric injury data collection in 1988. The injury data used in this report utilises five years of emergency department presentations and admissions (1989-1993) from the Royal Children's Hospital (RCH), Western Hospital (WH), and Preston and Northern Community Hospital (PANCH). Although the system is not statewide, it is a rich source of detailed data which is used to assist the identification of factors associated with injury and, thereby, inform prevention strategies.

2.4.1 Fall height of all fall injuries - VISS presentations

Injury severity (as indicated by hospital admission) by fall height for all fall-related presentations to VISS hospitals of children under 15 years of age is shown in Table 5. Clearly, injured children predominantly fell on the same level or from a height of up to one metre. However, there was a higher proportion of children who fell more than one metre in the group of children admitted to hospital, indicating that these fallers sustained more serious injuries.

Table 5: Fall injury hospital presentations by fall height for children under 15 years of age. Victorian Injury Surveillance System, 1989-1993

Breakdown Event	Non-admission		Admission		Total Presentations	
	N (% total)	%	N (% total)	%	N	%
Fell on same level	6,415 (19.9)	23.8	833 (2.6)	15.8	7,248	22.5
Fell from height up to 1 metre	5,164 (16.0)	19.1	1,068 (3.3)	20.2	6,232	19.3
Fell from height > 1 metre	3,127 (9.7)	11.6	1,199 (3.7)	22.7	4,326	13.4
Tripped on	3,241 (10.0)	12	397 (1.2)	7.5	3,638	11.3
Slipped on	2,863 (8.9)	10.6	509 (1.6)	9.6	3,372	10.5
Over-exerted, over-reached	2,150 (6.7)	8	319 (1.0)	6	2,469	7.7
Lost control of object or article	2,147 (6.7)	8	435 (1.3)	8.2	2,582	8
Other	1,874 (5.8)	7	518 (1.6)	9.8	2,392	7.4
Total	**26,981 (83.6)**	**100**	**5,278 (16.4)**	**100**	**32,259**	**100**

Table 6: Frequency and percentage of fall injury presentations of children under 15 years of age, by location of fall, Victorian Injury Surveillance System, 1989-1993

Location	0-4 years		5-9 years		10-14 years		Total	
	N	%	N	%	N	%	N	%
Residential	9,284	*59.9*	4,048	*26.1*	2,177	*14.0*	15,509	*100*
Educational	556	*9.2*	2,953	*48.6*	2,565	*42.2*	6.074	*100*
Public Playgrounds	274	*27.2*	421	*41.8*	313	*31.0*	1,008	*100*
Areas of Private Enterprise	581	*58.8*	227	*23.0*	180	*18.2*	988	*100*

2.4.2 Location of all fall injuries - VISS presentations

Overall, 49% of all child fall injuries occurred in the home. Fall injuries in educational settings comprising the second most frequent location for falls (19%). Table 6 provides an overview of the location of falls for the different age groups.

Children aged less than five years accounted for the major proportion of fall injuries that occurred in the home and areas of private enterprise. Children aged 5-9 were the predominant group injured in falls in public playgrounds. As expected, school aged children (5-14 years old) accounted for the vast majority (91%) of fall injuries in the educational setting.

Sixty-nine percent of all falls injury presentations occurred within the context of playing, 17% of these cases were admitted for further treatment. However, although only 3.1% of falls occurred within the context of sleeping or resting, 20% of these fallers were admitted for further treatment. This may be a function of fall height as falls while sleeping or resting were usually from one level to the next, whereas falls during play were often on the same level.

Similarly, falls while eating or drinking comprised just under one percent of the injury presentations, yet 19% of this group of children were admitted for further treatment.

2.4.3 Identification of product-related fall injuries

It was found from an analysis of the 32,259 fall injuries to children less than 15 years of age on the VISS database that 23,047 (71%) were product-related. The VISS computerised analysis package program does not allow the product-related cases to be cleanly separated from the non-product related cases for in-depth analysis[1].

Detailed listings of the products implicated in falls in residential, educational, public playground and private enterprise settings are included in Appendix 1.

2.5 VISS hospital emergency department admissions

Approximately 16% of children under 15 years of age presenting to the emergency departments of VISS hospitals are subsequently admitted to hospital. These admissions are then included in VIMD data. Therefore, more detailed data on the cause of injury are available for a small proportion of hospitalised injuries. This can be used to supplement the data available on VIMD.

2.5.1 Ranking of VISS product-related fall injury admissions

Table 7 shows the rank order frequency of the ten products most associated with child fall injuries that required hospital admission to VISS participating hospitals from 1989-1993. The table is derived from information in Table 10 (Section 2.6).

Bicycles appear to be the leading product associated with child falls that result in hospital admission. Several categories of playground equipment ranked high in fall admissions which has implications for countermeasure development. At least eight of the ten product categories involved a fall from a height.

Differences in product involvement for the three age groups are apparent (Table 8). Products associated with hospital admission for children under 5 years of age were more likely to be features of the home, while products involved in fall injuries to children 5-9 years old were predominantly related to play-grounds. Bicycles and sports products were most associated with fall injuries in 10-14 years olds.

[1] Up to two factors leading to, and two factors directly causing the injury, can be noted for each case. If these factors are a combination of products and non-products, any attempt to exclude a non-product will result in the exclusion of the product. The division of cases between products and non-products in VISS data cannot therefore be clean and neat.

Table 7: Rank order of products related to fall injury hospital admissions for children under 15 years of age. Victorian Injury Surveillance System, 1989-1993

Rank	Product Involved
1	Bicycles and bicycle accessories
2	Monkey bars and other climbing apparatus
3	Chairs and stools
4	Slides and sliding boards
5	Stairs and steps
6	Nursery furniture (aggregated)
7	Fences/fence posts/poles
8	Conventional beds
9	Skates and skateboards
10	Swings and swing sets

Table 8: Rank order of products related to fall injury hospital admissions by 5-year age groups for children less than 15 years of age, Victorian Injury Surveillance System, 1989-1993

	Product Involved		
Rank	Age group: 0-4 years	Age group: 5-9 years	Age group: 10-14 years
1	Chairs and stools	Monkey bars/climbing	Bicycles or accessories
2	Conventional beds	Bicycles or accessories	Skates and skateboards
3	Stairs and steps	Slides or sliding boards	Horseback riding
4	Toys	Fences/fence posts/poles	Vehicles
5	Bathtubs and showers	Swings or swing sets	Football
6	Slides or sliding boards	Trampolines	Basketball
7	Tables/benches/countertop	Chairs and stools	Monkey bars/climbing
8	Bicycles or accessories	Skates and skateboards	Soccer
9	Swings or swing sets	Bunkbeds	Fences/fence posts/poles
10	Prams, carriages, strollers	Conventional beds	Stairs and steps

Trampolines and bunkbeds were only implicated in injuries in the 5-9 year age group. While bunkbeds and conventional beds were almost equally represented in fall injuries for 5-9 year olds, bunkbed injuries are generally more severe than conventional bed injuries due to the increased fall height (Hawkins, 1992).

Using South Australian Injury Surveillance Control Unit data, Thompson (1995) estimated that the relative risk of hospital-treated injuries associated with elevated beds was five times higher than for conventional beds. He found that the relative risk of hospital-treated injuries was highest amongst children aged 2-4 years and it did not decrease significantly until age 9 years.

Overall, 18.5% of all children who presented to VISS emergency departments with product-related fall injuries were admitted to hospital.

2.6 VISS hospital emergency department non-admissions

Emergency department presentations that do not result in hospital admissions represents a third level of injury severity. It should be noted that the data on non-admissions include both treated and non-treated cases of injury.

As in the previous section the following information is based on VISS data collected during the period 1989-1993 from three Victorian hospitals, the Royal Children's Hospital, Western Hospital and Preston and Northcote Community Hospital. A two-stage process was required to identify product-related fall cases. Falls were extracted from the VISS database using breakdown event codes (what went wrong) and a text search of the terms "fall", "fell", "slip" and "trip".

2.6.1 Overview of non-admitted fall injuries

Table 9 presents an overview of the frequency of presentations to the emergency departments of VISS hospitals of children under the age of 15 years with fall injuries who were not subsequently admitted to hospital, by age group and gender.

A higher proportion of fall injury non-admissions were males, with the younger age group of males predominating. Overall, the under 5 year age group was more likely to be represented in the fall injury non-admissions to emergency departments.

The location of fall injuries for non-admitted presentations in the different age groups was very similar to that found for all fall injury VISS presentations (2.4.2).

2.6.2 Product-related non-admitted child fall injuries

The VISS injury surveillance database allows products implicated in falls to be specifically identified, although up to two products may be recorded per case.

Table 10 shows the products implicated in the injury events. It should be noted that approximately 26.5% of the sports injuries included in the table may not necessarily relate to the product, but rather to the activity itself, since the sporting activity cannot always be separated from equipment and apparel. This estimation is based on an examination of a sample of 215 VISS emergency department narratives.

Most children (81.5%) who presented to VISS emergency departments with product-related fall injuries did not require hospital admission.

Table 9: Frequency of non-admission fall injury presentations by age group and sex for children under 15 years of age. Victorian Injury Surveillance System, 1989-1993

	Males		Females		Total	
	N (% of males)	% of total	N (% of females)	% of total	N	% of total
< 5 years	6221 (39.6)	23.1	4575 (40.7)	17	10802	40
5-9 years	4750 (30.2)	17.6	3562 (31.7)	13.2	8314	30.9
10-14 years	4757 (30.2)	17.6	3105 (27.6)	11.5	7865	29.2
Total < 15 years	***15728 (100)***	***58.3***	***11242 (100)***	***41.7***	***26981****	***100***

Note: * 11 cases of unknown sex are included in the total column.

Table 10: Frequency of product-related falls by breakdown factors for children under 15 years of age. Victorian Injury Surveillance System, 1989-1993

Breakdown Factor	Frequency Present-ations	% Total Present-ations	Frequency Non-admissions	% Total Non-admissions	Frequency Admissions	% Total Admissions
Sports and recreation	6711	29.1	5713	30.4	998	23.5
- bicycles and bicycle accessories	2206	9.6	1820	9.7	386	9.1
- roller skating, skateboards, rollerblades	986	4.3	855	4.5	131	3.1
- football	645	2.8	578	3.1	67	1.6
- basketball	482	2.1	428	2.3	54	1.3
- soccer	400	1.7	358	1.9	42	1
- horseback riding	230	1	151	0.8	79	1.9
- gymnastics	189	0.8	161	0.9	28	0.7
- netball	182	0.8	170	0.9	12	0.3
- cricket	140	0.6	124	0.7	16	0.4
- swimming pool	131	0.6	99	0.5	32	0.8
- ice skating	52	0.2	46	0.2	6	0.1
- other	1068	4.6	923	4.9	145	3.4
Furniture and non-structural fittings	4178	18.1	3460	18.4	718	16.9
- chairs and stools	1201	5.2	1016	5.4	185	4.3
- beds	1041	4.5	903	4.8	138	3.2
- tables, benches and countertops	458	2	366	1.9	92	2.2
- sofas, couches, lounges, divans	402	1.7	348	1.9	54	1.3
- bunk beds	386	1.7	309	1.6	77	1.8
- bathtubs and showers	317	1.4	231	1.2	86	2
- cabinets, racks, room dividers, shelves	224	1	169	0.9	55	1.3
- other	149	0.6	118	0.6	31	0.7
Playground equipment	3751	16.3	2873	15.3	878	20.6
- monkey bars or other climbing apparatus	1309	5.7	978	5.2	331	7.8
- slides and sliding boards	668	2.9	505	2.7	163	3.8
- swings and swing sets	473	2.1	366	1.9	107	2.5
- trampolines	445	1.9	359	1.9	86	2
- flying fox	115	0.5	87	0.5	28	0.7
- other playground equipment	741	3.2	578	3.1	163	3.8
Structures and parts thereof	2987	13	2484	13.2	503	11.8
- stairs and steps	1319	5.7	1168	6.2	151	3.6
- floors and flooring material	321	1.4	277	1.5	44	1
- concrete and other man-made outdoor surfaces	271	1.2	234	1.2	37	0.9
- porches, balconies, open-side floors or floor openings	144	0.6	98	0.5	46	1.1
- gutters, drainpipes, down spouts, run-off pipes and kerbing	116	0.5	93	0.5	23	0.5
- roofs	105	0.5	57	0.3	48	1.1
- handrails, railings and banisters	100	0.4	71	0.4	29	0.7
- windows	95	0.4	62	0.3	33	0.8
- ramps and landings	73	0.3	63	0.3	10	0.2
- doors	58	0.3	46	0.2	12	0.3
- gates	46	0.2	36	0.2	10	0.2
- other	339	1.5	279	1.5	60	1.4
Yard and garden equipment	1048	4.5	819	4.4	229	5.4
- fences/fence posts/poles	577	2.5	577	3.1	148	3.5
- logs	121	0.5	93	0.5	28	0.7
- ladders	91	0.4	63	0.3	28	0.7
- other	111	0.5	86	0.5	25	0.6

Table 10 (continued)

Breakdown Factor	Frequency Present-ations	% Total Present-ations	Frequency Non-admissions	% Total Non-admissions	Frequency Admissions	% Total Admissions
Nursery furniture	836	3.6	686	3.7	150	3.5
- prams, baby carriages and strollers	239	1	195	1	44	1
- high chairs	147	0.6	120	0.6	27	0.6
- cots	113	0.5	99	0.5	14	0.3
- baby walkers and jumpers	97	0.4	88	0.5	9	0.2
- baby change tables	78	0.3	62	0.3	16	0.4
- other	162	0.7	122	0.6	40	0.9
Vehicles	537	2.3	410	2.2	127	3
Toys	511	2.2	409	2.2	102	2.4
- tricycles, scooters, wheeled riding toys	161	0.7	131	0.7	30	0.7
- tree houses and playhouses	79	0.3	57	0.3	22	0.5
- other	271	1.2	221	1.2	50	1.2
Animals	397	1.7	290	1.5	107	2.5
- horse	230	1	155	0.8	75	1.8
- dog	140	0.6	112	0.6	28	0.7
- other	27	0.1	23	0.1	4	0.1
Kitchenware	286	1.2	234	1.2	52	1.2
- knives	159	0.7	142	0.8	17	0.4
- other	127	0.6	92	0.5	35	0.8
Packaging materials and containers	259	1.1	208	1.1	51	1.2
- rope or string	63	0.3	51	0.3	12	0.3
- other	196	0.9	157	0.8	39	0.9
Fabrics, drapery, soft furnishings (excluding furniture)	227	1	204	1.1	23	0.5
- rugs, runners, throw rugs, doormats	120	0.5	107	0.6	13	0.3
- other	107	0.5	97	0.5	10	0.2
Industrial or retail plant	225	1	175	0.9	50	1.2
Personal use items (excluding cosmetics)	215	0.9	171	0.9	44	1
- footwear	86	0.4	77	0.4	9	0.2
- other	129	0.6	94	0.5	35	0.8
Food and drink	131	0.6	87	0.5	44	1
Laundry Appliances	94	0.4	72	0.4	22	0.5
- clotheslines, clothes drying racks or clothes horses	63	0.3	47	0.3	16	0.4
- other	31	0.1	25	0.1	6	0.1
Product unknown or not in scope	128	0.6	97	0.5	31	0.7
Other	526	2.3	402	2.1	124	2.9
Total	23047	100	18794	100	4253	100

The rank order of the ten products most frequently implicated in child fall injury non-admissions is provided in Table 11 to guide prioritisation of prevention strategies.

Table 11: Rank order of products most frequently implicated in non-admitted fall injuries for children under 15 years of age, Victorian Injury Surveillance System, 1989 - 1993.

Rank	Product Involved
1	Bicycles and bicycle accessories
2	Stairs and steps
3	Chairs and stools
4	Monkey bars and other climbing apparatus
5	Conventional beds
6	Skates and skateboards
7	Nursery furniture (aggregated)
8	Football
9	Fences/fence posts/poles
10	Slides and sliding boards

Table 12: Rank order of products implicated in non-admitted fall injuries, by 5-year age groups for children under 15 years of age, Victorian Injury Surveillance System, 1989 - 1993.

	Product Involved		
Rank	**Age group: 0-4 years**	**Age group: 5-9 years**	**Age group: 10-14 years**
1	Chairs and stools	Monkey bars/climbing	Bicycles and accessories
2	Conventional beds	Bicycles and accessories	Skates,skateboards,roller skates
3	Stairs and steps	Skates,skateboards,roller skates	Football
4	Toys	Stairs and steps	Basketball
5	Sofas/couches/lounges	Fences/fence posts/poles	Stairs and steps
6	Bicycles and accessories	Slides and sliding boards	Soccer
7	Tables/benches/countertops	Swings or swing sets	Netball
8	Slides and sliding boards	Trampolines	Fences/fence posts/poles
9	Prams, carriers, strollers	Conventional beds	Monkey bars/climbing
10	Bathtubs and showers	Bunkbeds	Horseback riding

Information on the products most associated with child falls by age group (0-4 years, 5-9 years, 10-14 years) is summarised in Table 12. Detailed tables of products associated with child falls by age group can be found in Appendix 2.

Products resulting in emergency department attendance but non-admission for children under 5 years of age related more to furniture and structural features of the home, while product involvement for children 5-9 years related to playground equipment, bicycles and fences, and children 10-14 years to bicycles and sports. Although products in the home were particularly hazardous for young children (perhaps because of exposure and/or their developmental stage), they became less important by the time the child reached 10 years of age. However, stairs and steps were a hazard for all three age groups.

When data from VISS was compared to national data from the National Injury Surveillance System (NISU), few differences were noted. A detailed account of the products associated with falls for children under 15 years of age in Australia is in Appendix 3. Of the 157 757 child fall injuries in the NISU database, 76% were product-related (5% higher than Victoria). The percentage of children presenting with furniture-related falls was higher in Victoria (18.1% of all fall presentations) than in the rest of the country (14.6%). Also, fall injuries relating to 'structures of a building' accounted for 13% of injury presentations in Victoria as opposed to 20% for the rest of Australia. The latter difference may be a function of different building designs across the country eg., elevated houses in Queensland or different building regulations.

2.7 General practitioner data - Extended Latrobe Valley Injury Surveillance (ELVIS)

The Extended Latrobe Valley Injury Surveillance (ELVIS) database began operation on November 7, 1994 (it captures 77% of injuries presenting to general medical practice clinics in the Latrobe Valley). As only the first six months of data was available for this analysis (from Nov 1994-May 1995), the sample of injuries may be biased as seasonal variations may have applied eg., the proportion of sports-related falls may be affected by the fact that the data collection period was in the summer months. It should also be noted that this collection of general practice data only covers the Latrobe Valley region which may not be representative of the whole of Victoria. A previous study found that people in the Latrobe Valley often use the Emergency Department of the Latrobe Valley Regional Hospital as an alternative to General Practice (Valuri & Routley, 1994). This finding suggests that the ELVIS data may under-estimate the rate of less severe injuries in the wider Victorian community.

Data on the 362 cases of child falls presenting in the 6 month period were extracted from ELVIS using E-code classifications. Table 13 summarises the results of the analysis of the product-related falls by age group.

Table 13: Product-related fall injury frequencies for children under 15 years of age.

Cause of Injury Age group	0-4 yrs	5-9 yrs	10-14 yrs	Total
Playground equipment	10	26	7	43
Stairs/steps	7	4	12	23
Chair/bed	14	5	2	21
Dive/jump into pool	0	1	3	4
Ladders/scaffolding	0	2	0	2
Building/structure	0	0	2	2
Other hole/opening	0	0	2	2
Product involvement not known	83	87	95	265
- slip/trip	*53*	*67*	*61*	*181*
- other fall from different level	*27*	*14*	*15*	*56*
- collision in sport	*0*	*3*	*11*	*14*
- other collision	*3*	*3*	*7*	*13*
- fracture, unspecified	*0*	*0*	*1*	*1*
Total	**114**	**125**	**123**	**362**

Source: The Extended Latrobe Valley Injury Surveillance (ELVIS) database

Overall, males and females were almost equally represented in all fall injuries (50.6% males and 49.4% females). However, more females than males fell from playground equipment (15.1% versus 8.7%). Playground equipment accounted for 11.9% of the total fall injury presentations to general practitioners, followed by steps and stairs which accounted for 6.4% of the total. Chairs and beds were the major products involved in fall injuries in children aged 0-4 years, playground equipment in children aged 5-9 years and stairs and steps in children aged 10-14 years.

All these findings are consistent with those reported from the analysis of the Victorian public hospital admissions data (VIMD).

The ELVIS system also allowed an analysis by breakdown factor (factors leading to the injury event) which enabled a more detailed examination of the products involved in the fall events. Breakdown factors involving natural environmental factors and persons were not included in the definition of product-related falls. Up to two product-related breakdown factors can be recorded for each fall injury event. As information on product involvement was not included in the majority (56.7%) of the fall cases on the database, the findings in this section are based on information on 43.3% of fall injuries.

As shown in Table 14, based on the products specified in the injury event records, the majority of the fall injuries to children presenting to general practice were caused by sporting equipment (11.4%) and playground equipment (10.4%).

Table 14: Frequency of product-related falls by breakdown factors for children under 15 years. General Practice presentations, Latrobe Valley, Victoria, Nov 1994 - May 1995

Breakdown Factor	Frequency	Percentage
Sports and recreation	66	11.4
- basketball	14	2.4
- roller/In-line skates, skateboards, ice-skates	7	1.2
- football	7	1.2
- swimming pool	6	1
- netball	5	0.9
- soccer	2	0.3
- other	25	4.3
Playground equipment	60	10.4
- monkey bars and other climbing apparatus	24	4.2
- trampolines	15	2.6
- slides/sliding boards	6	1
- flying fox	3	0.5
- swings and swing sets	2	0.3
- other	10	1.7
Structures and parts thereof	38	6.6
- stairs and steps	23	4
- concrete and other man-made outdoor surfaces	4	0.7
- floors or flooring material	3	0.5
- porches/balconies/open-side floors/floor openings	2	0.3
- ramps or landings	2	0.3
- windows	1	0.2
- other	3	0.5
Furniture	31	5.4
- chairs and stools	11	1.9
- tables, benches and countertops	6	1
- bunkbeds	5	0.9
- beds	4	0.7
- bathtubs and showers	2	0.3
- cabinets, racks, room dividers, shelves	2	0.3
- other	1	0.2
Yard and garden equipment	17	2.9
- fences/fence posts/poles	7	1.2
- ladders	4	0.7
- logs	3	0.5
- other	3	0.5
Toys	7	1.2
- tricycles, scooters, wheeled riding toys	2	0.3
- other	5	0.9
Nursery equipment	6	1
- highchairs	2	0.3
- prams and strollers	2	0.3
- other	2	0.3
Packaging materials	5	0.9
- rope or string	2	0.3
- bags	2	0.3
- containers	1	0.2
Industrial	5	0.9
- shopping trolleys	2	0.3
- other	3	0.5
Vehicles	3	0.5
Rugs, runners, throw rugs, doormats	2	0.3
Animals (dogs)	2	0.3
Other	8	1.4
Product unknown or not in scope	328	56.7
Total	**578**	**100**

A listing of the ten products most frequently implicated in child fall injuries presenting to general practitioners is shown in Table 15.

Table 15: Rank order of product-related fall injury by frequency for children under 15 years of age. General Practice presentations, Latrobe Valley, Victoria, Nov 1994 - May 1995

Rank	Product Involved
1	Monkey bars and other climbing apparatus
2	Stairs and steps
3	Trampolines
4	Basketball
5	Chairs and stools
6	Skates and skateboards
7	Fences/fence posts/poles
8	Football
9	Tables and benches
10	Slides and sliding boards

Note: the analysis excludes cases where product involvement was not known or not in scope and may include seasonal variations.

Monkey bars and other climbing apparatus accounted for most fall injuries, closely followed by stairs and steps. Trampolines, basketball and chairs and stools were also often implicated in child falls which resulted in General Practice visits. These findings generally accord with those from the above analyses of hospital admission and emergency department presentation data. The exceptions are that trampoline-related falls were found to be a frequent cause of fall injury visits to general practitioners but not to hospital emergency departments (presentations or admissions) and, conversely, that children with bicycle/bicycle accessory-related fall injuries do not present anywhere near as frequently to general practitioners as they do to hospital emergency departments.

2.8 Summary of findings

Table 16 compares the ranking of products involved in child fall injuries according to injury severity. It shows that products leading to fall deaths are very different from those resulting in non-fatal injury. None of the products implicated in deaths ranked in the ten most frequent causes of injury in the emergency department admissions, non-admissions or General Practice data.

While decisions about targetting of interventions should be firmly based on information on frequency or injury severity, the availability of effective countermeasures and implementation opportunities should also influence the selection and timing of interventions. These issues are canvassed in detail in Chapter 4.

Table 16: Rank order of product-related fall injuries by severity (deaths, emergency department presentations and admissions, general practice presentations) for children under 15 years of age. Victorian State Coroner's Office, July 1989 - June 1992, Victorian Injury Surveillance System, 1989 - 1993 and General Practice presentations, Latrobe Valley, Victoria, Nov 1994 - May 1995

Deaths VSCO: 1989-1992 **(n=27)**	%	**Emergency Department Admissions** (VISS: 1989-1993) **(n=4,253)**	%	**Emergency Department Non-admissions** (VISS: 1989-1993) **(n=18,794)**	%	**General Practice Presentations*** ELVIS: Nov 1994-May 1995 **(n=578)**	%
Swimming Pools	29.6	Bicycles or accessories	9.1	Bicycles or accessories	9.7	Monkey bars /climbing apparatus	4.2
Tractor/trailer	14.8	Monkey bars /climbing apparatus	7.8	Stairs and steps	6.2	Stairs and steps	4.0
Cars	11.1	Chairs and stools	4.3	Chairs and stools	5.4	Trampolines	2.6
Borehole/channel /irrigation/ sewer	11.1	Slides and sliding boards	3.8	Monkey bars/climbing apparatus	5.2	Basketball	2.4
Rubbish bins	7.4	Stairs and steps	3.6	Conventional beds	4.8	Chairs and stools	1.9
		Nursery furniture	3.5	Skates and skateboards	4.5	Skates and skateboards	1.2
		Fences/fence posts/poles	3.5	Nursery furniture	3.7	Fences/fence posts/poles	1.2
		Conventional beds	3.2	Football	3.1	Football	1.2
		Skates and skateboards	3.2	Fences/fence posts/poles	3.1	Nursery furniture	1.0
		Swings and swing sets	2.5	Slides and sliding boards	2.7	Slides and sliding boards	1.0

* Seasonal variations may apply.

