MONASH University
Accident Research Centre

INJURIES ASSOCIATED WITH NURSERY FURNITURE AND BUNK BEDS

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October, 1997

Report No. 123

Funded by the Consumer Affairs Division of the
Commonwealth Department of Industry, Science and Tourism

MONASH UNIVERSITY ACCIDENT RESEARCH CENTRE
REPORT DOCUMENTATION PAGE

Report No.	Date	ISBN	Pages
123	October 1997	0 7326 0703 5	(xviii) 129 pp (+ App)

Title and sub-title:

Injuries Associated with Nursery Furniture and Bunk Beds

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Type of Report & Period Covered:

General

Sponsoring Organisation(s):

This project was funded through the Consumer Affairs Division of the Commonwealth Department of Industy, Science and Tourism.

Abstract:

This publication reports on research undertaken into the safety of nursery furniture to underpin a proposed injury reduction program for these products. It contains a review of recent Australian and international literature on nursery furniture and bunk bed safety providing an overview of the injury issues involved and a review of the relevant standards. Major sources of Australian and international data relevant to this area were identified and the available data summarised. An in-depth analysis of Victorian data was undertaken to identify the relevant nursery furniture products,, the nature and severity of injuries sustained and any patterns or trends including age profiles.

The major items of nursery furniture associated with injury, in the 0-4 year olds, in Australia are : prams, cots, high chairs, baby walkers, strollers, change tables and baby bouncers. Injury associated with nursery furniture is most likely to occur in the first year of life. Cots have the highest mortality with all identified deaths occurring as the result of asphyxia. In terms of non-fatal injury the picture is less clear with the incidence of injuries associated with different products varying between States. A comparison of hospital admission rates in Victoria for injuries related to the different products suggest that baby bouncers are associated with the most severe non-fatal injuries with almost one-third resulting in hospital admission. Falls were the most common cause of non-fatal injury in every product category with injuries to the face and head being the most prevalent. For at least four of the products (cots, prams, strollers and high chairs) about 6 percent of cases could be clearly identified as product failure (collapse, malfunction or entrapment hazard).

Victorian injury surveillance data shows that 86 percent of bunk-bed related injuries in the under fifteen age-group occur in children under the age of ten. While bunk-bed injuries peak in the 5-9 year age-group, they still account for similar numbers of injuries as individual nursery products in the 0-4 year age-group. No deaths related to bunk-beds could be identified in the available Australian data, however, information from the United States suggest that at least 38 children (mainly under 3 years) have died of asphyxia due to entrapment in the bunk structure, since 1990. The main cause of non-fatal injury is due to falls from the top bunk resulting in a fracture (33 percent), mainly to the upper extremity (75 percent).

On the basis of this research a number of recommendations have been made regarding product standards, injury data collection, research and evaluation and the dissemination of information. In particular, it is recommended that standards be developed for baby walkers, high chairs and change tables, that mandation of standards in Australia should occur when voluntary standards and the market place are ineffective in achieving compliance and evidence warrants it and that there is sufficient evidence and lack of compliance to mandate standards for household and portable cots.

Key Words: (IRRD except when marked*)

Accidental falls
Infant equipment
Bunk Beds
Wounds & Injuries: prevention & control
epidemiology

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ACKNOWLEDGEMENTS

The authors wish to acknowledge the generous contribution of Ian Scott from Kidsafe Australia in the preparation of this report. The timely provision of data by various agencies is also greatly appreciated. Thanks to Stan Bordeaux, NISU; Virginia Rourtley, VISS; Art MacDonald, NEISS (US CPSC); Fons Blankendaal, LIS (The Netherlands CSI); Elizabeth Freeman, QISPP and Anne Bowden, South Australian Health Commission. The assistance of Margaret Young and Christine Chesterman of MUARC is also gratefully acknowledged.

EXECUTIVE SUMMARY

Rationale

Certain items of nursery furniture have been identified as potentially hazardous to children under five years of age. Bunk beds have also been shown to pose risks to children under ten years. The Monash University Accident Research Centre (MUARC) was invited by the Consumer Affairs Division of the Department of Industry, Science and Tourism to provide information on the hazards associated with nursery furniture and bunk beds to underpin a proposal for an injury reduction program in this area.

Aim

To undertake research into the safety of nursery furniture and bunk beds to underpin a proposed injury reduction program for these products.

Specific objectives

1. Undertake a review of recent Australian and international literature on nursery furniture and bunk bed safety to :
   (a) identify the relevant nursery furniture products;
   (b) provide an overview of nursery furniture and bunk bed injury issues;
   (c) review nursery furniture standards
2. Identify the major data sources and provide, to the extent possible, a summary of data available in Australia and internationally.
3. Undertake data analysis, to the extent possible (given the limitations of available data), including : nature of injuries and possible product involvement;
   ranking of occurrence and severity of injury by product;
   and identification of patterns and trends including age profiles.