Chapter 3 - Literature review - product involvement in child fall injuries

3.1 Introduction

The major focus of this chapter is to identify products implicated in child falls from the published literature and other relevant sources, including injury surveillance databases and a review of the informal literature located through the database held by the Consumer Safety Institute in Amsterdam. This information was used to develop a countermeasures matrix for addressing child product-related fall injuries, where the injuries have been shown to be frequent and/or severe and preventable (through the use of existing countermeasures).

3.2 Risk factors

It is important to recognise that child product-related fall injuries occur within a context of predisposing risk factors. Risk factors identified from the literature review and the injury data analysis (Chapter 2), include the gender and developmental stage (including physical size and body proportions) of the child and exposure to the hazardous product.

3.2.1 Gender and developmental stage of the child

Ozanne-Smith (1995) explained that 'injuries result from a complex interaction of exposure to the hazard, cognitive and motor development, level of supervision and other factors' (p.156). Prominent among the other factors that contribute to children's vulnerability to injury are: the child's physical size and shape and large head; larger surface area to body mass; short stature; and low body mass. Males predominate for most product-related injuries.

The nature of the products involved in injuries also varies across the age groups. This is influenced by the changing range of environments experienced by children as they grow older, as well as sociological and behavioural factors. Ozanne-Smith (1992) identified clear peaks in childhood for specific causes of injury. In the first year of life she reported that 19% of injuries were associated with nursery furniture, and more than 80% of these were due to falls. At age two, the frequency of injury presentations almost doubled compared with the first year of life, with furniture involvement (22%), mostly falls, still predominating. Medication involvement (16%) and finger jams in doors also reached their peak at this age.

For four-year-olds, bicycles and playground equipment were more frequently involved in injuries (23%) than for two-year-olds (11%), and vehicles emerged as an important factor (9%) as children were transported away from home more frequently. Sport and recreational injuries predominated for children eight years old (43%) through to twelve years old (52%), with bicycles and ball sports supplanting playground equipment as the major causes of these injuries in the older age group.

Ozanne-Smith (1992) stated that recognising the developmental stage at which particular factors are most dangerous provides manufacturers, authorities, parents and caregivers with the opportunity to strategically design and target interventions. She concluded that a sound knowledge of child development can make a significant contribution to the development of child injury prevention countermeasures and to the success of implementation strategies.

3.2.2 Exposure

There is a need for population-based studies to establish exposure to both hazardous and protective products in the environment. Exposure data allow the calculation of accurate estimations of the risk posed by products, enable relative risks of products to be determined and assist the selection of appropriate interventions (Ozanne-Smith, 1995). In addition, governments in Australia and elsewhere are increasingly requiring exposure information as evidence that there is a need for new or revised standards for consumer safety. Senturia et al. (1993) in Chicago found that once exposure data on the use of particular products was taken into account, the risk of injury for children increased for bunk beds, skateboards and sleds as age increased.

To date, few exposure studies of consumer products have been undertaken in Australia. In 1992 the Australian Bureau of Statistics (ABS) conducted Home Safety Surveys in Victoria and New South Wales that collected data on a number of hazardous and protective products and the frequency of their use. For example, it was found that only 20% of households (with children) that had steps and stairs inside the house had stair guards fitted, and only 40% of households had anti-slip surfaces in the bath or

shower (Lazzaro, 1993). Information collected in the Victorian survey on babywalkers showed that 12,453 babywalkers were in use in households with children under the age of one year. Because of the availability of this data, Ozanne-Smith and Brumen (1993) were able to calculate that the annual risk ratio for significant injury to children under one year of age from babywalkers was 1:192.

It is not known whether the observed male over-representation for most product-related injuries is accounted for by higher exposure rates. An exposure study undertaken by Drummond and Ozanne-Smith (1991) reported that male over-involvement in bicycle-related injuries was associated with their higher level of exposure.

Technical studies are also needed to establish risk. For example, the Consumer Research Laboratory in Amsterdam tested a number of products (e.g., bunk beds, highchairs and pushchairs) for stability by measuring how the products performed under different loads (van Aken, Biswell & Evans, 1994). Information about safety hazards when different loads or weights are applied to products has implications for injury risk management.

3.3 Products implicated in child fall injury

As the result of computerised searches of formal and informal literature databases, and analyses of injury databases, products identified as substantially implicated in child fall injuries are:

Nursery furniture:

- *babywalkers*
- *cot, cribs and cradles*
- *prams and strollers*
- *highchairs*
- *change tables*
- *porta-chairs*
- *bouncinettes (exercisers)*
- *car restraints*

Household furniture:

- *bunk beds*
- *conventional beds*
- *chairs and stools*
- *tables*
- *benches*
- *coffee tables*
- *sofas and couches*

Structural features of the home:

- *steps and stairs*
- *balconies*
- *concrete and other flooring*
- *domestic architectural glass (inc. windows)*
- *bathtubs and showers*

Playthings, sports equipment and sports activities:

- *toys*
- *bicycles and tricycles*
- *bicycle child carrier seats*
- *horse riding*
- *swimming pools and spas*
- *skating:*
  - *rollerskates*
  - *skateboards*
  - *rollerblades / in-line skates*
  - *ice skating*
- *playgrounds:*
  - *general*
  - *climbing apparatus and monkey bars*
  - *slides*
  - *swings*
  - *seesaws*
  - *trampolines and mini-trampolines*

Miscellaneous:

- *shopping trolleys*
- *ladders and stepladders*
- *footwear*

3.4 Literature review

The literature review is spread over several parts of this report. In this chapter the literature is analysed to identify associations between products and child falls. The political and economic context for product safety is briefly reviewed in Chapter 1. Information relating to relevant Australian and international standards is presented in Appendix 4. A comprehensive analytical review of countermeasures for child product-related injury together with a brief review of the theoretical principles of intervention strategies appears in Chapter 4.

3.4.1 Key products identified in the literature

Nursery furniture

Childsafe NSW analysed hospital admission data for the financial year 1990-1991 and found that 80% of nursery furniture-related injuries resulted from falls. The majority of the injuries were concussion and fractures (Kim, 1995). Routley & Valuri (1993) reported from Victoria that 62% of nursery furniture-related injury presentations were due to falls. Nursery furniture-related injuries were almost entirely confined to children less than 3 years of age, and 90% of injuries occurred in the victim's home.

Babywalkers

Author/Year	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Reported in 'The Age Newspaper' (1995)	USA	Descriptive	Infants and toddler injuries related to babywalkers	Unknown		• 25,000 infants/toddlers injured as a result of babywalkers in 1993 • 11 deaths since 1989
Australian Bureau of Statistics (1992)	Australia (VIC)	Random sample	N = approx 4,000 Random sample of households in Melbourne (sample scaled-up to include whole of Melbourne)	ABS Home Safety Survey (1992)	Exposure to babywalkers	• 19% of households with a child less than one year old had a babywalker in use.
Ozanne-Smith & Brumen (1993)	Australia	Injury surveillance database	133 babywalker injury cases	• Victorian Injury Surveillance System (1989-1992) • ABS Home Safety Survey (1992)	• Emergency department presentations • Exposure information: households with a child less than one year old with a babywalker in use	• 77% of babywalker injuries involved a fall • Steps and stairs implicated in 38% of injury cases • Estimated risk of 1 in 192 babywalkers causing significant injury to children under 1 year of age • Estimate increases to 1 in 96 if General Practice data is included
Williams (1994)	Australia (VIC)	Database (comparison groups)	Infants aged 6-11 months injured as a result of babywalkers (n=115), prams/strollers (n=86), or highchairs (n=67)	• Victorian Injury Surveillance System (VISS) (1989-1993) • ABS Home Safety Survey (1992)	• Emergency department presentations • Exposure information	• Risk of babywalker injury was 4.4 times higher than risk of pram/stroller injury, and 3.8 times higher than the risk of highchair injury
Ozanne-Smith & Heffernan (1990)	Australia	Injury surveillancedata base	• 168 cases of babywalker-related injuries to children under 3 years of age	National Injury Surveillance and Prevention Program (NISPP)	• Emergency department presentations	• 57% of the cases resulted from falls from one level to another, e.g., fall down or against steps or stairs, a steep embankment • 24% of the cases resulted from a fall on the same level • 88% of the injuries were to the head and face • 11.9% hospital admission rate

Note:

- The marketing manager of *Britex* (an importer of babywalkers) stated that babywalkers are recommended to be used under parental supervision like all other nursery toys/products (The Age Newspaper', 26/4/92).
- Babywalkers are claimed to adversely affect motor development and the development of gait (Williams, 1994). Restriction of mobility would reduce risk of exposure to changes in floor level and other hazards e.g., burns from oven doors (Ozanne-Smith & Brumen, 1993). A product banis recommended by many child safety authorities.

Cots, cribs and cradles

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Ozanne-Smith & Heffernan (1990)	Australia	Injury surveillance database	• 60 cases of cot-related injuries to children under 3 years of age	National Injury Surveillance and Prevention Program (NISPP)	• Emergency department presentations	• 77% of injury cases from cots were due to falls • Of the 46 falls recorded, 36% resulted from the child attempting to climb out of the cot • 11.7% hospital admission rate (includes deaths)
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	135 children under 3 years of age injured in the home	VISS (1989-1992)	• Emergency department presentations	• 34% of cot injuries were associated with a fall from less than one metre • 25% resulted from a fall over one metre • 14% admission rate • 21% of the injuries were fractures, primarily to the radius/ulna, clavicle and humerus

Prams and strollers

Author/Year	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	114 children (under 3 years of age) injured in the home	VISS (1989-1992)	• Emergency department presentations • Injuries in the home	• 42% of injuries were associated with a fall less than one metre • 17% admission rate • Bruising accounted for 36% of the injuries, cuts and lacerations 26% (especially to the face, scalp, nose and mouth)
Watson & Ozanne-Smith (1993)	Australia (VIC)	Follow-up telephone survey of children who fell from prams or strollers	37 children under 3 years of age	VISS (1989-1990)	• Survey of children attending the emergency department of VISS hospitals re. details of injury event	• Steps implicated in 57% of the cases • Of the 18 prams and strollers fitted with a child restraint, only five child restraints were in use at the time of the injury (28%)
Ozanne-Smith & Heffernan (1990)	Australia	Injury surveillance database	• 287 cases of pram and stroller-related injuries to children under 3 years of age	National Injury Surveillance and Prevention Program (NISPP)	• Emergency department presentations • Injuries associated with nursery furniture	• 75% of injuries fall-related • Of these, 11% involved the pram tipping or falling, suggesting problems with stability of design • Steps, stairs or escalators involved in 7% of the cases • Failure to use an appropriate child restraint was a major factor associated with injury risk • 12.2% hospital admission rate (includes deaths)

Note:

- *Choice* magazine conducted tests of pram and stroller safety (ACA Aug.1994, Nov.1991) and recommended regular monitoring of nursery furniture safety by consumer organisations.

Highchairs

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Watson & Ozanne-Smith (1993)	Australia	Survey (see above)	28 children under 3 years of age	VISS (1989-1990)	• Survey of children attending the emergency department of VISS hospitals re. details of injury event	• 83% of injuries associated with highchairs were the result of falls • only 25% of children who suffered an injury as a result of a fall from a highchair were wearing a form of safety restraint, while 80% of the sample had safety restraints fitted
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	154 children (under 3 years of age) injured in the home	VISS (1989-1992)	• Emergency department presentations • Injuries in the home	• 67% of the injuries caused by falls • 40% resulted from a fall under one metre • 21% from a fall greater than one metre • 6% resulted from a collapse or malfunction of the highchair • Bruising accounted for 29% of the injuries, cuts and lacerations 22% (especially to the face, scalp, nose and mouth) • Concussion accounted for 18% of the injuries, fractures 11%
Ozanne-Smith & Heffernan (1990)	Australia	Database	• 139 cases of highchair-related injuries to children less than 3 years of age	National Injury Surveillance and Prevention Program (NISPP)	• Emergency department presentations	• 83% of highchair injuries resulted from falls • Of these, 30% were standing up or attempting to climb out of the highchair at the time of the injury • Failure to use an appropriate child restraint was a major factor associated with injury risk • 12.2% hospital admission rate (includes deaths)

Change tables

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Ozanne-Smith & Heffernan (1990)	Australia	Database	• 94 cases of change table-related injuries to children less than 3 years of age	National Injury Surveillance and Prevention Program (NISPP)	• Emergency department presentations	• 91% of injuries associated with change tables resulted from falls • 87% of the injuries occurred during the first year of life • Absence of restraining devices in several models of change tables was noted • 11.7% hospital admission rate (includes deaths)

Bouncinettes (exercisers)

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Ozanne-Smith & Heffernan (1990)	Australia	Injury surveillance database	• 32 cases of bouncinette-related injuries to children less than 3 years of age	National Injury Surveillance and Prevention Program (NISPP)	• Emergency department presentations	• Fall from a height (e.g., benches, tables, freezer, washing machine, bed) accounted for at least 38% of the injury events • 94% of the injuries occurred during the first year of life • 15.6% hospital admission rate

Household furniture

Bunk beds

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Thompson (1995)	Australia (SA)	Prospective-comparison groups	150 children aged 12 years and under treated for injuries in Adelaide	• South Australian Injury Surveillance System	• Emergency department presentations	• Risk of injury for children aged 2-12 years was 9.2 injuries per 1 000 persons per year in a bunk bed, compared to 1.9 injuries per 1 000 persons per year in a conventional bed
				• Population survey of metropolitan Adelaide families	• Exposure information re. type of bed slept in	• Bunk beds had a relative risk almost five times greater than conventional beds for children aged 2-12 years and 13 times greater for children aged 2-4 years
					• Rates of hospital treated injury associated with elevated beds and conventional beds by age group	• Hospital admission rate for bunk beds was 22% as opposed to 8% for conventional beds • 20% of falls directly involved ladders, 10% structural failure of the bed and more than 10% occurred during sleep, indicating the inadequacy or absence of guard rails. • Injury risk reduced by 9 years of age
Routley & Valuri (1993)	Australia (VIC)	Database	1 533 children under 15 years of age were injured in the home in association with beds (321 of these were associated with bunk beds)	VISS (1989-1992)	• Emergency department presentations	• 18% of children required hospital admission for bunk beds injuries versus 11% for conventional beds • Falls over one metre accounted for at least 70% of all the injuries associated with bunk beds • Two thirds of the injuries associated with bunk beds occurred while playing • Bunk bed injuries: arm and wrist fractures accounted for 22% of the injuries, concussion 14%
Kim (1995)	Australia (NSW)	Database	• 186 bedroom furniture- related hospitalisations	Childsafe NSW database (July 1990 - June 1991)	• Product-related hospital admissions	• Bunk beds accounted for 48% of the injuries • 94% of bunk bed injuries involved a fall from the top bunk • Bunk bed injuries: fractures (58%), concussion (21%)

Note:

- The South Australia Health Commission submitted a draft standard to Standards Australia which become the new Australian Bunk Bed Standard (Thompson, 1995)

Conventional beds

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	1 212 children under 15 years of age injured in the home	VISS (1989-1992)	• Emergency department presentations	• 11% admission rate for conventional beds • Over half of the injuries were caused by falls under one metre • 40% of children were aged 2 years and younger, 20% aged 3 to 4 years • Of the 90 children sleeping or resting when the injury occurred, 60% were aged under three years • Arm and wrist fractures accounted for 11% of the injuries, concussion 7%
Xiaohan, Wesson & Kenney (1993)	Canada	Survey	1 538 children aged 18 years or less injured in the home	Emergency Department, The Hospital for Sick Children, Toronto (Oct 1990 - Sept 1991)	• Emergency room presentations • Questionnaires completed by parents and doctors	• Falls accounted for 51% of the injuries • Beds accounted for almost half of the furniture related falls in the home • Falls from beds resulted in a 13% admission rate

Chairs and stools

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	1 086 cases of chair- and stool-related injuries in the home to children under 15 years of age	VISS (1989-1992)	• Emergency department presentations	• 65% of the injuries caused by falls under one metre • Most injuries resulted from the child directly falling from a chair • 84% of the cases involved a child standing, sitting or climbing onto the chair • Floors or flooring materials actually caused 26% of the injuries
Xiaohan, Wesson & Kenney (1993)	Canada	Survey	1 538 children aged 18 years or less injured in the home	Emergency Department, The Hospital for Sick Children, Toronto (Oct 1990 - Sept 1991)	• Emergency room presentations • Questionnaires completed by parents and doctors	• Falls accounted for 51% of the injuries • Falls from chairs was the third most frequent type of fall from furniture (after beds and tables) • Falls from chairs resulted in a lower hospital admission rate (6%) than falls from beds, sofas and tables (13%, 23% and 9% respectively)

Tables

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	1 242 cases of table-related injuries in the home to children under 15 years of age	VISS (1989-1992)	• Emergency department presentations	• 59% of the injuries caused by falls under one metre • 48% of the victims were aged two years and under • 90% of the injuries occurred during play • 62% of all injuries were to the head and facial area
Xiaohan, Wesson & Kenney (1993)	Canada	Survey	1 538 children aged 18 years or less injured in the home	Emergency Department The Hospital for Sick Children, Toronto (Oct 1990 - Sept 1991)	• Emergency room presentations • Questionnaires completed by parents and doctors	• Falls accounted for 51% of the injuries • Falls from tables were the second most frequent type of fall from furniture (after beds) • 9% hospital admission rate

Coffee tables

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	1 242 cases of coffee table-related injuries in the home to children under 15 years of age	VISS (1989-1992)	• Emergency department presentations	• Glass topped tables were directly implicated in 7% of table-related injury events
Ruddy, Bacchi & Fleisher (1985)	USA	• Injury surveillance database • Survey	256 955 furniture-related injuries in the US, 1 982 involving children (computer estimated national figures based on a smaller sample of 5 576 children)	Consumer Product Safety Commission (CPSC) through the National Electronic Injury Surveillance System (NEISS) database	• Emergency department presentations • Questionnaires • Practicing pediatrician survey	• 29% (1 594) of the injuries were from coffee tables • Lacerations to the face comprised 55% of the injuries to children under 5 years of age • Injuries to the head (21%) and face (21%) comprised most of injuries to children over 5 years of age • Children aged 12-36 months predominated (ED survey) • Coffee tables were mainly square or rectangular in shape (90%) (ED survey) • Compliance with coffee table safety advice found to be low (Practicing pediatrician survey)

Sofas and couches

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Xiaohan, Wesson & Kenney (1993)	Canada	Survey	1 538 children aged 18 years or less injured in the home	Emergency Department, The Hospital for Sick Children, Toronto (Oct 1990 - Sept 1991)	• Emergency room presentations • Questionnaires completed by parents and doctors	• Falls accounted for 51% of the injuries • Falls from sofas were the fourth most frequent type of fall from furniture • Falls from sofas resulted in the highest hospital admission rate (23%) for falls from furniture

Structural features of the home

Steps and Stairs

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	942 cases of injuries related to step / stairs in the home to children under 15 years of age	VISS (1989-1992)	• Emergency department presentations	• At least 75% of the injuries were caused by falls • 37% of falls were under one metre, 20% related to slips, 20% to trips, 14% to a fall on the same level, and 6% to a fall greater than one metre • Arm and wrist fractures represented 8% of the injury cases, ankle sprains/strains 6% and concussion 8% • Most injuries (21%) resulted from cuts and lacerations to the face, mouth and scalp
Xiaohan, Wesson & Kenney (1993)	Canada	Survey	1 538 children aged 18 years or less injured in the home	Emergency Department, The Hospital for Sick Children, Toronto (Oct 1990 - Sept 1991)	• Emergency room presentations • Questionnaires completed by parents and doctors	• Falls accounted for 51% of the injuries • Steps and stairs accounted for 15% of falls in the home • Falls from steps and stairs resulted in a 15% admission rate
Musemeche, Bartherl, Cosentino & Reynolds (1991)	USA (Chicago)	Trauma database	70 child fall admissions from a height of at least 10 feet or one storey	Pediatric Trauma Centre admissions (1985-1988)	• Trauma-related hospital admissions	• 23% of the falls were from stairs

Balconies

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Musemeche, Bartherl, Cosentino & Reynolds (1991)	USA (Chicago)	Trauma database	70 child fall admissions from a height of at least 10 feet or one storey	Pediatric Trauma Centre admissions (1985-1988)	• Trauma-related hospital admissions	• 16% of the falls were from a porch or balcony
Lehman & Schonfeld (1993)	USA (California)	Retrospective study	151 children admitted for injuries sustained secondary to a fall from a building (windows, balconies, fire escapes and roofs)	Large, west coast hospital in California	• Hospital admissions • Hospital discharge data • Survey of building code regulations	• 24% of children fell from balconies

Concrete and other flooring

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Garrettson & Gallagher (1985)	Virginia, USA	Analysis of hospital data	1 032 children who fell and hit their head	• Trauma death data • Federally funded Injury Prevention Demonstration Project	• Hospital presentations and admissions	• Concrete and asphalt surfaces comprised 32% of the surfaces that children's heads impacted on
Xiaohan, Wesson & Kenney (1993)	Canada	Survey	1 538 children aged 18 years or less injured in the home	Emergency Department, The Hospital for Sick Children, Toronto (Oct 1990 - Sept 1991)	• Emergency room presentations • Questionnaires completed by parents and doctors	• Falls accounted for 51% of the injuries • Floors were implicated in 12% of falls in the home, 14% of these falls resulted in hospital admission.

Domestic architectural glass (including windows) and other structural features of the home

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Musemeche, Bartherl, Cosentino & Reynolds (1991)	USA (Chicago)	Trauma database	70 child fall admissions from a height of at least 10 feet or one storey	Pediatric Trauma Centre admissions (1985-1988)	• Trauma-related hospital admissions	• 36% of the falls were from windows, 16% from rooves, porches or balconies, and 23% from stairs
Lehman & Schonfeld (1993)	USA (California)	Retrospective study	151 children admitted for injuries sustained secondary to a fall from a building (windows, balconies, fire escapes and roofs)	Large, west coast hospital in California	• Hospital admissions • Hospital discharge data • Survey of building code regulations	• Windows were implicated in 62% of falls from a height • None were fitted with window guards • 70% of children fell from the second storey and 20% from the third storey • Low mortality and high morbidity cost of these injuries e.g., for long-term rehabilitation care
Valuri (1995)	Australia (VIC)	Injury surveillance database	443 children under 15 years of age with domestic architectural glass-related injuries	VISS (1989-1993)	• Emergency department presentations	• Falls accounted for a third of the injuries, with 88% occurring during play • 26% of children required hospital admission • 44% of the injuries occurred to children under 5 years of age • Children aged 5-9 years were the predominant age group admitted (30%)

Note:

- The Building Code of Australia has required safety glass installation in specified locations in both new and renovated homes since 1991 (Valuri, 1995).

Bathtubs and showers

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Xiaohan, Wesson & Kenney (1993)	Canada	Survey	1 538 children aged 18 years or less injured in the home	Emergency Department, The Hospital for Sick Children, Toronto (Oct 1990 - Sept 1991)	• Emergency room presentations • Questionnaires completed by parents and doctors	• Falls accounted for 51% of the injuries • Bathtubs were implicated in 3% of falls in the home, yet accounted for 4% of injury admissions

Playthings, sports equipment and sports activities:

Toys

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Kim (1995)	Australia (NSW)	Hospital presentations database	121 cases of toy injuries to children under 15 years of age	Childsafe NSW hospital presentations database (July 1990 - June 1991)	• Emergency department presentations	• 67% of injuries associated with toy structures (e.g. cubby houses) were fractures • Concussion was the most common injury associated with moving toys (29%) • Cuts / lacerations (29%) and insertion of foreign bodies (28%) accounted for the majority of injuries involving stationary toys

Bicycles and tricycles

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Kim (1995)	Australia (NSW)	Hospital presentations database	618 cases of bicycle, tricycle and scooter injuries to children under 15 years of age	Childsafe NSW hospital presentations database (July 1990 - June 1991)	• Emergency department presentations	• 98% of injuries were associated with a bike or bicycle equipment e.g., chains, brakes • Fractures comprised 53% of the injuries, concussion 18% and cuts/lacerations 12%
Finch, Newstead, Cameron & Vulcan (1993) Cameron, Vulcan, Finch & Newstead (1994)	Australia (Melbourne)	Analysis of pre- and post-legislation data (trend)	All ages	• Transport Accident Commission (TAC) data (July 1981-June 1991) • VicRoads annual helmet wearing surveys (1983-1991) • MUARC observational surveys of bicycle usage and helmet wearing (1987/1988-1992)	• Surveys • Observational studies • Injury compensation insurance claim data	• Bicycle use by children reduced by 36% during the first year of mandatory helmet wearing • The extent to which reduced cycling relates to the helmet legislation is unknown.

Note:

- Mandatory helmet wearing was introduced in Victoria on July 1, 1990 which required all bicyclists to wear an approved safety helmet (Cameron, Vulcan, Finch & Newstead, 1994).
- The effectiveness of helmet legislation is reported in Chapter 4.