SUMMARY OF FINDINGS

Nursery furniture

An analysis of injury surveillance data revealed that the major nursery furniture products associated with injury in Australia are : prams, cots, high chairs, baby walkers, strollers, change tables and baby exercisers (bouncers). While injuries in the under five age-group peak at around one to two years of age, injuries associated with nursery furniture are most likely to occur in the first year of life.

It is estimated that, in Australia, at least 6,540 injuries associated with nursery furniture (and treated in hospital Emergency Departments or by general practitioners) occur annually in the under five age-group. Of these, it is estimated that at least 540 cases result in hospital admission. Over 3,500 of these cases are aged under one year and of these, at least 270 result in hospital admission.

The estimated injury rate of 508 per 100,000 population for all medically treated (Emergency Department and general practitioner treated) nursery furniture-related injuries in the under five age-group is not too dissimilar from the U.S. injury rate of 431 per 100,000 population which only applies to treatments in hospital Emergency Departments.

In terms of injury severity, cots have the highest mortality. Of the 13 nursery furniture-related deaths identified in Victoria between 1985 and 1994, 10 (over 75 percent) were associated with cots. This is consistent with U.S. figures which show that almost 70 percent of nursery furniture-related deaths, identified by the CPSC, were associated with cots. All but one of the deaths associated with cots in Victoria were due to asphyxia and involved entrapment hazards directly related to cot design or modification (6) or to the cot environment (2 accessed blind cords, 1 strangled on the elastic attached to a toy). The other death resulted from a fall from a cot, though the actual mechanism of death was again asphyxia, due to the child falling into a clothes basket and suffocating in the contents. Strollers, high chairs and change tables have also been implicated in at least one death each in Victoria since 1985.

In terms of non-fatal injury, the picture is less clear cut with the frequency of injuries associated with the different nursery products varying between States. Baby walkers, high chairs and strollers were the three nursery furniture products most frequently associated with injury nationally while prams, cots and high chairs were most prominent in Victoria. A comparison between the national (NISPP) and Victorian (VISS) data sets suggests that this difference does not reflect demographic variations between the two collections. Rather, it may suggest different patterns of usage or changes over time since the collections represent different time periods. For example, the fall in baby walker injuries recorded by VISS over the period 1989-93 appears to coincide with a strong intervention program in Victoria to discourage the use of baby walkers. The proportion of baby walker injuries recorded in the new VEMD collection in 1996 (ranked sixth compared to fourth in VISS) suggests that such injuries are still declining in relation to injuries associated with other nursery furniture products.

A comparison of hospital admission rates in the Victorian collection for the different products suggest that baby exercisers or bouncers are associated with the most severe non-fatal injuries with almost one in three injuries resulting in hospital admission. This is due to the fact that falls from bouncers are usually from a height when care-givers place the bouncer on an elevated surface such as a bench-top. These are followed by high chairs and strollers both of which have admission rates equal to, or higher than, the overall admission rate for children under 5 years of age.

Falls were the most common cause of non-fatal injury in every product category (65 percent overall) ranging from 43 percent in the case of baby bouncers to 77.5 percent in the case of change tables. Injuries to the head and face were most prevalent in all product categories accounting for 63.5 percent overall (and up to 82 percent for stroller-related injuries). Injuries to the upper extremities were next at 15.3 percent of injuries recorded (and up to 22.3 percent for cots). Bruising, inflammation and/or swelling was the most common type of injury (31.3 percent), followed by lacerations (16.1 percent), concussion (11.2 percent) and fractures (8.3 percent).

For at least four of the nursery furniture products (cots, prams, strollers and high chairs) a small percentage of product failure was indicated as causal. For this group of products about 6 percent of cases could be clearly identified as product failure (collapse, malfunction or entrapment hazard). High chairs had the greatest percentage of identified product failure (8 percent) due mainly to the tray falling off allowing the baby to fall out. Seven percent of cot injuries were attributed to failure on the part of the product, mainly entrapment hazards. The main problem identified for prams and strollers was collapse of the product resulting in it folding up on the

child. Almost half of identified malfunctions in prams involved the restraint breaking or coming undone.

Bunk beds

Injury surveillance data (VISS) shows that eighty-six percent of bunk bed-related injuries in children under fifteen years of age occur in children under ten years. While bunk bed injuries peak in the 5-9 year age-group, they still account for similar numbers of injuries as individual nursery furniture products in the 0-4 year age-group.

It is estimated that, in Australia, there are at least 3,850 injuries annually, in the under fifteen age-group, associated with bunk beds, that are treated by hospital Emergency Departments or by general practitioners. Of these, it is estimated that about 390 cases result in hospital admission. Almost half of all bunk bed injury cases occur (1900) in the 5-9 year age-group and, of these, at least 180 result in hospital admission.