Bicycle child carrier seats

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Tanz & Kaufer Christoffel (1991)	USA(Washington DC)	Analysis of CPSC data	An estimated 4 960 bicycle seat-related injuries to children	• US Consumer Product Safety Commission (CPSC) Injury Information Clearinghouse (1978-1988) • National Electronic Injury Surveillance System	• Emergency department presentations	• Falls accounted for 80% of the injuries • 90% of injuries were suffered by children under five years old, 79% to children under the age of three • Injuries to the head (51%) and face (21%) predominated

Horses

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Williams and Ashby (1995)	Australia (VIC)	Injury surveillance database	• 1 068 horse riding-related injuries for all age groups	VISS (1988-1993)	• Emergency department presentations • In depth analysis of 251 horse-riding injury cases using VISS one-line narratives	• Children accounted for 35% of all horse riding-related injuries, with females comprising 77% of the injury cases, and the 10-14 age group pre-dominating • 77% of injuries were associated with falls • Fractures were the predominant injury type for children

Swimming Pools and Spas

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Jensen, Williams, Thurman & Keller (1992)	USA(Utah)	Retrospective study in four counties	119 submersion injuries involving children under 5 years of age	• 1984-1988 • Bureau of Vital Records and Health Statistics, Utah Department of Health • Office of the Medical Examiner, Utah Department of Health • Local community hospitals, Primary Children's Medical Center and the regional children's hospital	• review of medical records	• Infants under one year of age accounted for 28% of the 119 submersion injuries • Of the 86 injuries and deaths occurring in pools and open moving bodies of water, 71% resulted from unintentional falls.
Scott (1994)	Australia	Descriptive	295 recorded child drownings	ABS (1990-1992)	• Death data	• Drowning was the main cause of child injury death in Australia, accounting for 295 deaths between 1990-1992. • 75% of children who drowned were less than five years old • Most children drowned in an unfenced/unprotected pool they had legitimate access to, rather than by gaining access to someone else's property

Rollerskates

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Kim (1995)	Australia (NSW)	Injury surveillance database	344 cases of mobile unpowered sporting equipment injuries (e.g., skateboards, roller blades, roller skates, skating) to children under 15 years	Childsafe NSW hospital presentations database (July 1990 - June 1991)	• Emergency department presentations	• Roller skates/roller blades accounted for 63% of the injuries • 63% of the children injured were aged 9-12 years • Fractures comprised 88% of the injuries and concussion 6%
Schieber, Branche-Dorsey & Ryan (1994)	USA	Case series	30 863 persons treated for in-line skating, rollerskating or skateboard injuries	National Electronic Injury Surveillance System (NEISS) data (July 1992 - June 1993)	• Emergency department presentations	• For every one in-line skating injury treated, 3.3 rollerskating and 1.2 skateboarding injuries were treated • Median age of children with rollerskating injuries was 12 years • Fractures, dislocations, sprains, strains and avulsions accounted for 67% of rollerskating injuries • 44% of the injuries were to the wrist

Skateboards

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Kim (1995)	Australia (NSW)	Injury surveillance database	344 cases of mobile unpowered sporting equipment injuries (e.g., skateboards, roller blades, roller skates, skating) to children under 15 years	Childsafe NSW hospital presentations database (July 1990 - June 1991)	• Emergency department presentations	• Skateboards accounted for 37% of this type of injury • Falls were often implicated • 65% of the injured children were aged 11-14 years • Fractures comprised 71% of the injuries and concussion 15%
Schieber, Branche-Dorsey & Ryan (1994)	USA	Case series	30 863 persons treated for in-line skating, rollerskating or skateboard injuries	National Electronic Injury Surveillance System (NEISS) data (July 1992 - June 1993)	• Emergency department presentations	• For every one in-line skating injury treated, 3.3 rollerskating and 1.2 skateboarding injuries were treated • Mean age of children with skateboarding injuries was 13 years • 50% of injured skateboarders had a musculoskeletal injury • 19% of the injuries were to the wrist
Cass & Ross (1990)	Australia (NSW)	Database	69 children admitted for skateboard-related injuries (n=80 admissions)	Westmead Hospital (30 month period to June 1989)	• Hospital admissions	• Children aged 13 and 14 years predominated (46%) • Fractured radius and ulna was the most frequent injury recorded (52%) • 13% suffered head injuries • Children under 10 years of age were particularly at-risk for sustaining fractures or head injuries (probably caused by their inability to control the skateboard)

Rollerblades / in-line skates

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Schieber, Branche-Dorsey & Ryan (1994)	USA	Case series	30 863 persons treated for in-line skating, rollerskating or skateboard injuries	National Electronic Injury Surveillance System (NEISS) data (July 1992 to June 1993)	• Emergency department presentations	• For every in-line skating injury treated, 3.3 rollerskating and 1.2 skateboarding injuries were treated • Mean age of injured in-line skaters was 15 years • 63% of injured in-line skaters had a musculoskeletal injury • 37% of the injuries were to the wrist
Heller (July 1993)	Australia (VIC)	Injury surveillance database	113 rollerblade injuries	VISS (1992)	• Emergency department presentations	• Under 15 year olds accounted for 59% of the injury cases • the numbers estimated to increase over the Christmas period given expected sales of approximately 50,000 pairs

Ice Skates

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Bernard, Corlett, Thomsen, Bell, McMahon, Richmond & Porter (1988)	England (Birmingham)	Database	169 injuries to ice skaters at a local skating rink	Birmingham Hospital Accident emergency department data (1984)	• Injury data • Interviews	• 75% of the injuries resulted from a fall • 84% of the injured skaters were aged under 21 years • Mean age was 16.4 years

Playground equipment

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Beugels (1994)	The Netherlands	Safety inspections - observational	663 playground inspections involving 7 150 pieces of playground equipment	Inspectorate for Health Protection, Hertogenbosch, Division Product Safety	• National survey on playground safety • Playground safety inspections	• 85% of the playgrounds inspected failed on at least one criteria for safety, a 6% increase on 1992 results
Jones (1992)	USA	Descriptive	200 000 injuries per annum involving playgrounds or playground equipment	NEISS (1989)	• Emergency department visits	• More than 70% of playground-related injury cases involved falls onto the playground surface
Chalmers (1995)	NZ	Case control study	300 children under 15 years who had fallen from playground equipment (110 injury cases requiring medical attention and 190 controls not requiring medical attention)	Emergency Department at Dunedin and Christchurch Public Hospitals	• Emergency department presentations • Interviews	• Arm fractures were the predominant injury sustained • Risk of injury increased with increased fall height • Falls in excess of 1.5 metres resulted in a 4.14 times greater risk of injury • Estimated a 45% reduction in emergency department presentations if maximum fall height reduced to 1.5 metres
Routley & Valuri (1993)	Australia (VIC)	Injury surveillance database	579 children under 15 years of age with home playground equipment injuries	VISS (1989-1992)	• Emergency department presentations	• Falls accounted for 63% of the injuries, with most resulting from impact with the ground or other natural surfaces
Routley (1993).	Australia (VIC)	Injury surveillance database	536 children under 6 years of age who sustained injuries in child care settings	VISS (1989-1992)	• Emergency department presentations	• Playground equipment (mainly monkey bars and climbing apparatus, slides and swings) accounted for 44% of all fall injuries in child care settings • 77% of all playground injuries were caused by falls
Kim (1995)	Australia (NSW)	Database	900 child playground equipment-related injury admissions to children under 15 years of age	Childsafe NSW hospital presentations database (July 1990 - June 1991)	• Emergency department presentations	• 90% of playground equipment injuries resulted from a fall (mainly from a height) • Majority of the injuries comprised fractures (60-88%) or concussion (7-12%) • Monkey bars were the main type of equipment involved (35%), followed by trampolines (17%), slippery dips (17%) and swings (15%)
Routley (1992)	Australia (VIC)	Database	452 children under 15 years of age with trampoline-related injuries.	VISS (1989-1991)	• Emergency department presentations • VISS one-line narratives	• Falls accounted for 52% of the injury events • Analysis of 248 trampoline one-line narratives indicated that 31% of the injuries occurred within the context of sharing a trampoline, 17% fell onto the frame, 11% fell onto the springs, 11% fell onto concrete or bluestone 9% fell onto an obstacle on the ground, 7% due to incorrect mounting/dismounting, and 14% other

Note:

- A number of studies are underway across Australia to gain more information about the playground injury problem. Dr James Nixon et al. from the Department of Child Health at the RCH in Brisbane are currently undertaking observation studies of children in playgrounds to obtain baseline exposure data. A separate in-depth study of 0-14 year olds presenting to the emergency department of Brisbane RCH with playground equipment injuries also includes an assessment of the playground site where the injury occurred. Similarly, an audit (checklist of hazards) of playgrounds is currently being conducted by the NSW Health Promotion Unit and Kidsafe NSW. Few of the numerous studies of playground injuries have involved a control group.

Miscellaneous:

Shopping trolleys

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Ashby (1995)	Australia (VIC)	Injury surveillance database	268 children injured under 15 years of age	VISS (1989-1993)	• Emergency department presentations	• Children under 5 years of age accounted for 69% of the injury cases, with the age group 1-3 years predominating • Over half of the injuries (56%) were associated with falls from trolleys, and a further 19% occurred when the trolley toppled over • More than half of the injuries (54%) were to the head and face

Footwear

Author/Year	Country	Study Type	Subjects	Setting/Data	Measures	Results
Baker & Bell (1991)	USA	Case series	3 015 children	The Children's Hospital of Philadelphia (February, May, July and October 1988)	• Emergency department visits	• Reported a relationship between type of footwear worn and injuries caused by loss of footing • Barefoot children and children wearing sneakers were significantly less likely to incur injuries following loss of footing • Children wearing smooth-synthetic soled footwear were significantly more likely to experience loss of footing than children wearing rough-textured soled footwear • Rubber-soled footwear was found to be significantly less frequently associated with loss of footing than other sole materials • There were frequent reports of children tripping over untied shoelaces

Chapter 4 - Review of countermeasures

4.1 Introduction

Countermeasures can be identified from a number of sources including theoretical/conceptual models of injury prevention, available literature, data sources and statistics, informal networks (injury prevention personnel), designers and manufacturers, and health care organisations.

Ozanne-Smith (1995) highlighted a number of factors that should be considered when selecting countermeasures for injury prevention:

- Adequate problem definition should precede the determination of the appropriate countermeasure for the purpose.
- A countermeasure will ideally involve a design change so that individual action is not required each time it is used.
- A countermeasure should have a cumulative protective effect over time (e.g., pool fence, pedestrian median strip).
- Countermeasures must be acceptable to those to be protected and, therefore, community (user) consultation and awareness programs must be considered.
- Countermeasures must be accessible by the community, in terms of cost and ease of access.
- There should be no unwanted side effects or potential misuse of the countermeasure.
- Interventions should co-ordinate with national and state/territory injury prevention and control strategies.
- The protective effects of the countermeasure should be measurable in order to determine its effectiveness, including benefit /cost ratio, prior to widespread implementation.

Once potential countermeasures are identified, it is then necessary to develop appropriate implementation strategies. As outlined by Ozanne-Smith (1995) these include:

- legislation/regulation (accompanied by enforcement);
- environmental/design changes;
- education/behaviour change/incentives;
- advocacy; and
- community- or organisation- based action.

This chapter describes one theoretical/conceptual model (Haddon's matrix and strategies) that has been widely applied to injury prevention and comprehensively reviews the literature on the prevention of product-related fall injuries among children. The review is presented in the form of a matrix which provides a detailed overview of potential and proven countermeasures, implementation strategies, barriers to implementation and current work in progress relevant to each of the products identified as fall injury hazards in the literature. Strategies for implementation or further research which emerge from this review are listed at the end of each product table. These are examined in more detail in chapter 5. In addition, a list of relevant Australian and European Standards is provided in Appendix 4.

4.2 Theoretical principles - Haddon's matrix and strategies

Haddon's matrix provides a conceptual framework for understanding the chain of events and pre-existing circumstances that lead to an injury event and identifies opportunities for prevention or amelioration. Within the model, the notion of time represented as phases (pre-event, event and post-event) are plotted against three factors implicated in the injury event - the person, the product and the interacting environment. Schematic representation of these phases and factors in a matrix allows identification of each possible point of intervention.

Haddon also developed ten strategies for determining the types of countermeasures available for injury prevention:

1. Prevent the creation of the hazard in the first place.
2. Reduce the amount of the hazard brought into being.
3. Prevent the release of the hazard that already exists.
4. Modify the rate or spatial distribution of release of the hazard from its source.

5. Separate, in time or space, the hazard and that which is to be protected.
6. Separate the hazard and that which is to be protected by interposition of a material barrier.
7. Modify relevant basic qualities of the hazard.
8. Make what is to be protected more resistant to damage from the hazard.
9. Begin to counter the damage already done by the environmental hazard.
10. Stabilise, repair, and rehabilitate the object of the damage.

(Robertson, 1983; cited in Ozanne-Smith, 1995, p8-9)

Education and behavioural change, at various organisational and community levels, may need to be associated with these strategies.

4.3 Products reviewed in the countermeasures matrix

The following products have been selected for inclusion in the countermeasure review matrix based on injury data analyses (chapter 2) and information from the literature (chapter 3) :

Nursery furniture:
- *babywalkers*
- *cots, cribs and cradles*
- *prams & strollers*
- *highchairs*
- *change tables*
- *porta-chairs*
- *bouncinettes (exercisers)*
- *car restraints*

Household furniture:
- *bunk beds*
- *conventional beds*
- *chairs and stools*
- *tables*
- *benches*
- *coffee tables*
- *sofas and couches*

Structural features of the home:
- *steps and stairs*
- *balcony*
- *concrete and other flooring*
- *domestic architectural glass (inc. windows)*
- *bathtubs and showers*

Playthings, sports equipment and sports activities:
- *toys*
- *bicycles and tricycles*
- *bicycle child carrier seats*
- *horse riding*
- *swimming pools and spas*
- *skating:*
  - *rollerskates*
  - *skateboards*
  - *rollerblades / in-line skates*
  - *ice skating*
- *playgrounds:*
  - *general*
  - *climbing apparatus and monkey bars*
  - *slides*
  - *swings*
  - *seesaws*
  - *trampolines and mini-trampolines*

Miscellaneous:
- *shopping trolleys*
- *ladders and stepladders*
- *footwear*

4.4 Review of countermeasures

Reference is made to the relevant Australian and International Standards under the appropriate product headings, a more detailed description of the Standards is provided in Appendix 4.

4.4.1 Nursery furniture

Babywalkers

Australian Standards: - No Australian Standard exists for babywalkers, only for C*hild Barriers for Domestic Premises*
European Standards: - British Standard and British Draft
- German

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation	• Product ban on fireworks (1974) proven effective - (provides a model for action on babywalkers) (85)	• Ban babywalkers (85, 155, 159 Australia; 68, 91 Austria; 90 USA) • Recall poor quality babywalkers	
Reduced availability	• Myer/Grace Brothers ceased to stock babywalkers for safety reasons (85, 106)	• Retailers refusing to stock babywalkers (81) • Federal Minister for Consumer Affairs wrote to 350 retailers in 1995 asking them not to stock babywalkers (134)	
Design changes	• Prevalence of "tipping over" falls in Austria was reduced following improved babywalker design (design not specified) (68)	• Broad base that is wider than household doorways (86) • Correction of inherent "top-heavy" instability of baby-walkers (85) • New homes and renovations designed free from changes in level • Reduce speed reached by design changes to wheels	
Restrict access		• Stair guards to restrict access to hazardous areas (85)	• U.S.A. study found that less than 50% of households acquired a stair barrier after their child had fallen down stairs from a babywalker (Kidsafe, 1994) • U.K. study found that one third of babywalker-related falls down stairs occurred even when stair guards were available at the top of the stairs (68)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Education		• Reduce speed reached (1 metre per second) by restricting use to small rooms (71) • Ensure babywalker is used on a level surface to prevent it toppling over, e.g., rugs (127) • Target education at NESB consumers at the point of sale, through Maternal & Child Health Centres and ethnic media (85) • Information on the product's intended use to accompany sale of babywalkers (58) • Supervise use at all times (81)	• Television public awareness campaigns have proven ineffective in England (40) • U.K. study found that up to 20% of infants are unsupervised at the time of injury (40)
Warning labels			• Warning labels introduced in NSW (1978) (85; Kidsafe, 1994), U.S.A. and U.K. (68; 10; 40) have proven ineffective in reducing babywalker injuries, though compliance is reported to be poor (85; Kidsafe, 1994)

Strategies for implementation and research:

- ongoing research on babywalker exposure and injuries [86]
- evaluate the effectiveness of reducing availability of babywalkers
- implement the British Standard for Stability [71]
- conduct campaigns with retailers and the community not to stock or buy babywalkers

Cots, cribs and cradles

Australian Standards: - Voluntary Australian Standard & Draft Voluntary Australian Standard
Aust/NZ Standards: - Voluntary Standard
European Standards: - British Standard and British Draft
- German
- Austrian
- French
- International Standards Organisation

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Voluntary Australian Standard to be made mandatory (99) • Product recall of unsafe cots (11)	
Design changes		• Enhance stability of rocking cradles (11)	
Education		• Position cot away from windows to prevent falls (127) • Remove large toys and objects from the cot which the child could stand on to climb out (127) • Safety information at the point of sale, Maternal & Child Health Centres, and child care facilities (86; 11; 81) - implemented by Kidsafe and the Office of Fair Trading • Promote the use of portable cots when visiting as opposed to beds (9) • Education to apply Australian safety specification legislation to second-hand cots and repairs (11)	

Strategy for implementation:

- develop a horizontal standard for fall heights

Prams & strollers

Australian Standards: - Voluntary Australian Standard
Aust/NZ Standards: - Voluntary Standard
European Standards: - British Standard and British Draft
- German

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Voluntary Australian standard to be made mandatory (23)	
Design changes (general)	• Stroller with a continuous handle to prevent bags being hung from the handle. Parcel tray installed at the base of the unit and longer wheel base to ensure stability when fully loaded (113)	• Barrier behind child's head when in layback position to prevent the child slipping out the back of the stroller - layback stroller not suitable for children under 6 months (23) • Design that allows for easier negotiation of steps and stairs (151) • Use of alternative child restraints for infants aged less than 6 months when lying down - harnesses similar to those used in infant capsules (151)	
Design change (full shoulder harness)(Relatively inexpensive and easy to use)	• Promotion and correct use of a full 5-point shoulder harnesses could prevent up to 80% of child falls from prams and strollers (151)	• Hiring schemes (151) • Rebate schemes (supported by appropriate advertising) to encourage the purchase of safe equipment (151) • Attachment points for the shoulder straps that can be adjusted according to weight and height (23)	• Three-point harnesses which buckle across the waist and incorporate a crotch strap are ineffective in preventing falls to children as young as 9 months (151) • South Australian study found an 81% non-compliance figure for restraint use (113)
Warning labels		• Bold warning labels on the back support of the stroller to remind consumers to restrain their child properly (151)	
Education		• Educate caregivers and the public about the safe and correct use of prams and strollers, e.g., not overloading the handles with shopping (127) • Provision of safety information at the point of sale, maternity hospitals and Maternal & Child Health Centres, including information about continuous handles, luggage tray below, 5 point safety harness, use of brakes and not leaving pram unattended, supervision of siblings, and purchase of equipment stamped with the Standards Mark (86; 30; 58; 151) • Information about the safety requirements of second-hand products (100) • Avoidance of steps and stairs (127)	

Strategies for implementation and research:

- promote products designed to prevent falls including full 5-point shoulder harness, continuous handle, parcel tray underneath
- encourage retailers to stock and consumers to buy products with 5-point harnesses given that there is little difference in cost between a full safety harness and a lap type restraint [151]
- evaluate the impact of Kidsafe/Office of Fair Trading brochures regarding design features and distribution at the point of sale

Highchairs

Australian Standards: - No Australian Standard exists for highchairs, only for *Harnesses for use in prams, strollers, and highchairs (including a detachable walking rein)*

European Standards: - British Standard and British Draft
- European - adopted by Germany
- Austrian
- Swiss
- European Standard and European Draft
- International Standards Draft

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Mandatory safety standard required emphasising stability, secure locking mechanisms, and effective restraints (86) [2]	
Design changes (general)	• Lesser risk associated with lower height chairs (86)	• Secure locking mechanisms to prevent collapse (100) • Improved stability to prevent the chair from rocking or tipping (100)	
Design change (full shoulder harness)(Relatively inexpensive and easy to use)	The promotion and correct use of a full 5-point shoulder harnesses could prevent up to 80% of child falls from highchairs (151)	• Include anchor points for a transferable safety harness (151) • Ideally the chair should come supplied with a full safety harness, or provide the facility to have it attached (24)	• The majority of highchairs tested by Choice in 1993 did not have a suitable harness, and none came supplied with a full safety harness (24)
Education		• Provision of safety information at the point of sale, and Maternal & Child Health Centres including stability, 5-point restraint and supervision (151; 81; 58) [2] • Place highchairs away from other objects, furniture and walls to prevent child leaning over in the chair (127)	

Strategy for research:

- evaluation of the impact of educational materials required

[2] Also work in progress, Peter Thompson, SA Health Commission

Change tables

Australian Standards: - No Australian Standard
European Standards: - French

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Introduce an Australian Standard (81)	
Design changes (general)		• Raised side edges to prevent rolling off (86; 81) • Safety railing (9)	
Design change (safety restraint)	Victorian study found promotion and correct use of safety restraints could prevent up to 80% of child falls from change tables (151)	• Transferable safety harness (151) • Effective child restraint locking mechanism (86)	
Education		• Safety advice given to parents at the point of sale, and Maternal & Child Health Centres (86; 81; 58) • Never leave the child unattended (127) • Use floor for changing babies nappies (9)	

Strategies for implementation and research:

- develop a horizontal standard for fall heights
- evaluate the impact of safety information
- pilot a subsidy scheme for safety harnesses

Porta-chairs

Australian Standards: - Nil
European Standards: - British Draft
- Dutch

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• More secure fastening mechanisms	
Reduced availability	• Myer/Grace Brothers ceased to stock porta-chairs for safety reasons (85, 106)		
Education		• Ensure chairs are secure when fastened (127) • Supervise children at all times (127) • Always use and fasten the restraint strap (127) • Use chairs only up to the age and weight specified by the manufacturer (127) • Remove objects from under table to prevent child from pushing up and loosening the chair (127) • Don't use the chair on light weight tables (127)	

Strategy for research:

- ascertain risk of porta-chairs through exposure and injury studies

Bouncinettes

Australian Standards: - Nil
European Standards: - Nil

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Warning labels		• Warning label (on bouncinette) not to place the bouncinette on elevated surfaces such as tables, benches or washing machines and not to leave the child unattended (151; 11)	
Education		• Educate caregivers about the safe and correct use of bouncinettes (151) • Not placing bouncinette on high surfaces, e.g., tables or benches, and not leaving the child unattended (9; 127) • Stop using bouncinette when child can sit up and/or make vigorous movements (127)	

Strategies for implementation and research:

- education regarding bouncinette safety at the point of sale, with a particular focus on consumers from non-English speaking backgrounds
- evaluate the impact of education

Car restraints (non-crash related falls only e.g., car seats placed on benches, incorrect installation in vehicles, poor restraint devices)

Australian Standards: - Mandatory and Voluntary Australian Standards
Aust/NZ Standards: - Voluntary Standard

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation	• Law in Australia requires use of an approved child restraint for infants (25)	• Legislation to ensure that infant/child seats meet the minimum safety standards before sale (11)	
Design change (safety harness)		• Full safety harness in preference to the lap-belt (22)	
Installation	• Correct restraint use of 0-1 year olds increased by 30-67% in the US following hospital-based education (141)	• Restraint fitted correctly to prevent child climbing out or slipping under the restraint (22)	• Australian study found that 40% of car restraints were not installed properly (25)
Education		• Not leaving the child unattended • Not placing car seat on benches, tables or the bonnet of a car (9) • Use of restraint appropriate to weight and size of infant, e.g., booster seat when weighs 18kg (25)	

Strategies for implementation:

- instigate education campaigns regarding correct installation and restraint use
- expand restraint installation and checking stations (e.g., RACV, Victoria)

4.4.2 Household furniture

Bunk beds

Australian Standards: - Voluntary Australian Standard
Aust/NZ Standards: - Voluntary Standard
European Standards: - British Standard and British Draft
- Dutch

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Compliance with Australian Standard which includes: - stability, strength and durability tests to ensure safety under normal use and occasional misuse conditions (2) - specific marking, labelling and instructions supplied at the point of sale (2) - top of mattress at least 150mm below upper edge of guardrail (137) - access ladder not readily removed (137) - no sharp edges or protrusions where clothing could get caught while falling (137) - gaps and spaces not between 5-12mm, 30-60mm or 75-230mm to prevent entrapment (including fall-related) (137) - well secured guardrails required on all sides of the upper level (137) • Recall of defective or unsafe bunk beds (108)	
Design changes	• Bunk beds complying with the Australian Standard estimated to reduce injuries by 30% (119) • US study found significantly more head and face injuries in the absence of side rails on the top bunk (108)	• As contained in the Australian Standard • Reduce fall heights given that more severe injuries tend to occur in falls from greater heights	• Joyce Australia designed the SafeBunk based on British Standards for a lower height bunk bed, but it has since been found to be faulty with regard to entrapment hazards (27)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Education		• Educate parents about the safe and appropriate use of bunk beds. A US study found that most injuries could be prevented by not allowing children to play on beds (108; 58) • Installing a night light so that children can get in and out of bed safely at night (108) • Children under 9 years of age should not occupy a bunk bed - side rails too wide and young children can become entangled in the bunk bed parts or fall from them (117) • Not permitting children with an increased risk of falling (e.g., epilepsy, seizures) to sleep in bunk beds (108) • Position bunk bed away from windows (127) • Distribute brochures on how to modify a poorly designed bunk bed (116) - currently produced by SA Health Commission and SA Department of Public and Consumer Affairs	
Maintenance		• Regular maintenance and inspection of cross wires, bolts, ladders etc (108)	
Flooring	• US study found that carpet played a protective role in reducing the extent of injury (108)		
Lobbying	• Education Department of SA adopted a new bunk bed safety policy for school camps where no child under the age of nine years shall occupy the top bunk, and that children over nine years of age shall only occupy the upper bunk if it is designed according to the requirements of the SA Health Commission and if parental permission is obtained (117)	• 800 SA Health Commission summary papers of research and recommendations for bunk bed use were distributed to relevant safety bodies in SA (138) • SA television segments on the risks of elevated beds lead to interest in the production of a safer bunk bed (138)	

Strategies for implementation:

- increase compliance with Australian Standard by: - consulting with furniture manufacturers of bunk beds [58]
  - encouraging retailers to stock and consumers to purchase only bunk beds complying with AS.
- promote bunk beds designed to the Australian Standard

Conventional beds

Australian Standards: - Nil
European Standards: - French
- European: adopted by Germany

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design change		• Attach side-rails to beds to prevent children under 5 years of age falling out while sleeping (116; 158; 100) • Slightly raised edges on mattresses to prevent children from rolling out of bed (116; 100)	
Education		• Restricting use of conventional beds to children over 3 years of age given that 60% of the injuries to children under 3 years occurred while resting on conventional beds (100; 36) • Placing the mattress on the floor if a cot is not available (100) • Safety information made available through child care centres and outpatient facilities (11) • Children should be prevented or discouraged from playing on beds or using them to jump on (158) • Ensure area around floor of bed is clear to prevent falling onto sharp objects (100)	

Strategy for research:

- commission a study to determine the proportion of children under 3 years of age who sleep in conventional beds [36]
- investigate the need for an intermediate bed design between cots and conventional beds

Chairs and stools

Australian Standards: - Nil
European Standards: - European - adopted by Germany
- International Standards Draft

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• Use of stable chairs which have a solid build, wide base, and non-slip bottoms on chair leg ends (9) • Rounded edges on chairs (9) • Use of low chairs for young children	
Maintenance		• Regular inspection of chairs to ensure stability and safety (99)	
Education		• Children should be encouraged to sit on chairs properly (99) • Chairs should not be used to stand on or to reach for things (44)	

Strategy for research:

- determine specific mechanisms of injuries associated with chairs and stools to determine potential countermeasures

Tables

Australian Standards: - Nil
European Standards: - French

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• Rounded corners on tables (100) • Install corner protectors on sharp edges (100) • Enhanced stability of small tables (36)	

Strategy for research:

- determine specific mechanisms of injury and relevant countermeasures

Benches

Australian Standards: - Nil
European Standards: - Austrian

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• Rounded corners on edges • Install corner protectors on sharp edges (100)	
Education		• Children should not be placed on benches (e.g., to change nappies or in bouncinettes) or left unattended (36)	

Coffee Tables

Australian Standards: - Nil
European Standards: - Nil

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Introduce minimum safety standards re. materials used (particularly safety glass) and to eliminate sharp edges (102; 99; 100)	
Education		• Educate consumers, providers and pediatricians about the developmental stages of toddlers and the risks associated with coffee table falls (and other injuries such as tea and coffee scalds), particularly to children between the ages of one and three years (102) • Place coffee tables against the wall rather than in the centre of a room, and remove objects from around the coffee table, e.g., sofas (100; 158; 36) • Recommend removal of coffee tables during the peak injury period from 12-24 months of age	

Strategies for implementation:

- investigate whether glass coffee tables without safety glass are available on the retail or second-hand market
- institute an education campaign

Sofas & couches

Australian Standards: - Nil
European Standards: - British Standard

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Education		• Educate parents about the dangers of allowing babies to sleep on couches (11) • Discourage use of sofas for playing and jumping on	

4.4.3 Structural features of the home

Steps and stairs

Australian Standards: - Voluntary Australian Standard
European Standards: - British Standard

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Stair guards		• Install stair guards with self-closing latches and double closures at the top and bottom of stairs to restrict access for children under 4 years (44; 78; 135)	• Accordion-type gates found to be dangerous (135)
Design changes (general)		• Designing homes without a change of levels (100) • Limit steepness of stairs (141) • Shorter flights of stairs to reduce injury severity (78)	
Design changes (hand rails)		• Install guard rails on verandas so that children have something to hold on to when exiting from doors/platforms (100) • Adequate handrails on stairways (43) • Install a second hand rail of 38mm diameter at a height of 610mm above the stair line for children to hold on to (78)	
Design changes (banisters)	• Banisters that comply with the current Building Regulations are adequate to prevent falls (78)	• Install studs on top of the rails to discourage sliding on them (78) • Ensure there is not a gap between the rails that can allow a 100mm diameter sphere to pass through it (78) • Fill-in banisters with plywood or hardboard infillings to remove gaps (78)	

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Non-slip surfaces		• Install non-slip surfaces on steps and stairs to prevent falls (43; 9) • Discourage use of scatter rugs at the top or bottom of stairs (44) • Ensure carpet runners are securely fastened and properly fit the steps (44)	
Maintenance		• Replace or repair worn out carpet and runners (44) • Ensure steps and treads are secure and mould-free (9)	
Lighting	• Automatic night lights that turn on at dusk and off at dawn, and motion detectors that activate lights for a few minutes while ascending or descending stairs (44)	• Illuminate the sides of the stairway to ensure safe footing, and install low-level night lights along pathways. Lighting level on a stair tread should be at least 100 lux (9; 44) • Install visibility aids such as reflective strips, white paint, glow-in-the-dark tape on the top and bottom steps and tape along the edges of stairs (44; 9)	
Impact-absorbing surfaces		• Secure impact absorbing mats at the foot of all steps and stairs more than one metre high (9)	
Education		• Educate parents about the dangers of falling on steps and stairs (78) • Ensure parents are always below children so that they can break the fall (78)	

Strategy for research:

- case-control study comparing the characteristics of household stairs where children are injured with those where children are not injured [95]

Balconies

Australian Standards: - Nil
New Zealand Standard: - New Zealand Standard
European Standards: - Nil

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• Ensuring homemade decking and balconies comply with the safety standards (9) • Install fences or railings that discourage climbing (9)	
Education		• Educate parents about the dangers of unfenced balconies (9)	
Environmental changes		• Plant impact absorbing foliage at the landing base (9)	

Concrete & other flooring

Australian Standards: - Voluntary Australian Standard
European Standards: - German

The Australian/New Zealand Standard for *Slip resistance of pedestrian surfaces, Part 2: Guide to the reduction of slip hazards* (1994) provides details on test procedures, required minimum values of the measures of coefficients of friction, and the floor surfaces most recommended for slip-resistance (Stevenson, 1992; Day, Kent & Fildes, June 1994)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Impact-absorbing		• Use of impact-absorbing flooring such as cork or carpet (9)	
Non-slip surfaces		• Encourage the use of non-slip flooring, e.g., rubber-like surfaces in wet areas, textured or granulated surfaces (9) • Choosing floor surfaces which comply with the 1994 Australian and New Zealand Standard for Slip Resistance of Pedestrian Surfaces (35)	
Education		• Encourage supervisory and protective parenting styles (41)	
Environmental		• Reduce cluttering and trip hazards, e.g., loose scatter rugs (9) • Use of secured water absorbent mats at entrances and in bathrooms (35) • Clean spills (water or contaminants) immediately (9) • Do not polish floors which are likely to get wet, e.g., kitchen, bathroom (35) • Liquid floor cleaner with anti-slip properties claimed to meet the standard for safety on wet and dry tiled floors (DR 92139R) has been released by Floorsafe International	

Strategy for implementation:

- a Standard for slip-resistant flooring to be included in the Australian Building Code and to apply to new and renovated homes (similar to the *Australian/ New Zealand Standard for Slip Resistance of Pedestrian Surfaces*)

Domestic architectural glass (including windows)

Australian Standards: - Australian Standard
European Standards: - British Standard
- Dutch

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Window guards	• Window falls reduced by 50% in The Children Can't Fly program in New York City due to legislation to install window guards in high-rise houses and educating the public about their use (135)		
Design changes	• Annealed glass breaks into sharp jagged pieces at low impact and therefore should not be used in residential situations. The current Australian Standard (AS 1288) for glass in buildings recommends toughened, laminated or organic glass (145)	• Install bars/rails or affix decals across the glass to increase visibility (145) • Ensure glass tables are fitted with safety glass (100) • Use safety glass windows in high rise buildings (84) • Apply tinted laminate or organic coating to glass to prevent scattering of sharp shards of glass when shattered and to increase visibility (9; 84)	
Locks		• Prevent windows opening more than 6cms by installing safety locks on the upper tracks of double-hung windows or door-type safety chains on single-hinged casement windows (44; 9) • Install clamp-on stops on sliding windows (44)	
Maintenance		• Replace annealed glass with safety glass in the home (145) • Apply an approved plastic film over existing annealed glass surfaces to reduce the severity of injury due to shattering (145)	
Costing		• Reduce the cost of safety glass to encourage consumers to purchase it in preference to annealed glass. It currently adds approximately $260 to the average cost of a new dwelling (145)	
Education		• Discourage children from running in the house and supervise their play (145) • Increase the visibility of glass surfaces by placing decals on the glass	
Impact-absorbing		• Plant impact-absorbing foliage beneath windows (9)	

Strategy for research:

- evaluation studies of (a) safety glass performance, and (b) implementation and effectiveness of safety glass regulations in State Building Codes

Bathtubs & showers

Australian Standards: - Voluntary Australian Standards exist, but do not specifically address fall prevention
European Standards: - British Standard
- Germany

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes	• Sweden and Germany have developed a soft non-slip water-resilient heat-sealed vinyl floor (44)	• Installing slip-resistant mats or abrasive strips in the bathtub and shower base (44) • Installing slip-resistant baths which cost no more than non-treated baths • Safety glass shower door to comply with the Australian Standard • A sitting bench and hand-held shower head allow young children to bathe more independently and steadily (44) • Installing grab bars in tubs and showers and near toilets would benefit young children (44)	
Reduced availability	• Myer/Grace Brothers ceased to stock baby bath seats for safety reasons (85, 106)		
Environmental		• Use of secured water absorbent mats at entrances and in bathrooms (35)	
Education		• Do not leave young children in the bath unsupervised (56)	

Strategy for implementation:

- regulate for installation of slip-resistant baths in new and renovated homes

4.4.4 Playthings, sports equipment and sports activities

Toys

Australian Standards: - Voluntary Australian Standard
European Standards: - French
- Austrian
- European

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Standards required to ensure use of clear warning labels (58) • Warning labels specifying the proper use of, and age-specific toys	
Maintenance		• Carry out regular inspection checks and throw away broken toys (31)	
Education		• Encourage parents to select age-appropriate toys and follow age-suitability warning labels (58; 31) • Educate parents about the safety of toys. Several books and brochures are available in Australia on how to choose safe toys (58; 31) • Supervision needed at all times to ensure toy is used for its intended purpose, e.g., not standing or riding on them inappropriately (31; 58) • Ensure toys are put away to avoid slips and trips	

Strategies for research:

- further analysis to identify particular toys and brand names associated with high risk [58]

Sports - general

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Impact absorbing surfaces		• More resilient and less abrasive surfaces (9) • Ensure grass fields are well prepared, maintained, have even surfaces and no potholes, tussocks or grassless patches (9) • Dampen grass surfaces to soften them before play (9)	
Protective equipment		• Correct positioning and use of impact-absorbing mats, e.g., gymnastics	
Design changes		• Design equipment that is lighter, softer and yields on impact (9) • Pad goal posts and other collision hazards	
Game rules		• Implement modified rules sport to reduce injury (9)	
Education		• Match children on height and weight rather than age when playing in teams (9) • Ensure children are supervised while playing (58)	

Strategies for research:

- research of playing surfaces appropriate for each type of activity played [9]
- evaluate the effectiveness of protective equipment designed to reduce falls or the severity of fall injuries
- further research to investigate the circumstances leading to the fall event, e.g., uneven ground surface, game rules or equipment [58]

Bicycles and tricycles

Australian Standards: - Mandatory and Voluntary Australian Standards
European Standards: - British Draft
- International Standards Organisation
US Standards: - American Standards

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation	• Helmet wearing rates increased overall in Australia since the introduction of mandatory helmet wearing in July 1990. Emerging evidence shows a reduction in injuries and fatalities (75) • Observational studies in Victoria pre- and post-mandatory helmet wearing reported an average helmet wearing rate of 31% in March 1990 versus 75% in March 1991, with the largest increase found in the primary school age group (12; 38) • Insurance data indicated head injury deaths and hospital admissions decreased by 48% in the first year and 70% in the second year post-legislation (12) • Death and hospital admission data reported a 23% and 28% reduction in head injuries in the first two years post-legislation (12) • Victorian study reported a 40% reduction in the number of head injuries for children under 15 years of age after the advent of helmet wearing legislation (28) • For children under 15 years, VISS data post-bicycle helmet legislation reported a 66% reduction in head injuries (88)	• Legislation to control the age when children can ride unsupervised in public places (67) • Restrictions on riding after dusk (103) • Need a Standard for infant helmets to ensure that the mass of the helmet is compatible with poorly developed neck control (75) • Enforcement of compulsory helmet wearing legislation (75)	• Failure to obtain a reduction in injuries in Queensland prior to 1993 without legislation enforcing mandatory helmet wearing (75) • Maximum penalty for not wearing a helmet ($100) is rarely enforced (12)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes (helmets)	• Case control study in Brisbane involving 445 children found helmets reduced the risk of head injury by 63% and loss of consciousness by 86% (136) • US case control study by Thompson et al (1989) calculated that riders with helmets had an 85% reduction in risk of head injuries and 88% reduction in risk of brain injuries (cited in 141) • Testing by the American National Standards Institute or the Snell Memorial Foundation indicated that helmets protects the brain and neck during a crash more effectively than no helmets (144)	• Destruction of helmets that have received a solid knock due to compression and weakening of the protective lining (28)	
Design changes (general)		• Adjusting the maximum turning of handlebars on tricycles to decrease manoeuvrability and prevent tipping during sharp turns (103) • More tyre tread to reduce skidding (103) • Install padding over the handlebars to prevent the rider sustaining abdominal injuries during a fall (1) • Guard over the spokes to prevent foot becoming entangled in spokes of wheel (88) • Design of spoke-less bicycle wheels similar to those used in racing events (88) • Designated bicycle paths and lanes (103; 124)	
Training		• Cycling skills training programs (33)	
Education	• Wood & Milne (1988) reported helmet wearing in young children increased from 4.6% to 36.6% in two years following extensive media and school based education campaigns (141)	• Education in schools (e.g., Bike-Ed); community traffic safety programs; by medical professionals - focus on helmet wearing (153) • Parents serving as role models for helmet wearing (67) • Supervision for beginners and young children, e.g., not riding down steps (67; 103) • Minimise dangerous falls from tricycles/bicycles, e.g., into pools, off verandahs etc, by installing barriers around the area	
Maintenance		• Regular maintenance, e.g., check the bike for loose pedals, chains, seats and wheels, and check the braking system (103)	

Strategies for implementation:

- education campaigns to promote helmet wearing in off-road locations
- increasing the penetration of Bike Ed courses to all students in school years 4-7 [88]
- more rigid enforcement of bicycle helmet laws
- design improvements to bicycles to prevent injuries associated with handlebars, spokes and chains

Bicycle child carrier seat

Australian Standards: - Voluntary Australian Standard
Aust/NZ Standards: - Voluntary Standard
European Standards: - German Regulation

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation	• Several helmets available for young children which meet Australian, American National Standards Institute, or Snell Memorial Foundation impact and brain deceleration standards (133)	• Compulsory helmet use. Currently mandated in Australia for all states and all age groups, New York and California for child passengers under 4 years, and in Howard County, Maryland for all passengers under 16 years (133) • Include helmets at the point of sale of bicycle seats (133)	
Design changes (general)		• Improve stability of passenger seats (133) • Strengthen struts which support the weight of the child (133)	
Design change (safety harness)		• Children must be restrained in child carrier seats to prevent being thrown out, climbing out, or leaning over (133)	
Warning labels		• Warning labels on child carrier seats. Currently applicable in the US recommending that helmets and a restraint system be used (133)	
Education		• Children not to be left unattended in the seat (133) • Discourage use for restless children (133) • Only experienced riders should carry child passengers due to problems with balance (133) • Guidelines on the use and transportation of young children in bicycle seats - published by the American Academy of Pediatrics (133) • Education about the dangers of exposing children to adult levels of biomechanical forces and the release of kinetic energy (133) • Not designed for children weighing more than 18.2kg (133)	
Installation and maintenance		• Regular maintenance to check for stability of child carrier seats (133)	

Horse riding

Australian Standards: - Voluntary Australian Standard
European Standards: - British Standard and British Draft
- European - adopted by Germany
- German
- Dutch

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation	• The incidence of head injuries to children decreased with the use of protective helmets (cited in 110)	• Wear a correctly sized and fitted equestrian helmet approved by Standards Australia (110) • Firth (1985) recommends a 4 point suspension chin strap (156) • The Victorian Horse Council in 1983 adopted a policy that Standards Australia approved helmets be worn by persons riding outside their own property (110) • The Protective Headgear for Young Riders Horse Bill was introduced in the UK. prohibiting children under the age of 14 years to ride on a public road without a helmet (110)	
Protective equipment		• Appropriately designed and fitted stirrups, shoes, soled boots, elastic sides, non-slip gloves, tack and other protective equipment (156) • Ensure equipment is adjusted properly and checked for signs of fatigue (156)	
Training, lessons and experience	• Case control study found that riding lessons, riding experience and familiarity with the horse had a preventive effect on injury (cited in 110)	• Beginners should be encouraged to take lessons with an accredited instructor (156) • Parent training	
Education		• Choose a horse suited to the child's size and skill level (156) • No child or beginner should ride a horse younger than five years (156) • Supervise children at all times (156) • Ride on safer grounds and even surfaces (156) • Do not wear loose clothing which can catch on trees or other objects (156) • Increase riding confidence to reduce the likelihood of the horse being disobedient (110) • Increase riders general safety awareness (156) • Practice proper falling techniques (156)	

Strategies for implementation and research:

- evaluation studies to determine the effectiveness of protective equipment under different circumstances
- mandate helmet wearing in public areas

Swimming pools and spas

(*Note:* Drownings/near-drownings are precipitated by a fall in at least 24% of cases (Victorian State Coroner's Office, 1989-1992))
Australian Standards: - Mandatory and Voluntary Australian Standards
European Standards: - Nil (re: pool fencing)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation	• Introduction and enforcement of mandatory pool fencing of new and existing pools (e.g., separate pool fence, self-closing/latching doors at the access points to the house) in QLD has resulted in a reduction in drowning risk (141, QISPP, 1993)	• Unification of pool fencing regulations in Australia (currently controlled by state or local regulations) for new and existing pools which completely isolates the pool from the home and other surrounding play areas (105) • Rigid enforcement of pool fencing regulations	
Maintenance		• Regular maintenance of pool fencing and ensuring that the self-closing gate is functioning correctly	
Education		• Supervision of children at all times near water (56; 120)	

Strategies for implementation and research:

- The first national legislation on pool fencing was in New Zealand in 1987. Queensland was the first Australian state to introduce pool fencing regulations in March 1991, with existing pools having to comply by March 1992. Victoria introduced mandatory legislation for new pools in 1994, while existing pools are required to comply with the legislation by 1997.
- implement and enforce uniform pool fencing regulations in Australia which isolate the pool from the home and other surrounding areas
- educate the public about the importance of well maintained fencing [58]
- establish a National Coronial Information System to monitor injury deaths such as pool drownings

Rollerskates

Australian Standards: - Nil

European Standards:
- British Draft
- European - adopted by Germany
- Austrian
- German
- European Draft
- French

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• Attach training wheels or clampon-type skates for beginners (107) • Introducing higher friction wheels for beginners to slow down the speed of the roller skates (107)	
Protective gear		• Helmets and wrist, elbow and knee guards should be worn given that upper extremity fractures are the most common form of injury in children (52) • Development of a multipurpose 'starter' helmet which could be used for a range of recreational pursuits (77), e.g., Australian bicycle helmet standard (not suitable for horse riding)	• No evidence to suggest that routine use of wrist and forearm splints would reduce injuries (107) • Possibility that the injury could be transferred to a more proximal site on the arm when a splint is being used (107)
Training and instruction		• Instruction in roller skating technique by an experienced or professional teacher (52) • Safe training for beginners in uncongested separate areas (52; 107) • Learning to fall properly by rolling or distributing the force of the fall more evenly (52)	• Experience alone does not guarantee safety (107)
Reduce crowding	• US study found that most injuries resulting from collisions in skating rinks (71%) were due to overcrowding (107)	• Reduce crowding in roller skating rinks (107) • Avoid mixing of different level skaters	
Education		• Inform parents about physical and skill development required to use roller skates effectively (52) • Delay buying rollerskates until the child reaches 9-10 years of age (52)	

Strategies for implementation and research:

- Given that the overall risk of serious head injury is quite small, a real reduction in the severity of injury could only be demonstrated with 100% compliance of helmet wearing (Sedlin, Zitner & McGinnis, 1984). A Multi-activity Helmet Standard - Snell N-94 has been developed by the Snell Memorial Foundation for non-motorised sports. This standard addresses impact management (allows for several impacts), helmet stability, retention

system strength and the extent of protection offered (extends lower on the head to protect strikes when falling backwards) (Centre for Injury Control, 1995). Four additional standards have been proposed for multi-activity helmets, i.e. the Swedish Guidelines for Young Children's Helmets (May 1992), the CEN draft standard for Young Children's Helmets (June 1994), the ASTM draft Infant/ Toddler Standard (May 1994) and the CPSC proposed Bicycle Helmet Standard (August 1994) (Centre for Injury Control, 1995).

- evaluate the effectiveness of protective equipment, particularly wrist guards and helmets [52]
- Inkelis, Stroberg, Keller and Christenson (1988) recommend that parents delay buying rollerskates until 9-10 years of age when bone maturation, strength, agility, speed, coordination, balance and reaction time are developed sufficiently to avoid upper extremity rollerskating injuries

Skateboards

Australian Standards: - Nil

European Standards:
- British Standard and British Draft
- European - adopted by Germany
- Austrian
- German
- European Draft
- French

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Legislate against skateboard riding on public roads as more than half of skateboard injuries were sustained on-road in the US (13; 6; 93) • Manufacturers self-imposed regulations to guard against lower-quality imported products - currently occurring in the US (93) • Provision of suitable riding areas and skateboard parks (67; 72)	• Product bans for 'fad epidemics' only create adverse comment (13).• NSW data suggests that a product ban would not be necessary given that separating riders from traffic, wearing helmets, and restricting use to children over 10 years of age would help eliminate serious injuries and minimise minor injuries (13) • Reluctance of councils to build ramps or provide areas for skating given high building and maintenance costs, the fear of litigation, and opposition from residents (13)
Design changes		• Modifying the wheels on beginner skateboards to increase friction and slow them down (93)	
Maintenance		• Regular maintenance of riding surface to reduce the number of surface irregularities (6)	
Protective gear	• Helmets would have prevented all eight head injury admissions to children involved in a NSW skateboard injury study (13) • Data from VISS suggests that injuries are more minor if protective equipment is worn (149)	• Routine protective gear (knee pads, wrist guards, elbow pads) to guard against soft-tissue injuries to the extremities (6; 93) • Bicycle helmets tested to the Australian standard are appropriate for skateboard use (149) • Development of a multipurpose 'starter' helmet which could be used for a range of recreational pursuits (77)	• When protective gear is worn the force of the impact is transmitted through protective clothing rather than being absorbed by the soft-tissue injury (72; 93) • Protective clothing may encourage skaters to take more risks by giving them a false sense of security (72; 93) • Compulsory helmet use antagonises skaters if it is not enforced uniformly (93)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Warning labels		• Warning labels on skateboards re. hazardous areas for riding, helmet wearing and age requirements (13)	
Education		• Formal instruction on how to ride skateboards safely (e.g., balance and control) (6) • Appropriate supervision of novice skaters (6) • Restricting skateboard use to children over 10 years of age, when they have sufficient motor development to control and balance skateboards (13)	

Strategies for research:

- assessment of injury risk by conducting exposure studies to assess the level of participation in the sport [104]
- undertake research to determine the relative risks of ramps versus other locations for skateboarding
- evaluation studies of countermeasure effectiveness

Rollerblades / in-line skates

Australian Standards: - Nil
European Standards: - Nil

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Develop a standard for in-line skates (140) • Community restrictions to reduce riding in known hazardous areas, e.g., public roads (6)	
Design changes		• Construct wheels using polyurethane for increased surface gripping and enhanced manoeuvrability (6)	• Three out of nine in-line skates failed a 10 hour durability test due to problems with performance and wear-and-tear (26)
Protective gear		• Routine protective gear (helmet, knee pads, wrist guards, elbow pads) to guard against injuries to the extremities (6) • Development of a multipurpose 'starter' helmet which could be used for a range of recreational pursuits (77), e.g., Australian bicycle helmet standard (not suitable for horse riding)	• NSW study of emergency department presentations did not find that protective gear was associated with a reduced risk of fracture or concussion in under 15 year olds (there were no controls for this study) (140)
Maintenance		• Regular maintenance of riding surface to reduce the number of surface irregularities (6)	
Education		• Formal instruction on how to ride in-line skates safely (e.g., balance and control) (6) • Supervision of novice skaters(6)	

Strategies for implementation and research:

- develop a mechanism for independently evaluating new products on the market [140]
- establish a capability for surveillance data to be utilised for product detail identification, including brand
- clarify the role of protective gear in reducing injury through case control research studies [140]

Ice Skating

Australian Standards: - Nil
European Standards: - Czechoslovakia

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Helmet wearing		• Appropriate headgear to reduce craniofacial injuries (7)	• Williamson & Lowdon (1986) proposed that mandatory helmet and face mask wearing may lead to an increase in head and neck injuries (cited in 7)
Protective gear		• Heavy duty gloves to reduce tendon wounds in the hand (7) • Insistence of protective gear for beginners (7)	
Training and instruction		• Controlled and supervised training for beginners in a separate rink away from crowds and speed skaters (7)	

Playgrounds - general

Australian Standards: - Voluntary Australian Standard (no separate Standard for each type of equipment)
New Zealand Standards: - New Zealand Standard
European Standards: - British Standard
- European - adopted by Germany
- German

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Develop a Standard to cover fall height, installation, safety rails and soft fall surfaces based on scientific studies - NZ case-control study recommends that fall height onto appropriate impact absorbing material be no greater than 1.5 metres (58; 17; 99; 144; 79) • Ensuring size and width of the bars are not so wide that a child can slip between them	• Playground injury hospitalisation rates continued to increase prior to 1991 despite the introduction of a New Zealand Playground Standard. Chalmers suggests the Standard is defective or not adequately implemented (15)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Energy-absorbing surface material	• SA study of council playground equipment injuries found that of the falls onto the ground surface, no injuries were recorded where the ground surface comprised of wood chips or other safety surfaces (SA Health Commission, July 1987)	• Recommended depth of impact-absorbing material is around 300mm, depending on the type of material used. Correct installation, containment of material by a retaining curb (reduce potential for young children swallowing loose material), and regular maintenance are required to ensure adequate safety - testing by the University of Adelaide, Department of Mechanical Engineering (150; 15; 29; 54) • The width of the surface area should be wider than the equipment by a distance equal to the maximum height of the equipment (126) • Energy-absorbing mats or loose material (e.g., wood chips, sand) may reduce the risk of head injury from falls of eight feet (144) • Special rubber matting for playground surfaces is an acceptable protection against all fall injuries from heights of less than 1.5 metres (126) • Prohibiting the use of concrete and asphalt surfaces on playgrounds, and removing existing concrete and bitumen from under equipment (126; 57)	• Sand is not effective once it is smoothed out and compacted slightly (126) • The lack of efficacy of impact absorbing surfaces and synthetic surfaces for preventing injuries other than head injuries (15)
Installation & maintenance	• Beugels (1994) found that large playgrounds are better maintained than smaller ones	• Maintenance of energy-absorbing surfaces (e.g., cleaned, evened out and replenished) to ensure adequate depth and spread (144; 126) • The U.S. Department of Health and Human Services (1988) recommends that equipment be properly anchored, maintained, and repaired (e.g. covering protusions and removing broken equipment) (144) • Upgrading of existing playgrounds (15) • Weekly safety inspections (54)	
Fall height	• A NZ case control study involving 300 children under 15 years of age found that injury increased 4.14 times when the fall height exceeded 1.5 metres (21) • Children injured on playgrounds not complying with the NZ Playground Standard had an increased risk of injury on impacting the ground surface, i.e., 3 times greater for fall heights greater than 2.5m, and 2.28 times greater for non-impact absorbing surfaces (21)	• The severity and frequency of injury could be reduced by lowering the fall height to a maximum of 1.5 metres onto appropriate impact absorbing material (16; 21; 17)	

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• Playground equipment should be appropriate for the child's size and stages of development (99) • Location of equipment away from obstructions (144)	
Lobbying	• Nine joy wheels were removed from public playgrounds after PRAV, VISS, and CAPFA lobbied the St Kilda Council about their dangerous design (148)		
Protective gear		• Development of a multipurpose 'starter' helmet which could be used for a range of recreational pursuits (77)	• At least one case report of strangulation (from Sweden) involved helmet wearing while using playground equipment
Safety audits	• Evaluation of a playground audit of 16 schools in the Shire of Bulla Safe Living Program found three schools replaced obsolete equipment and at least half of the recommendations were addressed (87)		
Education	• US study by Fisher (1980) found that playground hazards were reduced by 42% and emergency room visits fell by 22.4% after individuals in authority attended a workshop on playground safety (57)	• Attendance by those in authority over public and school playgrounds at playground safety workshops (57) • Instructing children in the proper use of playgrounds (144) • Teaching children how to fall properly (43) • Supervising children's play, and separating younger children from older ones (99; 121; 20; 29)	

Strategies for implementation and research:

- The Playground and Recreation Association of Victoria (PRAV) advocates the need for a playground standard given the finding in 1992 that few preschools, schools and community playgrounds have adequate under-surfacing (Routley, 1993). The SA Health Commission has designed a portable electronic device for testing playground surfaces (Nov 1989). The Department of Mechanical Engineering of the University of Adelaide has calculated the required amount of "soft fall" material needed to reduce the impact of falls for each type of playground equipment (SA Health Commission, Nov 1989). For instance, falls under 1 foot onto concrete or asphalt, 2 feet on packed earth, 10 feet on 6 inch wood chips, or 12 feet on 12 inches of sand would be sufficient to produce a concussion (SA Health Commission, Aug 1989). "Soft fall" materials currently sold in Australia include pine wood peelings, bark chips, pine chips, "two-mesh rubber crumb" , and "grape marc" (Choice, Feb 1992).
- The New Zealand Standard currently states that fall height should not exceed 2.5 metres.
- A recently released New Zealand Playground Safety Manual outlines the steps required by people in authority to ensure that playgrounds are safe (Jambor, Chambers & O'Neill, 1994).
- Research evidence is needed to determine the effectiveness of new standards, or proposals for new standards before large sums of money are actually invested in upgrading and maintaining existing playgrounds (Chalmers, 1991).

- The Centre for Injury Control (1995) supports the use of a multi-activity helmet (Multi-activity Helmet Standard - Snell N-94) produced by Snell Memorial Foundation for non-motorised sports. The standard addresses impact management (allows for several impacts), helmet stability, retention system strength and the extent of protection offered (extends lower on the head to protect strikes when falling backwards) (Centre for Injury Control, 1995). Four additional standards have been proposed for multi-activity helmets, i.e. the Swedish Guidelines for Young Children's Helmets (May 1992), the CEN draft standard for Young Children's Helmets (June 1994), the ASTM draft Infant / Toddler Standard (May 1994), and the CPSC proposed Bicycle Helmet Standard (August 1994) (Centre for Injury Control, 1995).

Climbing apparatus & monkey bars

Australian Standards: - Nil
European Standards: - Nil

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Mandatory standard for climbing equipment and enforcement	
Design changes		• Reduction of fall heights by locating wooden platforms at different levels of the climbing structure (Root, 1983, cited in 19) • Ensuring that angles of ascending and descending access slopes are less than 45 degrees or more than 60 degrees (54) • Ensuring climbing frame handrails or gripping pipes are between 19-38mm to ensure easy grip (54) • Age appropriate climbing frames which are relevant to the child's abilities (29)	
Impact absorbing surface		• Operating area should extend at least 2m beyond the climbing frame on all sides (54)	

Slides

Australian Standards: - Nil
New Zealand Standards: - New Zealand Standard
European Standards: - German

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Mandatory standard for slides and enforcement	
Design changes		• Building slides into embankments or mounds to reduce the fall height - recommended by the NZ Standard (20) • Horizontal run-off segment to reduce the speed at dismounting (54) • Presence of handrails (54) • Protective guardrails around the top platform (54)	
Impact absorbing surface		• Extend at least 2m beyond the slide on all sides (54)	

Swings

Australian Standards: - Nil
New Zealand Standards: - New Zealand Standard
European Standards: - German

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Mandatory standard for swings and enforcement	
Design changes		• A design that would prevent the child from jumping or being thrown from the swing when it is at its highest (59)	
Surrounding area		• The length of the operating area for the swing should be at least 3m longer than the arc of the swing (54) • Need a distance of at least 2m between the operating area and other pieces of equipment, paths, fences, etc (54)	

Seesaws

Australian Standards: - Nil
New Zealand Standards: - Nil
European Standards: - Nil

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Mandatory standard for seesaws and enforcement	
Design changes		• Ensure there are grip handles (diameter between 13-38mm) for each rider which are at least 100mm from the riding board edge (54) • Riding board less than 1m above the ground surface when parallel to the ground, and no higher than 1.8m when extended (54) • Slope of the board should be less than 30 degrees (54) • Shock-absorbent devices (e.g., tyres) where the board makes contact with the ground (54)	
Impact absorbing surface		• Operating area extending at least 3m beyond the see-saw on all sides (54)	

Trampolines & mini-trampolines

Australian Standards: - Nil
New Zealand Standards: - New Zealand Standard
European Standards: - British Standard
US Standards: - American Standard

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation	• Significant drop in trampoline sales as a result of the American 1977 policy statement banning trampolines in schools (139) • Largest manufacturer of trampolines in the US ceased selling trampolines or replacement with the introduction of the 1977 policy statement and an increase in liability lawsuits (139)	• Banning trampolines - America banned the use of trampolines in school physical education programs due to the high incidence of cervical spine injuries and paralysis (139) • Mandatory standard for trampolines and mini-trampolines (98) • Standard should include guidelines on the siting, design, construction and installation of trampolines (20) • Restricting use to organisations that can provide safe settings and supervision, i.e., ban home use (9)	• Regulations requiring the use of helmets would not guard against cervical spine injuries (139)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• Installing frame pads to protect the top portions of the frame, the outer hooks of the springs, and the spring-anchor devices on the trampoline frame - recommended by ASTM (139) • Frame pads to be included in the cost of the trampoline (18; 98) • Ensuring trampoline bed is an adequate size to permit rebounding without falling (18) • Attaching a vertical rung ladder to the frame for safer mounting and dismounting (18)	
Protective equipment (harness)		• Use of harness when teaching various stunts and techniques (e.g., somersaults) to prevent impact to the head or neck (139)	
Installation and maintenance		• That trampolines be secured when not in use (139) • That trampolines be regularly checked for tears, rust and detachments (98) • Ensuring trampoline bed is level (112)	
Impact-absorbing surfaces		• Impact absorbing material (e.g., tan bark, woodchip, shredded tyres, spongy grass) around the trampoline for a distance of 2 metres (98; 112) • Trampoline placed in a pit deeper than 1 metre and of equal length and width to the trampoline to reduce fall height (98; 125)	
Organisation		• Clearance of 2 metres around the trampoline (98) • Sufficient overhead clearance (125) • Fencing around the trampoline to prevent unsupervised access (98) • Provision of point of sale safety information, e.g., correct use, regular maintenance(139) • Limiting the trampoline to one person at a time to reduce bounce (98) • Supervision to ensure that the user climbs on and off the trampoline correctly, is in the centre of the mat at all times, and is supervised by a trained professional and/or spotters (98)	• The effectiveness of trained spotters and instructors is questioned by a US study given that many injuries to the cervical spine were sustained by elite athletes, experienced athletes or trained professionals while attempting difficult manoeuvres or somersaults (139)

Strategies for implementation and research:

- In 1992 the Australian Trampoline Sports Union estimated that there were at least 250,000 trampolines in Australia, with another 50,000 trampolines being sold each year (Routley, Dec 1992).

- develop, implement and mandate an Australian Standard without further delay which covers research evidence on fall heights, design features, safety rails, impact-absorbing fall surfaces and installation of equipment
- develop a horizontal standard for fall height
- commission research to evaluate the effectiveness of the Standard before large sums of money are invested in upgrading and maintaining playgrounds [15; 20]
- following evaluation, mandate the Standard, if appropriate, for public playgrounds, schools, children's service regulations, and playgrounds in commercial premises [99]
- continue testing safe undersurfacing products in Australian and overseas laboratories with the focus on reducing long bone and head injuries [99]
- undertake exposure studies to estimate use of playground equipment [20; 150]
- undertake controlled studies to determine the effectiveness of undersurfacing on reducing playground injuries
- examine the critical drop height for more commonly occurring injuries such as arm fractures [21]
- update Australian Standard to incorporate new research findings
- develop a helmet design which minimises the risk of strangulation
- determine the rate of trampoline injuries, including exposure measures [20]
- evaluate the effectiveness of multi-lingual safety pamphlets and safety instruction videos (e.g., progressive skills learning) at the point of sale [98]

4.4.5 Miscellaneous

Shopping trolleys

Australian Standards: - Nil (although Voluntary Australian Standard (AS 3747-1989) "Harnesses for use in prams, strollers, and highchairs (including detachable walking reign) could apply)

European Standards: - Nil

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes		• Shopping trolleys need to be designed with a lower centre of gravity to ensure stability (4; 9)	
Safety harnesses	• Coles supermarkets in Australia provide a limited number of trolleys with baby capsules secured to them (4)	• Use of adjustable shoulder harnesses with side straps to prevent children from standing up, leaning over too far, or falling out of the trolley (4, 134)	• Baby capsules do not address the at risk age group (VISS data)
Education	• Ferrari & Baldwin (1989) found that a combination of signs, fliers, audio reminders over the public address system, personal approaches, and actual provision of the restraint proved effective in promoting shopping trolley restraint usage (9)	• Discourage riding on the end of shopping trolleys - accounted for 10% of shopping trolley fall injuries in a Victorian study (4) • Promote placing children in the seat provided and not in the trolley compartment itself (134)	

Strategies for implementation and research:

- carry out stability testing when trolley fully loaded and child passenger present [4]
- determine appropriate site for harness attachment points

Ladders and stepladders

Australian Standards: - Voluntary Australian Standard
European Standards: - British Standard
- European - adopted by Germany

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		• Widespread implementation of the standard	
Warning labels		• Warning labels on ladders - manufacturers in the U.K. produce safety stickers (73)	• Only 33% of patients in a U.K. study who had fallen off a ladder had obeyed safety regulations (73)
Education		• Free distribution of safety booklets with the purchase of ladders. Although available in the U.K. they are not distributed routinely (73) • Public information campaign (73) • Young children should be discouraged from using ladders • Supervision at all times when ladders are in use around the outside of the house • Ladders stored in locked sheds, or stored horizontally	

Strategies for implementation:

- increase compliance with standards by encouraging retailers to stock and consumers to purchase products which comply with AS.

Footwear

Australian Standards: - Nil (although Standards Australia is currently planning a standard relating to the selection of footwear for enhanced slip-resistance)

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Design changes	• US study found that children wearing smooth-synthetic sole footwear were significantly more likely to experience loss of footing than children wearing rough-texture sole footwear (5). Rubber-sole footwear, barefoot and sneakers were significantly less associated with loss of footing than other sole materials (5) NSW study found that shoes with heels made from nitrile rubber or polyurethane were the most slip resistant when tested (49)	• Encourage use of shoes that provide maximum surface area contact and friction, e.g., running shoes (9) • Discourage use of shoes with smooth plastic soles (9)	• Dis-benefits of barefeet (caught in bicycle spokes, lawn-mowers, bee-stings, glass lacerations, etc) need to be balanced against improved footing • Regardless of design, no shoe will perform optimally in the presence of water or other contaminants (130)
Education		• Ensure laces are always tied	

Strategy for implementation:

- develop and implement the proposed Australian Standard relating to the selection of footwear for enhanced slip-resistance

Chapter 5 - Discussion and recommendations

5.1 Introduction

This study identifies a wide range of issues and products specifically involved in child falls. This chapter summarises the major findings of the data analysis and the review of published and unpublished literature and the results of the consultation with experts, which consisted of a survey and personal communication.

Another key focus of this chapter is the description and application of the methodology that was used to systematically address the major issues identified in the review. As this chapter also reviews the progress made on the project's aims and objectives they are reproduced here for easy reference.

Aims:

- to identify specific products (including structural features of the home) which contribute to falls among children in the domestic environment and in playgrounds; and
- to develop a methodology to systematically address the issues identified in the review

Objectives:

- to analyse data on childhood falls using hospital admissions (including trend analyses over time), injury surveillance, general practice (to the extent possible) and coronial data;
- to review the literature, focusing on published literature on the prevention of domestic and playground product-related childhood falls, including the effectiveness of countermeasures;
- to review relevant Australasian and overseas standards;
- to review informed sources including work in progress, international consultation and advances in the development of relevant generic standards;
- to develop and apply a classification system for the effectiveness of interventions (both countermeasures and implementation strategies), including benefit/cost ratios to the extent possible;
- to determine potential benefits from countermeasures for other family members, particularly older people;
- to identify products and intervention strategies in need of further analytic study and design appropriate research protocols to systematically address the major issues; and
- to co-ordinate the work of this project with national and state injury Goals and Targets and injury control implementation strategies

The substantial recommendations arising from the project have been grouped into data and research recommendations and those related to the implementation of injury reduction measures. The latter are grouped as general and specific recommendations and a systems approach is suggested, where appropriate, to link interventions.

In addition, the authors have developed new or co-ordinating recommendations where these were warranted. The full complement of substantial recommendations included in this chapter provides a menu from which policy makers, researchers and implementors could plan a co-ordinated approach.

The action plan in this chapter is based on the recommendations which appear to the authors to be the most sound and relevant for immediate implementation in the current Australian context.

5.2 Summary of findings

This section includes a summary of the key findings from the review and a report on the objectives which are not fully addressed elsewhere.

5.2.1 Findings from injury data analyses

The major fall-related products identified from the data analyses were discussed in detail in chapter 2. Table 16 from Chapter 2 summarises the products related to falls across all levels of severity and is reproduced below.

Table 16 (from Chapter 2): Rank order of product-related fall injuries by severity (deaths, emergency department presentations and admissions, general practice presentations) for children under 15 years of age.
Victorian State Coroner's Office, July 1989 - June 1992, Victorian Injury Surveillance System, 1989 - 1993 and General Practice presentations, Latrobe Valley, Victoria, Nov 1994 - May 1995

Deaths VSCO: 1989-1992 **(n=27)**	%	**Emergency Department Admissions** (VISS: 1989-1993) **(n=4,253)**	%	**Emergency Department Non-admissions** (VISS: 1989-1993) **(n=18,794)**	%	**General Practice Presentations*** ELVIS: Nov 1994-May 1995 **(n=578)**	%
Swimming Pools	29.6	Bicycles or accessories	9.1	Bicycles or accessories	9.7	Monkey bars /climbing apparatus	4.2
Tractor/trailer	14.8	Monkey bars /climbing apparatus	7.8	Stairs and steps	6.2	Stairs and steps	4.0
Cars	11.1	Chairs and stools	4.3	Chairs and stools	5.4	Trampolines	2.6
Borehole/channel /irrigation/ sewer	11.1	Slides and sliding boards	3.8	Monkey bars/climbing apparatus	5.2	Basketball	2.4
Rubbish bins	7.4	Stairs and steps	3.6	Conventional beds	4.8	Chairs and stools	1.9
		Nursery furniture	3.5	Skates and skateboards	4.5	Skates and skateboards	1.2
		Fences/fence posts/poles	3.5	Nursery furniture	3.7	Fences/fence posts/poles	1.2
		Conventional beds	3.2	Football	3.1	Football	1.2
		Skates and skateboards	3.2	Fences/fence posts/poles	3.1	Nursery furniture	1.0
		Swings and swing sets	2.5	Slides and sliding boards	2.7	Slides and sliding boards	1.0

* Seasonal variations may apply.

Key findings

- the product most frequently involved in fall-related injury deaths is the swimming pool.
- the products most frequently involved in fall-related injury across most levels of severity are playground equipment, stairs and steps, bicycles, football, chairs and stools, nursery furniture, skates and skateboards, conventional beds and fences/fence posts/poles. When VISS data were compared with National Injury Surveillance Unit data, few differences were noted.
- the rate of fall injuries to children aged under 15 years resulting in hospitalisation in Victoria showed a statistically significant increase over the period July 1987 - June 1994, with significant increases also noted in the under one year and the 10-14 year age groups. Recent increases in rates may be affected by changes to hospital admission policy and coding practices due to casemix funding.
- there was a higher proportion of children who fell more than one metre in the group of children admitted to hospital, indicating that these fallers sustained more serious injuries.
- overall, 49% of all child fall injuries occurred in the home, educational settings were the second most frequent location for falls (19%).
- the main injury resulting from child falls was fractures, 38% of which were of the radius/ulna. Although concussion was the fifth most frequent type of injury, it rated highest in terms of severity (45% hospital admission rate).
- the upper extremity was the most frequently injured body part (accounting for 40% of fall injuries) and injuries to the face ranked second (accounting for 24% of fall injuries). Although injuries to the head (excluding face and scalp) comprised 10% of all fall injuries, they accounted for 21% of hospital admissions, only second to upper extremity injuries (which accounted for 38.6% of admissions).
- although product involvement was not known for more than half of the radius/ulna and head injuries, the available data showed that radius/ ulna injuries were associated with playground equipment in 30.5% of cases where product involvement was known. Head injuries were predominantly associated with bicycles (13.8%), playground equipment (11.5%) and chairs/beds (11.7%).

Literature review

As reported in Chapter 3, a large volume of published and unpublished literature was accessed and a selection of 159 of the articles that were examined are referenced in this report. This review included the *Proceedings from the First National Conference on Injury Prevention and Control* (1995)and *Better Health Outcomes For Australians (1994),* which incorporates the national goals targets and strategies for injury prevention and control, and related publications.

The list of products implicated in falls in our study was similar to that identified in the international literature, and in Australian studies that used data from sources other than Victoria. A small number of additional products were identified as hazardous in North American studies, including child carrier seats on bicycles and ice-skates.

The products that were identified in the literature as substantially implicated in child falls are:

Nursery furniture- *babywalkers, cots, cribs and cradles, prams and strollers, highchairs, change tables, porta-chairs, bouncinettes (exercisers) and car restraints.*

Household furniture- *bunk beds, conventional beds, chairs and stools, tables, benches, coffee tables, sofas and couches.*

Structural features of the home- *steps and stairs, balconies, concrete and other flooring, domestic architectural glass, bathtubs and showers.*

Playthings, sports equipment and sports activities- *toys, bicycles and tricycles, bicycle child carrier seats, horseriding, swimming pools and spas, skating (rollerskates, skateboards, rollerblades/in-line skates, ice skating) and playgrounds (general, climbing apparatus and monkey bars, slides, swings, seesaws, trampolines and mini-trampolines).*

Miscellaneous- *shopping trolleys, ladders and step ladders and footwear.*

5.2.2 Countermeasure review

As reported in Chapter 4 countermeasures identified in the literature were reviewed and categorised according to their level of effectiveness. Countermeasures and strategies were included in the "proven" category if they were supported by evaluation studies or strong evidence that a reduction in injuries was associated with an intervention (as was the case for some exposure reduction measures). Although this definition was broad only 50 countermeasures and strategies were identified as "proven" and these covered only 20 products or product types.

Approximately 335 other countermeasures were classified by the authors as having "good potential for prevention", based on scientific or accepted theoretical principles, and included in the countermeasure matrix.

There were no studies of benefit/cost ratios in relation to product-related child fall interventions reported in the literature. Such studies are a necessary precursor to widespread implementation of interventions but would be a longer-term priority at this stage.

5.2.3 Australasian and overseas standards

Where Australian and European standards apply, these are indicated for each product in the countermeasure matrix (chapter 4) and are abstracted in Appendix 4. The review revealed that many products are not currently covered by Australian standards, that standards are outdated (such as those relating to playgrounds) or that standards are simply not adequate for a variety of reasons (such as their voluntary nature). North American standards were not comprehensively reviewed since this task was out of the scope and resources of this project. Numerous recommendations relating to standards are made in the sections which follow.

5.2.4 Benefits for other family members

The proposed child product-related fall countermeasures, particularly the home design improvements, would be of benefit to other family members, especially older persons. A systems approach to safe home design is discussed in the action plan.

Another substantial benefit flowing from a reduction in child fall injuries would be a reduction in lost time from work for parents of injured children. This is usually 1 or 2 days per admitted fall injury or a half day for hospital emergency department or GP treatment, plus recovery time. Additional costs to the family for such items as transport, child care, private or non-medicare health care and pharmaceutical products would also be saved by families.

5.2.5 Co-ordination with national and state injury goals and targets and implementation strategies.

A lead agency, guided by a National Injury Prevention Taskforce, is required to encourage, facilitate and, at least partially, fund a co-ordinated approach to the implementation of child falls prevention measures in accordance with national and state injury prevention strategies. This lead agency should also monitor impacts and outcomes.

This method of implementation is consistent with the approach adopted by the Commonwealth and State/Territory health departments in the implementation of the national goals and targets for injury prevention and control. The national agenda was set out in *Better Health Outcomes for Australians* (1994) but the states and territories developed their own priorities and implementation strategies from the menu of goals, targets and strategies in this report. A forum of Commonwealth and State/Territory injury prevention managers has been established by the Commonwealth

Department of Human Services and Health to facilitate communication and co-operative action.

5.3 Framework for injury reduction measures

Product-related fall injury is a complex problem. Countermeasures should be multi-faceted and geared towards reducing the likelihood of falling, increasing the use of protective devices and improving the safety features in the design of products and the environment. The focus for intervention should be on major areas where there is the potential for significant gains but should also be flexible to allow for opportunistic action when a supportive climate for change arises.

An intersectoral approach will be required since responsibility for action lies with a range of government departments and authorities.

5.3.1 Principles underlying the selection of countermeasures

These principles, devised by Ozanne-Smith (1995), were used to select countermeasures and implementation methods for injury prevention. Their utility was confirmed by the literature review and consultation with experts in the field.

- Adequate problem definition should precede the determination of the appropriate countermeasure for the purpose.
- A countermeasure will ideally involve a design change so that individual action is not required each time it is used.
- A countermeasure should have a cumulative protective effect over time (e.g., pool fence, pedestrian median strip).
- Countermeasures must be acceptable to those to be protected and, therefore, community (user) consultation and awareness programs must be considered.
- Countermeasures must be accessible by the community, in terms of cost and ease of access.
- There should be no unwanted side effects or potential misuse of the countermeasure.
- Interventions should co-ordinate with national and state/territory injury prevention and control strategies.
- The protective effects of the countermeasure should be measurable in order to determine its effectiveness, including benefits/costs ratio, prior to widespread implementation.

5.3.2 Implementation strategies

Implementation strategies recommended in this report are of the following types:

- legislation/regulation (accompanied by enforcement);
- environmental/design changes;
- education/behaviour change/incentives;
- advocacy; and
- action based at the community or organisation levels.

In practice, multi-faceted approaches which incorporate several of the above strategies are common in injury prevention. Furthermore, strategies may range from those tackling specific single issues, such as prevention of falls from supermarket trolleys, to a systems approach which covers multiple injury issues, such as safe home design.

5.4 Action plan

A small number of recommendations involving a range of sectors are presented here for early action because of the potential impact they could have, the relatively favourable climate for their implementation and the likelihood that each of the sectors involved would be able to initiate some preventive activity in the next 12 months. Protocols to systematically address the major research issues are outlined where appropriate. The recommendations in this report which are not included in the action plan form a menu from which researchers and implementors can choose for future development and action.

Some general strategies, which may be effective across several major fall injury issues, have emerged from the data and literature reviews- critical fall heights, generic safety helmets, home design, wrist protection and a product safety policy directive. These strategies demand immediate attention and form the basis of the action plan.

Progress would also be enhanced if injury and exposure data were integrated to assist the identification of targets, priority setting and the selection of interventions.

Some measures can be implemented with minimal costs, such as accreditation schemes, subsidies on safety products and, to the extent possible, incentives

such as sales tax removal from safety products, or disincentives such as litigation.

The reduction of product-related fall injuries will result in significant savings in health care costs and, to a lesser extent, the costs to other sectors, as well as community costs. While there are opportunities for low cost interventions, a substantial investment in injury prevention will be necessary to make large gains. Therefore, funding sources need to be established for the substantial action required to improve product safety in this country.

5.4.1 General recommendations

- Establish a national consumer product safety commission to fund, co-ordinate, facilitate, drive and enforce product safety research and implementation and to co-ordinate product safety imperatives with international trade policy. In-house and commissioned tasks should include data collection, research, policy development and implementation and cover regulatory measures, monitoring and improving product safety.
- Implement a product safety directive placing responsibility for product safety on manufacturers, importers, retailers and any others with an interest in products in the marketplace.
- Monitor the effectiveness of the Trade Practices Act in improving product safety and product-related injury reduction and amend it, where necessary, to provide more protection to consumers. Select test cases, including baby-walkers and other high risk products, to monitor effectiveness. This recommendation may be superseded if recommendation 2 is implemented.
- Establish an intersectoral National Injury Prevention Taskforce to advise government and to drive, co-ordinate and facilitate the child fall injury prevention action plan within the context of the broader implementation of national and state injury prevention strategies.
- Establish an exposure database to centralise available information regarding the prevalence of hazardous and protective products, and other exposure measures as they become available. The availability and accessibility of product sales figures and import information, and the potential for improved disaggregation of data covering imports (e.g. in ABS statistics babywalkers are included in the category of chairs) require investigation.

Preliminary collaborative work has commenced between MUARC and NISU to establish such a database and to undertake studies to extend currently available exposure data.

5.4.2 Specific recommendations

Playgrounds and forearm fractures - a systems approach

Playground equipment related falls were identified as a major injury problem in this study. The authors consider that the recommendations from this study with the greatest potential for results in terms of meeting national targets for injury reduction are those which address fall heights, forearm fractures, exposure to risk, and the lack of relevant standards.

There are some gaps in the research evidence guiding interventions in relation to critical fall heights for arm fractures by age, mechanical protection offered by wrist guards or other relevant mechanisms, and the effectiveness of play equipment under-surfacing in preventing or ameliorating forearm injuries. A staged approach is therefore recommended

Stage 1

- Commission a controlled study to determine the critical fall heights by age for reductions in forearm fractures using a similar methodology to that employed in a New Zealand study by Chalmers (1995). It is necessary to verify the results of the New Zealand study and to extend its scope prior to the widespread implementation of its findings.
- Conduct a controlled study to determine the effectiveness of undersurfacing on reducing playground equipment-related upper limb injuries.
- Conduct an exposure study to determine the amount of time children spend on each type of playground equipment and on playground equipment above 1.5 metres fall height to determine the relative risk associated with each type of equipment using corresponding injury data.
- Conduct a research study to determine the effectiveness of wrist guards in preventing child wrist fractures (MUARC has prepared a detailed research design for such a study).
- Develop and implement simple consensus measures for best practice performance-based guidelines for playground safety. An independent agency, such as Kidsafe, could be commissioned to research and draft performance-based

guidelines for further development at a national workshop of key stakeholders. The MUARC childhood poisoning prevention workshops involving key stakeholders provides a model for this approach.

Stage 2

- Conduct a benefit/cost analysis to determine a strategy for replacing playground equipment of non-conforming height (determined from the research in *Stage 1*) which compares a phasing out strategy to one which promotes active replacement.
- Develop a horizontal standard for fall heights based on the New Zealand findings (Chalmers 1995), if findings confirmed and refined for age groups by Australian research.
- Develop a new Australasian playgrounds standard based on the interim guidelines and *Stage 1* research, which refers to the horizontal standard on fall heights.
- Mandate and enforce the new standards in public playgrounds, schools, children's service regulations (Regulations 81 and 97), and playgrounds in commercial premises.

Safe home design - a systems approach

An important finding from this study was that 49% of product related fall injuries to children occur in the home. Of these, 18% directly involved structural features, while an unknown proportion indirectly involved structural problems such as poor lighting, and lack of opportunity for visual supervision.

The primary recommendation is that a systems approach to safe home design be adopted, which focuses on transferring safety design features routinely into new homes and home renovations. These features are identified in the Australian Standard (*Guidelines for Safe Housing Design (AS 4226)*, August 1994) and incorporated in Kidsafe and community safety display homes (e.g., City of Hume in Victoria, Noarlunga in South Australia).

The standard and the safety display homes include many safety measures which are relevant to child falls prevention. They include: minimising changes in floor level; maximising opportunities for visual supervision of children in internal and external play areas; incorp-orating slip resistant surfaces in baths and flooring; laminating glass doors; improving kitchen layout and design (e.g., rounded edges and corners, minimising traffic, kitchen appliances such as dishwashers which don't open outward into traffic areas); installing night lights and movement sensitive lights in hallways, toilets and stairways; pool fencing; self-closing and self-latching doors restricted access to pools, ponds and open drains; and balustrades to prevent climbing on exterior decking and balconies.

- Increase the number and accessibility of safety designed display homes.
- Further develop and promote safe home design packages for standard home designs (some progress has been made by Kidsafe/Archicentre).
- Integrate safety design components into tertiary courses for home builders and designers.
- Integrate safety design and safety package concepts into courses currently offered for home buyers.
- Reduce the marginal additional cost for a safety design features package by means of sales tax reductions, increased market share to complying builders or other incentives.
- Develop and promote a safety accreditation scheme for new homes in consultation with key stakeholders.
- Investigate incorporating into the Australian Building Code a requirement for the installation of slip resistant baths and slip resistant flooring in bathrooms in new and renovated homes.

Child restraint regulation and promotion

Falls from nursery furniture constitute approximately 15% of injuries presenting to hospital emergency departments in the first year of life (Ozanne-Smith 1990). While falls from supermarket trolleys make up only 1% of fall injuries in the peak age group of 1-3 year olds, most of these injuries are preventable.

- Develop and implement regulations requiring 5-point child restraints to be fitted to nursery furniture, including high chairs, prams and strollers, and attachment points for restraints to shopping trolleys. This could be achieved by the development and implementation of a horizontal mandatory standard or product specific standards.
- Devise and implement education campaigns regarding the correct installation and restraint use in motor vehicles.

Protective helmets

- Develop and promote guidelines for best practice helmet use in various settings (eg., the broader

use of bicycle helmets for adventure sports, where appropriate).

- Implement education campaigns to promote bicycle helmet wearing in off-road locations.
- Enforce bicycle helmet laws.
- Further develop, evaluate and implement (to the extent possible), a universal helmet which can be used across a range of activities where the risk of head injury is high

Compliance with Standards

- Pending the implementation of mandatory standards (or product bans), encourage retailers to stock, and consumers to purchase, products conforming to voluntary standards (e.g. nursery furniture, bunk beds and ladder standards) or to safety designs supported by research (pending their incorporation into standards).

Review progress

Disseminate the countermeasure review widely, update the recommendations regularly and review progress towards implementation

5.4.3 Additional data, research and implementation recommendations

The project brief prepared by the Commonwealth Department of Human Services and Health, identified a lack of research evidence pertaining to the risk factors associated with fall injuries to children. Substantial recommendations to expand research evidence are presented here. These relate to data, which could underpin further knowledge and analytic research, and to analytic, exposure and evaluation research. Selected injury reduction measures, including regulation, are also included in this section.

Injury data

- Include a product involvement code in injury data systems for death, hospital admissions and presentations and general practice data to enhance surveillance for new, ongoing and previously unidentified hazards.
- Widely implement level one data collections in health care settings using the NMDS (Injury Surveillance) and develop a sampling frame for more detailed (level 2) data, with the potential for in-depth follow-up studies on particular issues.
- Ensure that product involvement (including brand name) information is recorded, to the extent possible, on injury surveillance forms and in the text description in electronic NMDS injury surveillance collections and coronial data systems.
- Implement quality control programs to monitor and control data quality by means of feedback, training collectors and other methods as required
- Expand E-code classifications to cover more types of falls

Analytic research

Analytic research, particularly based in the disciplines of epidemiology and biomechanics, is required to inform interventions in the future. The recommended studies outlined below are not presented in priority order.

- Conduct follow-up studies to investigate the mechanism of injuries associated with high risk products such as beds, chairs, stools and tables to see whether these products require modification, redesign or other countermeasures.
- Conduct controlled studies to address the circumstances surrounding falls and the factors contributing to the fall, for example, a case-control study to compare the characteristics of household stairs that are involved in child fall injuries to household stairs where there is no/low involvement.
- Conduct relative risk studies where comparisons of different product designs are possible to inform future prevention strategies e.g., porta chairs versus standard high chairs (requires exposure data) and ramps versus other locations for skate-boarding.
- Determine the proportion of children under three years of age who sleep in conventional beds, determine relative risks of beds and cots at various ages (e.g., 12, 18, 24 and 30 months of age) and investigate the need for an intermediate bed design between cots and conventional beds.
- Carry out stability testing of loaded supermarket trolleys (including child passengers) to inform future design considerations.
- Determine the relative risks associated with various playing surfaces for sports and recreational activities.

Exposure studies

Exposure studies would contribute to the development of a national exposure database and assist with the choice of countermeasures and target populations for the implementation of preventive measures.

- Conduct surveys at regular intervals to ascertain exposure to hazardous and protective products - similar to that undertaken in the ABS Home Safety Survey in Victoria and NSW in 1992. Comprehensive studies are required which include many products such as glass-topped coffee tables with and without safety glass, coffee tables in households with young children, in-line skates, trampolines, babywalkers, steps and stairs. These surveys would also establish trends over time.
- Undertake exposure studies to determine the contribution of reduced exposure (by comparison with available baseline data) to the reduction of injuries to bicyclists, and to monitor the rate of helmet wearing.

Evaluation studies

Evaluation studies are required to monitor the effectiveness of countermeasures and implementation methods. Such studies can be methodologically difficult and costly to implement. However, they ultimately determine the effectiveness of interventions and must be conducted. Many potentially successful countermeasures require evaluation in order to determine future policy on choice of counter-measures and implementation strategy, the appropriateness of widespread implementation and cost effectiveness.

- Conduct evaluation studies to assess the efficacy of these countermeasures: safety glass performance in reducing fall and other domestic architectural glass injuries; the implementation of the 1991 safety glass regulations; equestrian protective equipment under different circumstances of riding; and protective equipment for roller skating, roller-blading, skateboarding.
- Undertake evaluation studies to assess compliance with voluntary and mandatory standards.
- Document the implementation of interventions as the basis for impact evaluation e.g. progress towards the withdrawal of babywalkers from sale in stores.
- Evaluate the content and impact of English language and non-English language safety information that is distributed at the point of sale to consumers, provided by product distributors to retail staff or distributed by other methods such as child safety centre educational programs.

5.4.4 Injury reduction measures

Regulation/standardisation

- Streamline processes for the development and implementation of horizontal and vertical standards for product safety, including the introduction of iterative processes.
- Mandate standards, where required to achieve compliance e.g., horse riding helmets in public places.
- Explore other means of achieving compliance with standards such as consultation with manufacturers, importers and retailers and raising public awareness e.g. bunk beds.
- Encourage the upgrading of products to comply with new standards.
- Adopt quality overseas standards where no Australasian standards exist e.g., high chairs (British) and possibly babywalker stability (British).
- Develop Australian standards for high risk products where no relevant standards are available, such as shopping trolleys.
- Update Australian standards to incorporate new research findings.
- Ensure that imported products are tested to Australian safety standards.

Consumer and industry education

- Promote safety awareness and education campaigns for the products most implicated in falls, particularly where products designed to prevent falls are available e.g., 5-point shoulder harness, prams and strollers designed with continuous handles and with parcel trays underneath.

5.4.5 Strategies for intersectoral action

The ladder is an example of a product which is associated with injury in many settings including children's environments. Settings in which ladders are used include the workplace, do-it-yourself home maintenance, the general home environment, playgrounds, building sites and public places. A co-ordinated strategy on ladder safety could be more effective than isolated interventions by a number of sectors. The expertise in one sector, for example, the ladder safety strategies adopted by fire brigades, could be transferred to other sectors.

5.5 Conclusion

This review highlights the extraordinary amount of action required to systematically address the data, research, implementation and evaluation issues which are pertinent to reducing product-related child falls. It confirms the very poorly developed state of product safety research and development in Australia and identifies the scope and potential strategies for improvement.

In particular, consumer safety agencies must fulfil their responsibilities as described in *Better Health Outcomes for Australians* (1994):

> '[by means of a collaborative and well-informed approach] to upgrade standards for products, to develop more effective methods of instituting best design practice, to identify products that need redesigning and to facilitate redesign, to control any adverse consequences of international trade agreements and deregulation, and to inform consumers of the risks associated with products' (p 220).

The target published in *Better Health Outcomes for Australians (1994)* - to reduce the hospital admission rate that results from falls to children aged 0-4 and 5-9 by 10% by the year 2000 - can be met if the recommended action plan set out above is implemented in a timely manner.

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Title and sub-title:
Product-related child fall injury

Author(s)
Ozanne-Smith, J., Brumen, I.A.

Type of report & period covered
Children under 15 years of age, July 1987 - June 1994

Organisation:
Monash University Accident Research Centre

Abstract:
This study identified a wide range of issues and products specifically involved in child falls and proposes a number of strategies to improve our understanding of the problem and to prevent and control fall injuries that are related to consumer products.

The methods used in this investigation included: an examination of available Victorian data on injury deaths, hospital admissions, hospital emergency department presentations and general practice presentations to obtain an overview of the size and nature of the product-related child injury problem; a review of published and unpublished literature which was used to develop a countermeasures matrix; and a review of countermeasures which was used to develop an hierarchy of countermeasures based on evidence of their effectiveness which formed the basis for the action plan.

The products identified as most frequently involved in fall-related injury across most levels of severity were playground equipment, stairs and steps, bicycles, chairs and stools, nursery furniture, skates and skateboards, conventional beds and swimming pools. Most falls occurred in the home (49%) and educational settings (16%).

The rate of fall injuries to children aged under 15 years resulting in hospitalisation in Victoria showed a statistically significant overall increase over the period July 1987 - June 1994, with significant increases also noted in the under one year and the 10-14 year age groups.

There was a higher proportion of children who fell more than one metre in the group of children admitted to hospital, indicating that these fallers sustained more serious injuries. The main injury resulting from child falls was fractures, 38% of which were of the radius/ulna. Although concussion was the fifth most frequent type of injury, it rated highest in terms of severity with a 45% hospital admission rate.

A comprehensive intersectoral action plan to reduce fall-related child injuries is recommended which includes general recommendations such as the establishment of a national consumer product safety commission, an intersectoral National Injury Prevention Taskforce to advise government and an exposure database to centralise available information on the prevalence of hazardous and protective products. Specific recommendations cover playground and forearm fractures, safe home design, child restraint regulation and promotion, protective helmets, compliance with standards, data and research, regulation and standardisation and consumer and industry education.

Key Words:
falls, children, product-related, consumer safety,

Disclaimer:
This report is disseminated in the interests of information exchange. The views expressed are those of the authors, and not necessarily those of Monash University nor the Commonwealth Department of Human Services & Health.

Monash University Accident Research Centre
Wellington Road, Clayton, Victoria, 3168
Australia

Appendix 1

VISS product-related child falls by location where injury sustained

Table 1: Residential locations, 1989-1993 (VISS: RCH, WH, PANCH)

Breakdown factor	Frequency of presentations	% Presentations	Frequency admitted	% Total Admitted
Furniture and non-structural fittings	3 601	34.11	597	32.53
- chairs and stools	929	8.8	142	7.74
- beds	1 000	9.47	126	6.87
- tables, benches and countertops	317	3	60	3.27
- sofas, couches, lounges, divans and studio couches	386	3.66	51	2.78
- bunk beds	350	3.32	69	3.76
- bathtubs and showers	306	2.9	81	4.41
- cabinets, racks, room dividers, shelves	192	1.82	47	2.56
- other	121	1.15	90	4.9
Structures and parts thereof	1 634	15.48	282	15.37
- stairs and steps	766	7.26	89	4.85
- floors and flooring material	217	2.06	29	1.58
- concrete and other man-made outdoor surfaces	80	0.76	8	0.44
- porches, balconies, open-side floors and floor openings	109	1.03	36	1.96
- gutters, drainpipes, downspouts, run-off pipes and kerbing	14	0.13	3	0.16
- roofs	70	0.66	30	1.63
- handrails, railings or banisters	32	0.3	10	0.54
- windows	76	0.72	29	1.58
- ramps or landings	12	0.11	1	0.05
- doors	48	0.45	10	0.54
- gates	30	0.28	8	0.44
- structural tile (glazed and plain)	79	0.75	11	0.6
- bricks and concrete blocks (not part of structure)	30	0.28	2	0.11
- other	71	0.67	16	0.87
Sports and recreation	1 326	12.56	183	9.97
- bicycles and bicycleaccessories	525	4.97	67	3.65
- roller skating, skateboards, rollerblades	236	2.24	30	1.63
- football	79	0.75	7	0.38
- basketball	64	0.61	4	0.22
- soccer	52	0.49	7	0.38
- horseback riding	32	0.3	12	0.65
- gymnastics	19	0.18	1	0.05
- cricket	41	0.39	2	0.11
- swimming pool	50	0.47	18	0.98
- other	228	2.16	34	1.85
Playground equipment	782	7.41	160	8.72
- monkey bars and other climbing apparatus	52	0.49	14	0.76
- slides and sliding boards	107	1.01	23	1.25
- swings and swing sets	236	2.24	49	2.67
- trampolines	347	3.29	63	3.43
- flying fox	2	0.02	1	0.05
- other playground equipment	38	0.36	10	0.54
Nursery furniture	610	5.78	105	5.72
- prams, baby carriages and strollers	92	0.87	14	0.76
- highchairs	136	1.29	25	1.36
- cots	105	0.99	11	0.6
- baby walkers and jumpers	89	0.84	8	0.44
- baby change tables	63	0.6	13	0.71
- baby exercisers	44	0.42	12	0.65
- other	81	0.77	22	1.2

Breakdown factor	Frequency of presentations	% Presentations	Frequency admitted	% Total Admitted
Yard and garden equipment	603	5.71	118	6.43
- fences/fence posts/poles	426	4.04	77	4.2
- logs	14	0.13	2	0.11
- ladders	71	0.67	20	1.09
- other	92	0.87	19	1.04
Toys	383	3.63	70	3.81
- tricycles, scooters, wheeled riding toys	112	1.06	19	1.04
- tree houses and playhouses	45	0.43	12	0.65
- two wheeled riding toys, unpowered	19	0.18	3	0.16
- other	207	1.96	36	1.96
Kitchenware	245	2.32	39	2.13
- glass drinking glasses	28	0.27	8	0.44
- knives	140	1.33	13	0.71
- tableware and accessories	32	0.3	9	0.49
- other	45	0.43	9	0.49
Fabrics, drapery and soft furnishings (excluding furniture)	197	1.87	16	0.87
- rugs, runners, throw rugs, doormats	99	0.94	8	0.44
- pillows and cushions loose	37	0.35	3	0.16
- other	61	0.58	5	0.27
Packaging materials and containers	166	1.57	27	1.47
- rope and string	37	0.35	6	0.33
- other	129	1.22	21	1.14
Animals	134	1.27	33	1.8
- horse	30	0.28	11	0.6
- dog	90	0.85	20	1.09
- other	14	0.13	2	0.11
Personal use items (excluding cosmetics)	122	1.16	27	1.47
- footwear	34	0.32	3	0.16
- pens and pencils	16	0.15	6	0.33
- other	72	0.68	18	0.98
Vehicles	94	0.89	19	1.04
Food and drink	94	0.89	35	1.91
- Fruit and vegetables	25	0.24	5	0.27
- Hot water	34	0.32	19	1.04
- Other	35	0.33	11	0.6
Laundry appliances	91	0.86	20	1.09
- clotheslines, clothes drying racks and clothes horses	62	0.59	15	0.82
- other	29	0.27	5	0.27
Workshop tools and appliances	53	0.5	14	0.76
- separate garages and tool sheds	37	0.35	12	0.65
- other	16	0.15	2	0.11
Craft and hobby equipment	51	0.48	8	0.44
- knives with replaceable blades	20	0.19	1	0.05
- other	31	0.29	7	0.38
Industrial or retail plant	47	0.45	8	0.44
Other	263	2.49	62	3.38
Product involvement not known or not in scope	61	0.58	12	0.65
Total	**10 557**	**100**	**1 835**	**100**

Table 2: Areas of Education, 1989-1993 (VISS: RCH, WH, PANCH)

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Playground equipment	1 715	41.99	417	53.05
- monkey bars and other climbing apparatus	982	24.05	253	32.19
- slides and sliding boards	208	5.09	49	6.23
- swings and swing sets	63	1.54	16	2.04
- flying fox	43	1.05	9	1.15
- other playground equipment	419	10.26	90	11.45
Sports and recreation	1 361	33.33	182	23.16
- bicycles and bicycle accessories	35	0.86	7	0.89
- football	212	5.19	21	2.67
- basketball	228	5.58	31	3.94
- soccer	162	3.97	20	2.54
- gymnastics	100	2.45	17	2.16
- netball	72	1.76	6	0.76
- cricket	37	0.91	6	0.76
- other	515	12.61	74	9.41
Structures and parts thereof	430	10.53	61	7.76
- stairs and steps	230	5.63	18	2.29
- floors or flooring material	36	0.88	5	0.64
- concrete and other man-made outdoor surfaces	57	1.4	8	1.02
- gutters, drainpipes, downspouts, run-off pipes and kerbing	17	0.42	5	0.64
- roofs	13	0.32	3	0.38
- handrails, railings and banisters	22	0.54	7	0.89
- ramps and landings	12	0.29	2	0.25
-other	43	1.05	13	1.65
Yard and garden equipment	163	3.99	45	5.73
- fences/fence posts/poles	79	1.93	21	2.67
- logs	77	1.89	21	2.67
- other	7	0.17	3	0.38
Furniture and non-structural fittings	160	3.92	33	4.2
- chairs and stools	81	1.98	12	1.53
- tables, benches and countertops	57	1.4	15	1.91
- other	22	0.54	6	0.76
Toys	46	1.13	10	1.27
- tricycles, scooters, wheeled riding toys	8	0.2	1	0.13
- tree houses and playhouses	21	0.51	6	0.76
- other	17	0.42	3	0.38
Personal use items (excluding cosmetics)	38	0.93	5	0.64
- footwear	19	0.47	3	0.38
- other	19	0.47	2	0.25
Other	171	4.19	33	4.2
Total	**4 084**	**100**	**786**	**100**

Table 3: Public Playgrounds, 1989-1993 (VISS: RCH, WH, PANCH)

Breakdown Factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Playground equipment	561	61.58	127	72.99
- monkey bars and other climbing apparatus	136	14.93	35	20.11
- slides and sliding boards	148	16.25	33	18.97
- swings and swing sets	82	9	20	11.49
- flying fox	44	4.83	10	5.75
- other playground equipment	151	16.58	29	16.67
Sports and recreation	252	27.66	30	17.24
- bicycles or accessories	28	3.07	3	1.72
- roller skating, skateboards, rollerblades	131	14.38	14	8.05
- horseback riding	12	1.32	4	2.3
- ice skating	37	4.06	4	2.3
- other	44	4.83	5	2.87
Structures and parts thereof	39	4.28	5	2.87
- stairs and steps	15	1.65	2	1.15
- ramps and landings	14	1.54	2	1.15
- other	10	1.1	1	0.57
Yard and garden equipment	15	1.65	2	1.15
Animals	17	1.87	4	2.3
- horse	14	1.54	3	1.72
- other	3	0.33	1	0.57
Other	27	2.96	6	3.45
Total	**911**	**100**	**174**	**100**

Table 4: Private Enterprise, 1989-1993 (VISS; RCH, WH, PANCH)

Breakdown factor	Frequency of presentations	%presentations	Frequency admitted	% Total admitted
Structures and parts thereof	173	22.7	26	17.33
- stairs and steps	76	9.97	9	6
- floors and flooring material	26	3.41	3	2
- concrete and other man-made outdoor surfaces	5	0.66	0	0
- handrails, railings or banisters	16	2.1	5	3.33
- ramps and landings	8	1.05	3	2
- elevators and other lifts	18	2.36	0	0
- other	24	3.15	6	4
Playground equipment	145	19.03	41	27.33
- monkey bars and other climbing apparatus	13	1.71	4	2.67
- slides and sliding boards	76	9.97	23	15.33
- flying fox	10	1.31	2	1.33
- other playground equipment	46	6.04	12	8
Sports and recreation	110	14.44	11	7.33
- roller skating, skateboards, rollerblades	31	4.07	0	0
- horseback riding	10	1.31	2	1.33
- gymnastics	10	1.31	0	0
- ice skating	5	0.66	1	0.67
- other	54	7.09	8	5.33
Furniture and non-structural fittings	98	12.86	23	15.33
- chairs and stools	63	8.27	13	8.67
- bunk beds	2	0.26	1	0.67
- other	33	4.33	9	6
Industrial and retail plant	86	11.29	19	12.67
- grocery and shopping trolleys	80	10.5	19	12.67
- other	6	0.79	0	0
Nursery furniture	61	8.01	11	7.33
- prams, baby carriages and strollers	49	6.43	9	6
- highchairs	3	0.39	0	0
- other	9	1.18	2	1.33
Yard and garden equipment	12	1.57	4	2.67
- fences/fence posts/poles	6	0.79	1	0.67
- other	6	0.79	3	2
Food and drink	8	1.05	0	0
Other	69	9.06	15	10
Total	**762**	**100**	**150**	**100**

Appendix 2

VISS product-related child falls by age group

Table 5: Product-related falls for children under 5 years old, 1989-1993 (*VISS*: RCH, WH, PANCH)

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Furniture and non-structural fittings	2 954	34.7	490	30.5
- chairs and stools	874	10.3	125	7.8
- beds	794	9.3	111	6.9
- sofas, couches, lounges, divans or studio couches	329	3.9	41	2.6
- tables, benches and countertops	323	3.8	61	3.8
- bathtubs and showers	225	2.6	70	4.4
- cabinets, racks, room dividers, shelves	165	1.9	41	2.6
- bunk beds	155	1.8	31	1.9
- other	89	1	10	0.6
Structures and parts thereof	1 281	15.1	230	14.3
- stairs and steps	672	7.9	94	5.9
- floors and flooring material	137	1.6	21	1.3
- concrete and other man-made outdoor surfaces	74	0.9	6	0.4
- porches, balconies, open-side floors and floor openings	72	0.8	25	1.6
- windows	64	0.8	21	1.3
- handrails, railings and banisters	43	0.5	13	0.8
- doors	32	0.4	7	0.4
- gutters, drainpipes, downspouts, run-off pipes and kerbing	19	0.2	5	0.3
- ramps and landings	12	0.1	5	0.3
- gates	11	0.1	2	0.1
- roofs	8	0.1	4	0.2
- other	137	1.6	27	1.7
Playground equipment	923	10.9	196	12.2
- slides and sliding boards	292	3.4	63	3.9
- swings and swing sets	173	2	45	2.8
- monkey bars and other climbing apparatus	139	1.6	32	2
- trampolines	110	1.3	20	1.2
- other playground equipment	209	2.5	36	2.2
Nursery furniture	822	9.7	149	9.3
- prams, baby carriages and strollers	236	2.8	44	2.7
- high chairs	146	1.7	27	1.7
- cots	110	1.3	14	0.9
- baby walkers and jumpers	97	1.1	9	0.6
- baby change tables	77	0.9	16	1
- other	156	1.8	39	2.4
Sports and Recreation	604	7.1	100	6.2
- bicycles and accessories	323	3.8	49	3.1
- swimming pool	54	0.6	21	1.3
- roller skating, skateboards, rollerblades	35	0.4	5	0.3
- football	28	0.3	3	0.2
- basketball	11	0.1	0	0
- soccer	11	0.1	1	0.1
- horseback riding	10	0.1	2	0.1
- other	132	1.6	19	1.2

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Toys	383	4.5	72	4.5
- tricycles, scooters, wheeled riding toys	136	1.6	23	1.4
- tree houses and playhouses	32	0.4	5	0.3
- other	215	2.5	44	2.7
Yard and garden equipment	301	3.5	71	4.4
- fences/fence posts/poles	187	2.2	43	2.7
- ladders	45	0.5	12	0.7
- other	69	0.8	16	1
Vehicles	192	2.3	46	2.9
Fabrics, drapery and soft furnishings (excluding furniture)	153	1.8	13	0.8
- rugs, runners, throw rugs, doormats	75	0.9	6	0.4
- other	78	0.9	7	0.4
Industrial and retail plant	122	1.4	30	1.9
Kitchenware	107	1.3	26	1.6
- knives	26	0.3	25	1.6
- other	81	1	1	0.1
Packaging materials and containers	105	1.2	22	1.4
Personal use items (excluding cosmetics)	83	1	19	1.2
- footwear	29	0.3	1	0.1
- other	54	0.6	18	1.1
Animals	74	0.9	37	2.3
- dog	55	0.6	16	1
- other	19	0.2	21	1.3
Food and drink	69	0.8	35	2.2
Laundry appliances	47	0.6	8	0.5
- clotheslines, clothes drying racks or clothes horses	22	0.3	4	0.2
- other	25	0.3	4	
Product involvement not known or not in scope	57	0.7	15	0.9
Other	229	2.7	47	2.9
Total	**8 506**	**100**	**1 606**	**100**

Table 6: Product-related child falls for children 5-9 years, 1989-1993 (*VISS*: RCH, WH, PANCH)

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Playground equipment	2 260	31.1	575	38.7
- monkey bars and other climbing apparatus	997	13.7	265	17.8
- slides and sliding boards	308	4.2	91	6.1
- swings and swing sets	241	3.3	53	3.6
- trampolines	214	2.9	47	3.2
- flying fox	79	1.1	20	1.3
- other playground equipment	421	5.8	99	6.7
Sports and recreation	1 941	26.7	313	21
- bicycles and bicycle accessories	792	10.9	148	10
- roller skating, skateboards, rollerblades	306	4.2	35	2.4
- football	131	1.8	18	1.2
- basketball	71	1	8	0.5
- soccer	71	1	8	0.5
- gymnastics	71	1	13	0.9
- horseback riding	56	0.8	15	1
- swimming pool	43	0.6	7	0.5
- cricket	41	0.6	4	0.3
- netball	19	0.3	3	0.2
- ice skating	12	0.2	4	0.3
- other	328	4.5	50	3.4
Furniture and non-structural fittings	895	12.3	161	10.8
- chairs and stools	202	2.8	39	2.6
- beds	195	2.7	30	2
- bunk beds	184	2.5	33	2.2
- tables, benches and countertops	105	1.4	21	1.4
- bathtubs and showers	59	0.8	11	0.7
- sofas, couches, lounges, divans and studio couches	58	0.8	9	0.6
- cabinets, racks, room dividers, shelves	48	0.7	12	0.8
- other	44	0.6	6	0.4
Structures and parts thereof	805	11.1	141	9.5
- stairs and steps	287	3.9	29	2
- floors and flooring material	92	1.3	14	0.9
- concrete and other man-made outdoor surfaces	82	1.1	15	1
- porches, balconies, open-side floors and floor openings	49	0.7	12	0.8
- roofs	49	0.7	24	1.6
- handrails, railings and banisters	40	0.5	12	0.8
- gutters, drainpipes, downspouts, run-off pipes and kerbing	30	0.4	4	0.3
- gates	25	0.3	7	0.5
- windows	24	0.3	8	0.5
- other	127	1.7	16	1.1
Yard and garden equipment	449	6.2	106	7.1
- fences/fence posts/poles	320	4.4	67	4.5
- logs	61	0.8	19	1.3
- ladders	30	0.4	10	0.7
- other	38	0.5	96	6.5
Vehicles	131	1.8	33	2.2

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Animals	113	1.6	25	1.7
- horse	59	0.8	17	1.1
- dog	44	0.6	7	0.5
- other	10	0.1	1	0.1
Toys	92	1.3	23	1.5
- tree houses and playhouses	37	0.5	13	0.9
- tricycles, scooters, wheeled riding toys	21	0.3	7	0.5
- other	34	0.5	3	0.2
Kitchenware	83	1.1	11	0.7
- knives	55	0.8	5	0.3
- other	28	0.4	6	0.4
Packaging materials and containers	74	1	11	0.7
- rope and string	29	0.4	3	0.2
- other	45	0.6	8	0.5
Personal use items (excl cosmetics)	65	0.9	13	0.9
- footwear	32	0.4	2	0.1
- other	33	0.5	11	0.7
Industrial and retail plant	55	0.8	12	0.8
Laundry appliances	42	0.6	14	0.9
- clotheslines, clothes drying racks and clothes horses	38	0.5	12	0.8
- other	4	0.1	2	0.1
Fabrics, drapery and soft furnishings (excluding furniture)	38	0.5	5	0.3
- rugs, runners, throw rugs, doormats	23	0.3	5	0.3
- other	15	0.2	0	0
Food and drink	25	0.3	4	0.3
Nursery furniture	11	0.2	1	0.1
Product involvement not known or not in scope	42	0.6	10	0.7
Other	157	2.2	29	2
Total	**7 278**	**100**	**1 487**	**100**

Table 7: Product-related child falls for children 10-14 years, 1989-1993 (*VISS*: RCH, WH, PANCH)

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Sports and recreation	4 166	57.4	582	50.5
- bicycles and accessories	1091	15	189	16.4
- roller skating, skateboards, rollerblades	645	8.9	91	7.9
- football	486	6.7	46	4
- basketball	400	5.5	46	4
- soccer	318	4.4	33	2.9
- horseback riding	164	2.3	62	5.4
- gymnastics	109	1.5	15	1.3
- netball	163	2.2	9	0.8
- cricket	94	1.3	11	1
- swimming pool	34	0.5	2	0.2
- ice skating	40	0.6	2	0.2
- other	622	8.6	76	6.6

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Structures and parts thereof	901	12.4	130	11.3
- stairs and steps	360	5	28	2.4
- floors and flooring material	92	1.3	8	0.7
- concrete and other man-made outdoor surfaces	115	1.6	16	1.4
- porches, balconies, open-side floors and floor openings	23	0.3	8	0.7
- gutters, drainpipes, downspouts, run-off pipes and kerbing	67	0.9	14	1.2
- roofs	48	0.7	20	1.7
- handrails, railings and banisters	17	0.2	4	0.3
- windows	7	0.1	4	0.3
- ramps and landings	51	0.7	5	0.4
- doors	12	0.2	4	0.3
- gates	10	0.1	1	0.1
- other	99	1.4	18	1.6
Playground equipment	568	7.8	107	9.3
- monkey bars and other climbing apparatus	173	2.4	34	2.9
- slides and sliding boards	68	0.9	9	0.8
- swings and swing sets	59	0.8	9	0.8
- trampolines	121	1.7	19	1.6
- flying fox	30	0.4	7	0.6
- other playground equipment	117	1.6	29	2.5
Furniture and non-structural fittings	329	4.5	66	5.7
- chairs and stools	119	1.6	21	1.8
- beds	52	0.7	7	0.6
- tables, benches and countertops	33	0.5	10	0.9
- sofas, couches, lounges, divans and studio couches	15	0.2	3	0.3
- bunk beds	47	0.6	13	1.1
- bathtubs and showers	33	0.5	5	0.4
- cabinets, racks, room dividers, shelves	11	0.2	2	0.2
- other	19	0.3	5	0.4
Yard and garden equipment	298	4.1	52	4.5
- fences/fence posts/poles	208	2.9	33	2.9
- logs	48	0.7	7	0.6
- ladders	16	0.2	6	0.5
- other	26	0.4	6	0.5
Vehicles	214	2.9	48	4.2
Animals	210	2.9	62	5.4
- horse	162	2.2	56	4.9
- dog	41	0.6	5	0.4
- other	7	0.1	1	0.1
Kitchenware	96	1.3	15	1.3
- knives	78	1.1	11	1
- other	18	0.2	4	0.3
Packaging materials and containers	80	1.1	18	1.6
- rope and string	24	0.3	7	0.6
- other	56	0.8	11	1
Personal use items (excluding cosmetics)	67	0.9	12	1
- footwear	25	0.3	6	0.5
- other	42	0.6	6	0.5
Industrial and retail plant	48	0.7	8	0.7
Food and drink	37	0.5	5	0.4
Toys	36	0.5	6	0.5
- tricycles, scooters, wheeled riding toys	4	0.1	0	0
- tree houses and playhouses	10	0.1	4	0.3
- other	22	0.3	2	0.2
Fabrics, drapery and soft furnishings (excluding furniture)	36	0.5	5	0.4
- rugs, runners, throw rugs, doormats	18	0.2	1	0.1
- other	18	0.2	4	0.3
Product involvement unknown or not in scope	29	0.4	6	0.5
Other	196	2.7	39	3.4
Total	**7 263**	**100**	**1 153**	**100**

Appendix 3

NISU product-related child falls

Table 8: Product-related fall injuries to children <15 years of age, (NISU 1994)

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Sports and recreation	33 741	28.2	5 214	25.2
- bicycles and accessories	12 044	10.1	2 099	10.1
- roller skating, skateboards, rollerblades	6 573	5.5	1 115	5.4
- football	2 334	2	264	1.3
- basketball	1 594	1.3	157	0.8
- soccer	1 481	1.2	221	1.1
- netball	1 189	1	57	0.3
- gymnastics	987	0.8	165	0.8
- swimming pool	851	0.7	216	1
- cricket	503	0.4	53	0.3
- horseback riding	482	0.4	154	0.7
- ice skating	406	0.3	47	0.2
- other	5 297	4.4	666	3.2
Structures and parts thereof	23 661	19.8	3 380	16.3
- stairs or steps	6 681	5.6	786	3.8
- floors or flooring material	6 248	5.2	645	3.1
- concrete and other man-made outdoor surfaces	4 807	4	576	2.8
- porches, balconies, open-side floors or floor openings	723	0.6	277	1.3
- windows	516	0.4	163	0.8
- gutters, drainpipes, downspouts, run-off pipes or kerbing	498	0.4	83	0.4
- handrails, railings or banisters	456	0.4	118	0.6
- doors	368	0.3	56	0.3
- ramps or landings	320	0.3	64	0.3
- roofs	292	0.2	106	0.5
- gates	191	0.2	46	0.2
- other	2 561	2.1	460	2.2
Furniture and non-structural fittings	17 496	14.6	2 635	12.7
- chairs and stools	4 961	4.1	687	3.3
- beds	4 106	3.4	519	2.5
- tables, benches and countertops	2 021	1.7	335	1.6
- bunk beds	1 785	1.5	406	2
- bathtubs and showers	1 658	1.4	234	1.1
- sofas, couches, lounges, divans and studio couches	1 582	1.3	210	1
- cabinets, racks, room dividers, shelves	686	0.6	136	0.7
- other	697	0.6	108	0.5
Playground equipment	17 163	14.4	878	4.2
- monkey bars and other climbing apparatus	5 980	5	1 714	8.3
- slides and sliding boards	2 729	2.3	701	3.4
- trampolines	2 676	2.2	581	2.8
- swings and swing sets	2 645	2.2	636	3.1
- flying fox	417	0.3	124	0.6
- other playground equipment	2 716	2.3	603	2.9
Yard and garden equipment	4 400	3.7	951	4.6
- fences/fence posts/poles	2 541	2.1	575	2.8
- logs	538	0.4	103	0.5
- ladders	450	0.4	118	0.6
- other	871	0.7	155	0.7

Breakdown factor	Frequency of presentations	% presentations	Frequency admitted	% Total admitted
Nursery furniture	3 542	3	613	3
- prams, baby carriages and strollers	891	0.7	137	0.7
- baby walkers and jumpers	601	0.5	111	0.5
- highchairs	587	0.5	121	0.6
- cots	429	0.4	56	0.3
- baby change tables	424	0.4	71	0.3
- other	610	0.5	117	0.6
Vehicles	2 653	2.2	651	3.1
Toys	2 513	2.1	403	1.9
- tricycles, scooters, wheeled riding toys	777	0.6	115	0.6
- tree houses and playhouses	472	0.4	128	0.6
- other	1 264	1.1	160	0.8
Animals	2 362	2	596	2.9
- horse	1 420	1.2	444	2.1
- dog	733	0.6	144	0.7
- other	209	0.2	8	0
Packaging materials and containers	1 185	1	215	1
- rope and string	303	0.3	82	0.4
- other	882	0.7	133	0.6
Kitchenware	1 154	1	138	0.7
- knives	787	0.7	66	0.3
- other	367	0.3	72	0.3
Industrial and retail plant	1 048	0.9	212	1
Fabrics, drapery and soft furnishings (excluding furniture)	990	0.8	93	0.4
- rugs, runners, throw rugs, doormats	459	0.4	46	0.2
- other	531	0.4	47	0.2
Personal use items (excluding cosmetics)	898	0.8	129	0.6
- footwear	380	0.3	42	0.2
- other	518	0.4	87	0.4
Food and drink	454	0.4	114	0.6
Laundry appliances	393	0.3	88	0.4
- clotheslines, clothes drying racks and clothes horses	286	0.2	69	0.3
- other	107	0.1	19	0.1
Product involvement not known or not in scope	3 192	2.7	433	2.1
Other	2 721	2.3	484	2.3
Total	**119 566**	**100**	**20 708**	**100**

Appendix 4

Australian and international Standards relating to product related falls

1. Nursery furniture

Babywalkers (Baby walking frames)

Australian Standards	• Nil • **Child Barriers for Domestic Premises - 1976:** Standard requires that the safety barrier is 75mm high and has vertical bars fitted which are between 70-90mm apart (Ozanne-Smith & Heffernan, 1990)
European Standards	*British* • **Child care articles. Baby walking frames. Safety requirements and test methods (prEN 1273): 94/300113 DC** (British Draft) • **Specification for safety requirements for baby walking frames: BS 4648: 1989** (British Standard) *German* • **Aids for helping children in walking; safety requirements and testing: DIN 66356: 1987** (German)

Cots, cribs and cradles

Australian Standards	• **Infants rocking cradles - safety requirements (DR 95138):** Currently being drafted (Australian Furniture Research and Development Institute Limited, 1995) • **Metal Dropside Cots For Day Nurseries, Hospitals And Institutions (AS 2130-1981):** Specifies dimensions, materials, construction and assembly, and finish, and requirements for accessories where these relate to the safe use of a cot. Strength and durability are established by performance tests. Information to be given to the purchaser regarding assembly, maintenance and use is also specified. • **Carry Cots And Stands (AS 2196-1978):** Specifies dimensions, materials, construction and assembly, finish, flammability, and accessories, where these relate to the safe use of a carry cot and the stand that converts the cot from a carrying device to a cradle. A loading test for the cot and the stand is included. • **Carry Cots And Stands (AS 2195-1978):** Specifies dimensions, materials, construction and assembly, finish, flammability, and accessories, where these relate to the safe use of a carry cot and the stand that converts the cot from a carrying device to a cradle. A loading test for the cot and the stand is included.
Aust/NZ Standards	• **Cots For Household Use (AS/NZS 2172-1995):** Specifies material, construction and design requirements for cots as well as performance criteria, labelling and marking, all of which are related to the child's safety while in the cot. It does not include carry cots or folding cots. Requirements for toys, if these are included with the cots, are also specified. The safety and performance of cots are established by a number of tests. Information which is to be supplied to the purchaser regarding assembly, maintenance, the maximum weight of child and the recommended mattress weight and size is also specified.

European Standards

Austrian

- **Furniture - Children's and nursery furniture - children's cots and folding cots for domestic use - safety requirements: DENORM EN 716 Teil;: 1992** (Austrian)
- **Furniture - Children's and nursery furniture - children's cots and folding cots for domestic use - Test methods: DENORM EN 716 Teil 2:1992** (Austrian)

British

- **BS EN 1466. Child care articles. Carry cots. Safety requirements and test methods (prEN 1466): 94/504284 DC:1994** (British Draft)
- **Furniture. Cribs and cradles for domestic use. Part 2. Test methods (prEN 1130-2): 93/309260: DC:1993** (British Draft)
- **Furniture. Cribs and cradles for domestic use. Part 1 Safety requirements (prEN 1130-1): 93/3092259 DC: 1993** (British Draft)
- **BS 1877. Domestic bedding. Part 10. Specification for mattresses and bumpers for children's cots, perambulators and similar domestic articles: 92/44242 DC: 1992** (British Draft)
- **Furniture. Children's and nursery furniture. Children's cots and folding cots for domestic use. Part 1. Safety requirements (prEN 716-1): 92/39914 DC: 1992** (British Draft)
- **Specification for safety requirements for carry cots and similar handled products and stands: BS 7551: 1992** (British Standard)
- **Children's and nursery furniture. Children's cots and folding cots for domestic use. Part 1. Test methods (prEN 716-1): 92/39914 DC: 1992** (British Draft)
- **Specification for safety requirements for children's travel cots of internal base length not less than 900mm: BS 7423:1991** (British Standard)
- **Specification for safety requirements for children's cots for domestic use: BS 1694: 1990** (British Standard)

French

- **Child care articles. Carrycots, moses baskets and similar articles. Safety requirements and tests: NF S54-004:1985** (French)

German

- **Child care articles - Carry cots - Safety requirements and test methods; German version prEN 1466: DIN EN 1466: 1994** (German)
- **Children's and nursery furniture; cribs and cradles for domestic use; part 1: safety requirements; German version prEN 1130-1: 1993: DIN EN 1130-1: 1993** (German)
- **Children's and nursery furniture; cribs and cradles for domestic use; part 2: test methods; German version prEN 1130-2:1993: DIN EN 1130-2: 1993** (German)
- **Furniture; children's and nursery furniture; children's cots and folding cots for domestic use; part 1: safety requirements: DIN EN 716-1: 1992** (German)
- **Furniture; children's and nursery furniture; children's cots and folding cots for domestic use; part 2: test methods: DIN EN 716-2: 1992** German)
- **Prams, push-chairs, carry cots; dimensions, safety requirements: DIN 66068-1: 1989** (German)
- **Prams, push-chairs, carry cots; test methods: DIN 66068-2: 1989** (German)
- **Children's cots; safety requirements, testing: DIN 66078: 1982** (German)

	International • **Furniture; children's cots; safety requirements and testing; part 1: safety requirements: ISO/DIS 7175-1: 1992** (International Standards Organisation) • **Furniture; children's cots; safety requirements and testing; part2: test method (revision of ISO 7175-2: 1988): ISO/DIS 7175-2: 1992** (International Standards Organisation)
Prams & strollers	
Australian Standards	• **Harnesses for use in prams, strollers, and high chairs (including a detachable walking rein) (AS-3747-1990):** Specifies requirements for materials, construction, and performance of children's harnesses comprising a shoulder harness and side straps, and requirements for a detachable walking rein. Requires a three-point crotch strap and lap restraint to be fitted to all strollers, and a restraint preventing the child from falling out when the stroller is reclined backwards more than 1500
Aust/NZ Standards	• **Prams and strollers (AS/NZS 2088:1993):** Specifies requirements for the construction and performance of prams and strollers. Includes requirements for permanent marking of products and information to be supplied by manufacturers. New draft standard includes a shoulder harness for strollers.
European Standards	*British* • **Specification for webbing safety harness for baby carriages and chairs and walking reins: BS 3785: 1964** (British Standards) *German* • **Prams, push-chairs, carry cots; dimensions, safety requirements: DIN 66068-1: 1989** (German) • **Prams, push-chairs, carry cots; test methods: DIN 66068-2: 1989** (German)
High chairs	
Australian Standards	• Nil • **Harnesses for use in prams, strollers, and high chairs (including a detachable walking rein) (AS3747-1989):** Specifies requirements for materials, construction, and performance of children's harnesses comprising a shoulder harness and side straps, and requirements for a detachable walking rein.
European Standards	*Austrian* • **Child care articles - Convertible high chairs - Safety requirements and test methods: DENORM EN 1887:1995** (Austrian) • **Furniture - Children's high chairs for domestic use - Part 1: Safety requirements (ISO 9221-1 modified): DENORM ENV 1178 Teil 1: 1995** (Austrian) • **Furniture - Children's high chairs for domestic use - Part 2: Test methods (ISO 9221-2 modified): DENORM ENV 1178 Teil 2: 1995** (Austrian) *British* • **Furniture. Children's high chairs. Safety requirements and testing. Part 1. Safety requirements (ISO/DIS 9221-1): 90/35653 DC:1990** (British Draft) • **Furniture. Children's high chairs. Safety requirements and testing. Part 2. Test methods (ISO/DIS 9221-2): 90/35654 DC: 1990** (British Draft) • **Specification for safety requirements for children's high chairs and multi-purpose high chairs for domestic use: BS 5799: 1986** (British Standards)

• **Specification for webbing safety harness for baby carriages and chairs and walking reins: BS 3785: 1964** (British Draft)

European

• **Furniture- Children's high chairs for domestic use Part 1: Safety requirements (ISO 9221-1. modified): ENV 1178-1: 1994** (European)

• **Furniture - Children's high chairs for domestic use - Part 2: Test methods (ISO 9221-2, modified): ENV 1178-2:1994** (European)

• **Child care articles - Convertible high chairs - Safety requirements and test methods: prEN 1887:1992** (European Draft)

German

• **Furniture - Children's high chairs for domestic use - Part 1: Safety requirements (ISO 9221-1: 1992, modified); German version ENV 1178-1: 1994: DIN V ENV 1178-1: 1995** (European - adopted by Germany)

• **Furniture - Children's high chairs for domestic use - Part 2: Test methods (ISO 9221-2: 1992, modified); German version ENV 1178-2:1994: DIN V ENV 1178-2: 1995** (European - adopted by Germany)

• **Child care articles - Convertible high chairs - Safety requirements and test methods; German version prEN 1887:1995: DIN EN 1887: 1995** (European - adopted by Germany)

International

• **Furniture; children's high chairs; part 1: safety requirements: ISO 9221-1:1992** (International Standards Draft)

• **Furniture; children's high chairs; part 2: test methods: ISO 9221-2: 1992** (International Standards Draft)

Swiss

• **Furniture - Children's high chairs for domestic use - Part 1: Safety requirements (ISO 9221:1992, modified): SN ENV 1178-1: 1995** (Swiss)

• **Furniture - Children's high chairs for domestic use - Part 2: Test methods (ISO 9221-2: 1992, modified): SN ENV 1178-2: 1995** (Swiss)

Change tables

Australian Standards	• Nil
European Standards	*French* • **Child care articles. Changing tables. Minimum safety requirements and tests: NF S54-005:1987** (French)

Porta-chairs

Australian Standards	• Nil
European Standards	*British* • **Child care articles. Table mounted chairs. Safety requirements and test methods (prEN 1272): 94/300112 DC: 1994** (British Draft) *Dutch* • **Child care articles; Table mounted chairs; Safety requirements and test methods: NEN-EN 1272 Ontw.: 1994** (Dutch)

Bouncinettes (exercisers)

Australian Standards	• Nil
European Standards	• Nil

Car Restraints

(non-crash related falls only, eg., carseats placed on benches, incorrect installation in vehicles, poor restraint devices)

Australian Standards	*MANDATORY STANDARD* • **Child restraint systems for use in motor vehicles (effective 2 June 1993):** The requirements for the design and performance of child restraints are set out. It also includes static and dynamic performance tests.
Aust/NZ Standards	• **Child restraint systems for use in motor vehicles (AS 1754-1991) (NZS 5411:1991):** Specifies general requirements for all types of restraining devices for child occupants of passenger cars and their derivatives. Identical with NZS5411:1991 and produced as a joint Australian/New Zealand Standard. • **Webbing for restraining devices for occupants of motor vehicles (AS 1753-1990) (NZS 5432:1990):** Specifies requirements for webbing for restraining devices, and gives methods of test. Webbing complying with this Standard is intended for adult seat belts and child restraints, but may be suitable for other applications. Produced as a Joint Australian/New Zealand Standard.
European Standards	• **Specification for carry cot restraints (BS AU 186a: 1983)** (British Standard)

2. Household furniture

Bunk beds

Aust/NZ Standards	• **(AS/NZS 4220 - 1994):** Specifies safety requirements for bunk beds. These requirements include material, construction, design and performance, all of which are important for the well-being of the occupants (especially children). who use bunk beds. Covers entrapment hazards, spaces between side rails, ladders, mattress supports and thickness, stability and durability tests, marking, labelling and instructions on safe use, restricting use of upper bunk to children over 6 years of age, and maximum height of 1650mm for children over 12 years of age. Gaps or entrapment hazards between 5-12mm (finger entrapment), 30-65mm (limb entrapment), and 75-230mm (head entrapment) are specifically excluded by the Standard (Australian Furniture Research and Development Institute Limited, 1995)
European Standards	*British* • **Furniture. Bunk beds for domestic use. Safety requirements: BS EN 747-1: 1993** (British Standard) • **Furniture. Bunk beds for domestic use. Test methods: BS EN 747-2: 1993** (British Standard) • **ISO/DIS 9098-1. Furniture. Bunk beds. Safety requirements and testing. Part 2. Test methods: 91/35488 DC: 1991** (British Draft) *Dutch* • **Furniture; Bunk beds for domestic use; Part 1: Safety requirements: NEN-EN 747-1: 1993** (Dutch) • **Furniture; Bunk beds for domestic use; Part 2: Test methods: NEN-EN 747-2: 1993** (Dutch) *International* • **Bunk beds for domestic use, safety requirements and tests, Part 1: Safety requirements: ISO 9098.1** (International Standards Organisations) • **Bunk beds for domestic use, safety requirements and tests, Part 2: Test methods: ISO 9098.2** (International Standards Organisations)

Conventional beds

Australian Standards	• Nil
European Standards	*French* • **Rigid and folding beds for children: NF S54-002: 1984** (French) *German* • **Domestic furniture - Beds and mattresses - Safety requirements and test methods; German version prEN 1725: 1994: DIN EN 1725: 1995** (European - adopted by Germany)

Chairs and stools

Australian Standards	• Nil
European Standards	*German* • **Domestic furniture; seatings; determination of stability; German version prEN 1022: 1993: DIN EN 1022: 1993** (European - adopted by Germany) *International* • **Furniture; chairs; determination of stability. Part 1: Upright chairs and stools: ISO 7174.1, 1992** (International Standards Organisation) • **Furniture; chairs; determination of stability. Part 2: Chairs with tilting or reclining mechanisms when fully reclined: ISO 7174.2, 1992** (International Standards Organisation) • **Furniture; chairs and stools; determination of strength and durability. (for adults): ISO 7173: 1989 (and Part 2 - ISO 7174-2: 1992)** (International Standards Organisation)

Tables

Australian Standards	• Nil
European Standards	*French* • **Contract furniture. Tables. General characteristics. Mechanical tests and specifications: D62-070: 1992** (French) *International* • **Tables: Determination of stability: ISO 7172** (International Standards Organisation)

Benches

Australian Standards	• Nil
European Standards	*Austrian* • **Kitchen furniture - Safety requirements and test methods for built-in and free standing kitchen cabinets and work tops: DENORM EN 1153: 1993** (Austrian)

Coffee tables

Australian Standards	• Nil
European Standards	• Nil

Sofas & couches

Australian Standards	• Nil

European Standards	*British* • **Strength and stability of furniture. Methods for determination of stability of settees: BS 4875: Part 4: 1985** (British)

3. Structural features of the home

Steps and stairs

Australian Standards	• **Fixed platforms, walkways, stairways and ladders-Design, construction and installation (AS 1657-1992):** Specifies requirements for the design, construction and installation of fixed means of access to, and safe working places normally used by operating inspection, maintenance and servicing personnel. Included in appendices are methods for testing guard rails and posts, as well as typical component dimensions and spacings for guard railing.
European Standards	*British* • **Wood stairs. Specification for stairs with closed risers for domestic use, including straight and winder flights and quarter or half landings: BS 585: Part 1: 1989** (British Standard) • **Stairs, ladders and walkways. Code of practice for the design of helical and spiral stairs: BS 5395: Part 2: 1984** (British Standard) • **Stairs, ladders and walkways. Code of practice for the design of straight stairs: BS 5395: Part 1: 1977: 1976** (British Standard)

Balcony

Australian Standards	• Nil
European Standards	• Nil
New Zealand Standards	• **New Zealand Standard For House Design (NZS 4102:1990):** States that all exterior decking and balconies over 1200mm above ground level should have a fence/balustrade at least 900mm high. Provision should be made to prevent climbing, e.g., installing vertical palings no more than 8cms apart.

Concrete & other flooring

Australian Standards	• **Safety on wet and dry tiled floors (DR 92139R):** • **Test for slip resistance (AS 2983.4-1988)** (synthetic sporting surfaces) • The following Voluntary Australian Standards apply to concrete and other flooring but do not specifically address fall prevention: - Residential slabs and footings (AS2870): - Construction (AS2870.1-1988): Amdt 1 July 1992 (ISBN 0 7262 7612 X), Amdt 2 Sept 1993 (ISBN 0 7262 8452 1) - Floor coverings-Resilient sheet and tiles-laying and maintenance practices (AS1884-1985): - Timber-Seasoned hardwood-Milled products (AS2796 -1985), Amdt 1 Nov 1985:
Aust/NZ Standards	• The Australian/New Zealand Standard for **Slip resistance of pedestrian surfaces, Part 2: Guide to the reduction of slip hazards (1994)** provides details on test procedures, required minimum values of the measures of coefficients of friction, and the floor surfaces most recommended for slip-resistance (Stevenson, 1992; Day, Kent & Fildes, June 1994)

European Standards	*German* • **Testing of floor coverings, determination of the anti-slip properties, wet-loaded barefoot areas, walking method ramp test: DIN 51097: 1992** (German)

Domestic architectural glass (including windows)

Australian Standards	• **Glass in buildings-selection and installation (AS 1288-1994):** The Standard requires that safety glazing materials (eg., toughened, laminated or organic glass) be used rather than annealed glass which is known to break easily into jagged pieces. Specifies procedures for the selection of glass to comply with wind loading requirements and human impact considerations for framed and unframed glass assemblies of limited dimensions. The Standard also includes installation guidelines and appendices for design of glass fins as well as the interpretation of human impact considerations and wind load design charts. • **Safety glazing materials for use in buildings (human impact considerations) (AS2208-1978):** Specifies the functional properties of various safety glazing materials, including toughened glass, laminated glass, wired glass, organic-coated glass and plastics. Two grades are covered, with different impact performance levels. Other requirements include size tolerances, weathering and ageing performance. Test methods are given in appendices, and other appendices deal with sampling and acceptance procedures, notes on the storage and handling of toughened safety glass, and notes on safe performance criteria and human dynamics data.
European Standards	*British* • **Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings: BS 6206: 1981** (British Standard) *Dutch* • **Glass in buildings; Glazing requirements; Glazing blocks (ISO/DIS 14439:1995): NEN-EN-ISO 14439 Ontw.: 1995** (Dutch) • **Glazing of window frames, windows and doors; functional requirements: NEN 3576** (Dutch)

Bathtubs & showers

Australian Standards	• The following Voluntary Australian Standards apply to bathtubs and showers but do not specifically address fall prevention: • **Baths for ablutionary purposes (AS 2023-1989):** Specifies material, construction and installation requirements for baths for ablutionary purposes manufactured from cast iron vitreous enamelled, pressed steel vitreous enamelled, vitreous china, stainless steel, plastics and composite materials. • **Shower bases and shower modules (AS 3588-1989):** Specifies material, construction and installation requirements for shower bases and shower modules manufactured from pressed steel vitreous enamelled, stainless steel, vitreous china, plastics and composite materials.
European Standards	*British* • **Shower units. Guide on choice of shower units and their components for use in private dwellings: BS 6340: Part 1: 1983** (British Standard) • **Shower units. Specification for the installation of shower units: BS 6340: Part 2: 1983** (British Standard) *German* • **Testing of floor coverings; determination of the anti-slip properties; wet-loaded barefoot areas; walking method; ramp test: DIN 51097: 1992** (German)

Toys

Australian Standards	• Australian Standard sets out toxicological, construction and flammability requirements for all sorts of toys • **Constructional requirements (AS 1647-1992):** Specifies in two broad groups various hazards associated with constructional aspects of toys intended for use by children up to the age of 14 years. The first group of hazards is applicable to all toys (eg., sharp edges, sharp points, pinch or crush hazard). The second group of hazards relates to specific toys which, because of their design or their traditional play modes, present a particular hazard eg., ingestion or inhalation hazard of small toys particularly if handled by a child aged less than three years; puncture hazard of small toys particularly if handled by a child aged less than three years; puncture hazard resulting from being struck by a projectile toy such as a toy dart. In addition to a series of normal use and reasonably foreseeable abuse tests, the Standard specifies a number of tests for specific toys (eg., rattles, teethers, projectile toys). Labelling requirements and age suitability gradings are also specified. • The following Voluntary Australian Standards apply to toys but do not specifically address fall prevention: **(a) General requirements (AS 1647.1-1990):** Specifies general safety requirements for toys, including material, packaging and labelling. **(b) Flotation toys and swimming aids for children (AS 1900-1991): Amdt 1 Aug 1993 (c) Toxicological requirements (AS 1647.3-1982), Amdt 1 June 1983 (d) Flammability requirements (AS 1647.4-1980)**
European Standards	*Austrian* • **Safety of toys - Part 6: Graphical symbol for age warning labelling: DENORM EN 71 Teil 6: 1994** (Austrian) *European* • **Safety of toys - Part 6: Graphical symbol for age warning labelling: EN 71-6: 1994** (European) *French* • **Safety of toys, Part 6 : Graphical symbol for age warning labelling. (European standard EN 71-6): NF S51-271, NF EN 71-6: 1994** (French)

Sports - general

Australian Standards	• **Methods of test for synthetic sporting surfaces (AS 2983) (a) Determination of rebound resistance (AS 2983.1-1988) (b) Determination of rolling resistance (AS 2983.2-1988) (c) Test for spin (AS 2983.3-1988) (d) Test for slip resistance (AS 2983.4-1988) (e) Determination of impact resistance (AS 2983.13-1987)** • **Guide to sports lighting (AS 2560)** • **General principles (AS 2560.1-1982)** • **Specific recommendations (AS 2560.2) (a) Lighting for outdoor tennis (AS 2560.2.1-1982) (b) Lighting for multipurpose indoor sports centres (AS 2560.2.2-1986) (c) Lighting for football (all codes) (AS 2560.2.3-1986) (d) Lighting for outdoor netball and basketball (AS 2560.2.4-1986) (e) Specific recommendations - Swimming pools (AS 2560.2.5-1994) (f) Specific recommendations - Baseball and softball (AS 25602.6-1994) (g) Specific recommendations - Outdoor hockey (AS 2560.2.7-1994)**
European Standards	• Nil

Bicycles and tricycles

Australian Standards	*Mandatory standards*

- **Protective Helmets for Pedal Cyclists (1992):** Helmets manufactured or imported into Australia since 9 April 1992 must comply with Australian Standard AS 2063.2-1990. The aim of the standard is to minimise risk of injury or death through head injuries suffered in cycling accidents.
- **Pedal Bicycles (1986):** All bicycles supplied having a wheelbase greater than 640mm and not being a speciality bicycle must comply with the Australian Standards for Pedal Bicycles.
- **Victorian Cycle Helmet Act (July 1, 1990):** Implemented through the Road Safety Bicycle Helmets Regulations 1990, under the Road Safety Act of 1986. The regulation stipulates that all riders and passengers on-road or riding on the footpath, a bicycle path or a public park must wear a securely fitted approved bicycle helmet (12). *VOLUNTARY STANDARDS*
- **Lightweight Protective Helmets (for use in pedal cycling, horse riding and other activities requiring similar protection), Part 1 - Basic Performance Requirements (AS2063.1-1990):**
- **Lightweight Protective Helmets (for use in pedal cycling, horse riding and other activities requiring similar protection), Part 2 - Helmets for Pedal Cyclists (AS2063.2-1990), Amdt 1 August 1990, Amdt 2 April 1991):** The standard specifies performance requirements for energy impact attenuation, localised loading, and retention and ventilation.
- **Pedal bicycles for normal road use - Safety requirements (AS 1927-1989):** Specifies performance requirements for the fully assembled bicycle and individual components such as the fork and frame, the wheel and tyre assemblies, the seat and handlebar assemblies, and for the efficiency of the braking system. Design requirements are specified where they relate to rider safety. The Standard applies to adult bicycles and children's bicycles which have a wheel base of not less than 640mm. Competition and specially built bicycles are not covered.

European Standards

British

- **Cycles. Safety requirements for bicycles for young children (ISO/DIS 8098): 87/77145 DC: 1987** (British Draft)

International

- **Cycles.; safety requirements for bicycles for young children; amendment 1: ISO 8098 AMD 1:1992** (International Standards Organisation)
- **Cycles.; safety requirements for bicycles: ISO 4210** (International Standards Organisation)

American Standards

- **Standard specification for protective headgear used in bicycling (F1447-93):** Standard developed by the American Society for Testing and Materials Committee on Standards (US Department of Health and Human Services, 1995).
- **1990 Standard for protective headgear for use in bicycling:** Standard developed by Snell Memorial Foundation (143).
- **American national standard for protective headgear - for bicyclists (ANSI Z90.4-1984):** Standard developed by the American National Standards Institute (143).

Bicycle child carrier seat

Australian Standards	• **Lightweight Protective Helmets (for use in pedal cycling, horse riding and other activities requiring similar protection), Part 1 - Basic Performance Requirements (AS2063.1-1990):** • **Lightweight Protective Helmets (for use in pedal cycling, horse riding and other activities requiring similar protection), Part 2 - Helmets for Pedal Cyclists (AS2063.2-1990), Amdt 1 August 1990, Amdt 2 April 1991):** The standard specifies performance requirements for energy impact attenuation, localised loading, and retention and ventilation. • **Victorian Cycle Helmet Act (July 1, 1990):** Implemented through the Road Safety Bicycle Helmets Regulations 1990, under the Road Safety Act of 1986. The regulation stipulates that all riders and passengers on-road or riding on the footpath, a bicycle path or a public park must wear a securely fitted approved bicycle helmet (12).
Aust/NZ Standards	• **Child carrier seats for pedal cycles - safety requirements (AS/NZ 4287:1995):** Specifies safety requirements for child carrier seats which may be attached to a bicycle other than a child's bicycle for the purpose of transporting as a passenger, a child having a body weight of not greater than 22kg.
European Standards	*German* • **Guidelines for the quality and installation of children's seats and foot rests on bicycles and bicycles with auxiliary motors with a design-bound speed of not more than 25 km/hr (mofa 25): FahrradKindersitzRL: 1980** (German Regulation)

Horseriding helmets

Australian Standards	• **Lightweight protective helmets (for use in pedal cycling, horseriding and other activities requiring similar protection) (AS 2063):** Helmets tested and approved as suitable for horse riding. Extensive testing for shock absorption, penetration resistance, vision clearance, strength/retention systems, and peak flexibility (Williams & Ashby, 1995). • **Helmets for horse riders (AS 2063.3-1988):** Specifies requirements for mass, retention systems, and peaks for helmets for horse riders that are additional to the basic performance requirements of AS 2063.1 • **Basic performance requirements (AS 2063.1-1986), Amdt 1Nov 1987, Amdt 2 May 1988:** Specifies performance requirements for impact attenuation, penetration resistance, strength of retention system and its attachment points and peripheral vision clearance for lightweight protective helmets intended to mitigate the adverse effects of a blow to the head. Marking requirements are also specified.

European Standards	*British* • **Specification for protective helmets for horse riders: 94/305144 DC: 1994** (British Draft) • **Specification for protective skull caps for jockeys: BS 4472: 1988** (British Standard) • **Specification for protective hats for horse and pony riders: BS 6473: 1984** (British Standard) *Dutch* • **Specification for protective helmets for horse riders: NEN-EN 1384 Ontw.:1994** (Dutch) *European* • **Specification for protective helmets for horse riders: prEN 1384: 1994** (European Draft) *German* • **Specification for protective helmets for horse riders; German version prEN 1384: 1994: DIN EN 1384: 1994** (European - adopted by Germany) • **Protective sports helmets; rider's helmets; safety requirements, testing: DIN 33951: 1988** (German)

Swimming pools and spas (pool fencing)

Australian Standards	• **Location of fencing for private swimming pools (AS 1926.2-1995):** Sets out options for the location of fencing that provides barriers in restricting the access to private swimming pools of young children. • **Swimming pool safety (AS 1926-1993)** • **Fencing for swimming pools (AS 1926.1-1993):** Specifies design, construction and performance requirements for child-resistant fences and gates intended primarily for use in preventing access to swimming pools by young children. The pool fence must be 1.2 metres high, have a self-closing/self-latching child-resistant gate, be resistant to climbing, have vertical members no more than 100mm apart, and horizontal members at least 900mm apart (105). • **Gate units for private swimming pools (AS 2820-1993)** • **Fences and gates for private swimming pools (AS 1926-1986)** • **Safety covers for private swimming pools and wading pools (for the protection of children 5 years of age and under) (AS 2020-1977):** Sets out performance tests to prove the child-resistance of covers designed primarily for use as a barrier against unsupervised access by young children to private swimming pools and wading pools. Tests are also included to ensure that the potential hazard of water pooling on the surface of the cover, either from rain or from the pool itself, has been eliminated. Instructions for installation and use of the cover, and warnings that must be given to the user are also specified.
New Zealand Standards	• **The Fencing of Swimming Pools Act 1987:** Installation of fences between 1.2 and 1.8 metres high to restrict pool access for children under 6 years. Includes the use of self-closing and self-latching gates. Legislation applies to new and existing pools (9 month enactment clause) unless the pool is emptied of water. Maximum penalty of $500 plus $50 for each day of non-compliance.
European Standards	• No Standard on pool fencing

Rollerskates

Australian Standards	• Nil

European Standards

Austrian

- **Helmets for users of skateboards and rollerskates: DENORM EN 1079: 1993** (Austrian)

British

- **Protective helmets for users of skateboards and roller skates (prEN 1079): 93/305618 DC: 1993** (British Draft)

European

- **Helmets for users of skateboards and roller skates: prEN 1079: 1993** (European Draft)

French

- **Protective helmets for skateboard and roller-skate users: NF S72-401: 1980** (French)

German

- **Helmets for users of skateboards and roller skates; German version prEN 1079: 1993: DIN EN 1079: 1993** (European - adopted by Germany)
- **Roller sport equipment; skates, technical requirements of safety and testing: DIN 7921: 1981** (German)

Skateboards

Australian Standards

- Nil

European Standards

Austrian

- **Helmets for users of skateboards and rollerskates: DENORM EN 1079: 1993** (Austrian)

British

- **Specifications for skateboards for recreational and sports use: BS 5715: 1993** (British Standard)
- **Protective helmets for users of skateboards and roller skates (prEN 1079): 93/305618 DC: 1993** (British Draft)

European

- **Helmets for users of skateboards and roller skates: prEN 1079: 1993** (European Draft)

French

- **Protective helmets for skateboard and roller-skate users: NF S72-401: 1980** (French)

German

- **Roller sport equipment - skateboarding facilities - Definitions, safety requirements, testing: DIN 33943: 1995** (German)
- **Helmets for users of skateboards and roller skates; German version prEN 1079: 1993: DIN EN 1079: 1993** (European - adopted by Germany)
- **Roller sport equipment; skates, technical requirements of safety and testing: DIN 7921: 1981** (German)
- **Roller sport equipment - skateboard (German) requirements and testing: DIN 7920: 1979** (German)

Rollerblades / in-line skates

Australian Standards

- Nil

European Standards

- Nil

Ice skating

Australian Standards

- Nil

European Standards

Czechoslovakian

- **Speed skating skates: CSN 94 0012: 1955** (Czechoslovakian)

Playgrounds - general

Australian Standards

- **Playgrounds - Guide to siting and to installation and maintenance of equipment (AS 2155-1982):** Lists aspects to be considered when siting a playground, and landscaping and planning the layout, and when organising a maintenance program. It recommends an inspection procedure to be followed during the course of installation of equipment and prior to its approval for use to ensure that the structure has been erected in accordance with the requirements of AS 1924, Parts 1 and 2. Recommendations for minimising potential hazards are made regarding the structural design, construction, installation, labelling and maintenance of playground equipment, movable playground equipment and exercise equipment (Goss, 1992).
- **Supervised adventure playgrounds - Guide to establishment and administration (AS 2555-1982):** Outlines recommended procedures for choosing a site for and establishing and operating a supervised adventure playground where children can develop their own patterns of play, learn to develop skills and use their creative talents. It also draws attention to potential hazards within such a playground and recommends ways in which these can be minimised.
- **Playground equipment for schools, parks and domestic use (AS 1924-1981): *(a) General requirements (AS 1924.1-1981):*** Specifies the minimum requirements for materials and protective coatings, labelling requirements and instructions for erection and maintenance. Information on painting methods is also included. ***(b) Design and construction-Safety aspects (incorporating Amdt 1) (AS 1924.2-1981):*** Includes loads and design criteria for structures, maximum heights of and safety requirements for safe access including handrails and guard railing, with additional requirements and recommendations related to static, swinging, rocking and rotating equipment. A method for testing for head entrapment points is included. The rationale for the head entrapment test and a guide to the design loads that might be expected are given in appendices.

New Zealand Standards

- **Standard Specification for Playgrounds and Playground Equipment (NZS 5828 - 1986):** Specifies that the equipment height should not exceed 6 metres, the fall height should not exceed a maximum of 2.5 metres (16), and that the incidence and severity of playground falls could be reduced through the provision of impact absorbing surface material (Chalmers, 1991).

European Standards

British

- **Methods of test for impact absorbing playground surfaces: BS 7188; 1989** (British Standard)
- **Play equipment intended for permanent installation outdoors. Methods of test: BS 5696: Part 1 1986** (British Standard)
- **Play equipment intended for permanent installation outdoors. Specification for construction and performance: BS 5696: Part 2: 1986** (British Standard)
- **Play equipment intended for permanent installation outdoors. Code of practice for installation and maintenance: BS 5696: Part 3 :1979** (British Standard)

European

- prEN 1176: European General Product Safety Directive covers regulations to provide safe playgrounds, but does not extend to safe layout, installation and maintenance (8). Minimal draft standard (prEN 1177) for surfacing material in

Europe is that concrete, bricks or comparable surfacing material are not allowed above a fall height of 60 cm (Beugels, 1994). *German*

- **Playground equipment, part 1: general safety requirements and test methods, German version, pr EN 1176-1: 1993: DIN EN 1176-1: 1994** (German)
- **Playground equipment, part 9, operation, German version pr EN 1176-9: 1993: DIN EN 1176-8: 1994** (European - adopted by Germany)
- **Playground surfacing, specification, requirements and test methods, German version prEN 1177: 1993: DIN EN 1177: 1994** (European - adopted by Germany)
- **Playground equipment for children, carousel, terms, safety requirements and testing: DIN 7926-5: 1992** (German)
- **Playground equipment for children, cable railways, dimensions, technical requirements of safety and testing: DIN 7926-4:1990** (German)
- **Playground equipment for children, concepts, safety requirements, testing, explanatory report: DIN 7926-1 Beiblatt 1: 1987** (German)
- **Playground equipment for children, concepts, safety requirements, testing: DIN 7926-1: 1985** (German)
- **Playground equipment for children, carousel, terms, safety requirements and testing: DIN 7926-5: 1984** (German)

Climbing apparatus & monkey bars

Australian Standards	• Nil
European Standards	• Nil

Slides

Australian Standards	• Nil
New Zealand Standards	• **(NZS 5828, Part 1: 1986, Section 105.5):** Building slides into embankments or mounds to reduce the fall height (Chalmers & Langley, 1988).
European Standards	*German* • **Playground equipment, slides terminology safety requirements and testing: DIN 7926-3: 1989** (German)

Swings

Australian Standards	• Nil
New Zealand Standards	• **(NZS 5828, Part 3: 1986, Section 3.3.3.):** Requires that swing seats should be designed for use by one child only. The seat should be "constructed by impact-absorbing materials, proportioned so that the leading edges and corners are relatively large in potential contact area, and light in mass" (Chalmers & Langley, 1990; 333). There should be adequate operating and circulating areas around the moving equipment (Chalmers & Langley, 1990).
European Standards	*German* • **Playground equipment for children, swings, technical requirements of safety and testing: DIN 7926-2: 1984** (German)

Seesaws

Australian Standards	• Nil
European Standards	• Nil

Trampolines & mini trampolines

Australian Standards	• Nil
New Zealand Standards	• **(NZS 5855:1993):** Consumer Safety Specifications for Components, Assembly and Use of a Trampoline based on a modified version of the American Standard (Chalmers, Hume & Wilson, 1994).
European Standards	*British* • **Gymnasium equipment. Particular requirements. Specification for trampolines, mini-trampolines and safety harnesses. (trampoline spotting rig): BS 1892: Part 2: Section 2. 8: 1986** (British Standard)
American Standards	• **(ASTM F381-84:** American Society for Testing and Materials (ASTM) voluntary standard (1974) relating to the components, assembly and safe use of trampolines. It specified that an information packet and suitable markings should be included at the point of sale. The information packet should include instructions about assembly, care and maintenance, use and necessary precautions. Standards relating to the suspension system, frame pads and shock-attenuating material are also included (Torg & Das, 1985).

5. Miscellaneous

Shopping trolleys

Australian Standards	• No Australian Standard for shopping trolleys • Voluntary Australian Standard (AS 3747-1989) for **Harnesses for use in prams, strollers, and high chairs (including detachable walking reign)** could apply
European Standards	• Nil

Ladders and stepladders

Australian Standards	• **Portable ladders-timber (AS 1892.2-1992):** Sets out the minimum requirements for the materials, design and construction of timber ladders rated for domestic or industrial use. It applies to single, extension, step and trestle ladders as well as to platforms step ladders and domestic extension step ladders. Methods for grading timber stiles and examples of labels that may be used to convey safety warnings are provided. • **Portable ladders-metal (AS 1892.1-1986), Amdt 1 Nov 1986:** Sets out requirements for ladders rated as domestic and industrial. It applies to single section, extension, step and trestle ladders, and to ladders representing a combination of these basic types. A full range of tests is included and an appendix includes examples of labels that may be used to convey safety warnings.
European Standards	*British* • **Specification for step stools: BS 7377: 1944** (British Standard) *German* • **Ladders; terms, types, functional sizes; German version EN 131-1: 1993: DIN EN 131-1: 1993** (European - adopted by Germany)

Footwear

Australian Standards	• Nil • Standards Australia is currently developing a standard relating to the selection of footwear for enhanced slip-resistance