No deaths associated with bunk beds have been identified in the Victorian data. However, the U.S. Consumer Product Safety Commission has identified 38 cases, since 1990, in which children (mainly aged under 3 years) have died of asphyxia due to entrapment in the bunk structure. Based on NEISS data, it was estimated that there were at least 17 bunk bed-related deaths in the U.S. in 1995.

The main cause of non-fatal injury associated with bunk beds is a fall from the top bunk (80 percent of cases). The most common activity associated with a fall is playing (32 percent of falls). Over half of these falls occur in the under five age-group (55 percent), with about 40 percent in the 5-9 age-group and only 4 percent in the 10-14 year age-group. Jumping from bunks (7 percent of all injury) as a cause of injury also decreases with age. After playing, sleeping is the next most common activity associated with falls. The pattern is somewhat different in this instance with the majority of injuries (64 percent) occurring in the 5-9 year age-group, 19 percent in the 10-14 year age-group and the remainder (17 percent) in the under fives. One would expect that the lower involvement of under fives is due to the fact that they are less likely to sleep in a bunk bed. However, the high proportion of 5-9 year olds falling from bunks while sleeping suggests that children of this age may not be ready to sleep in a top bunk.

Because only 5 percent of narratives specified the presence or absence of a safety rail, little can be inferred about the usefulness of these in preventing falls. In at least 10 cases (1.6 percent), the injury can be directly attributed to a failure of the product or its design. Nine of these cases involved a collapse of part of the bunk (7 safety rails, one ladder and one base) resulting in a fall. The other case involved entrapment of the child's arm in part of the bunk.

Of the five-year age-groups, the admission rate is highest for 10-14 year olds at 22 percent which is substantially higher than the overall admission rate for the age-group. While the admission rate for under fives is similar to the overall admission rate for the age-group, the admission rate for one-year olds is particularly high at 27.5 percent.

The most common non-fatal injuries associated with bunk beds are fractures (33 percent), three-quarters of which are upper extremity fractures. Bruising (21 percent) is the next most prevalent type of injury followed by lacerations (17 percent) and concussion (10 percent). These types of injury are most commonly associated with falls. Fractures and concussion result in the greatest number of hospitalisations (fractures accounting for 48 percent of admissions and concussion 20 percent). Injuries to the upper extremities are most common (38 percent) followed by injuries to the face (27 percent) and the head (13.5 percent).

RECOMMENDATIONS

General

1. Action should be taken by the Federal Bureau of Consumer Affairs and other responsible authorities to reduce deaths and injuries related to nursery furniture and bunk beds.

2. A general product safety directive should be adopted and enforced in Australia/New Zealand.

3. Safety guidelines for standardisation such as ISO/IEC Guides 50 and 51 should be actively promoted in Australia/New Zealand.

4. Where necessary to inform and monitor policy and action on product safety, research and evaluation studies should be commissioned.

5. Resources should be allocated, where required to meet the recommendations which follow.

Standardisation

6. Standards should be developed for baby walkers, high chairs and change tables. No Australian/New Zealand standards exist. These standards should be based on the best available international standards or draft standards.

7. Children's furniture safety standards should be reviewed and, if necessary, modified at least once every five years, to ensure that new requirements or revision of existing requirements occurs as new substantive information becomes available.

8. Compliance with voluntary nursery furniture and bunk bed standards should be actively improved by measures such as: seeking industry co-operation, public education by means of media and hot-lines and a policy of mandation if necessary.

9. As in the United States, mandation of standards should occur in Australia where voluntary standards and the marketplace are ineffective in achieving compliance and evidence warrants it.

10. There is currently sufficient evidence, at least in the case of household cots and portable cots to mandate standards. Both of these items are involved in deaths (at a rate of about 9 times that for other nursery furniture) and studies by the Australian Consumers' Association have repeatedly shown lack of compliance in the marketplace.

11. To avoid unacceptable "non-tariff" barriers to trade, Australia/New Zealand should focus initially on improving its safety requirements for nursery furniture in-line with other major importers of nursery equipment, particularly the United States.

Injury data collection

12. Hospital based injury surveillance should be implemented nationally to collect product-related injury data in sufficient detail and sufficient numbers to provide useful in-depth analyses and reliable secular trend data. It should contain sufficient cases by state to allow comparisons to identify best practice and effective interventions. There is potential for state support for options which would involve adequate numbers of cases to be collected to meet state needs.

13. Linkage of emergency department injury surveillance and hospital admission datasets should be undertaken to provide reasonably comprehensive information on moderate and severe injury cases (admissions).

14. The national coroners data and information system, currently under development, should identify products and their involvement in deaths.

Research and evaluation

15. Household surveys should be undertaken to collect additional information with regard to nursery furniture, bunk beds and possibly other products of interest. It is recommended that the surveys be undertaken collaboratively with other sectors or state departments interested in further exposure issues

16. Retail outlet observations of compliance of nursery furniture and bunk beds with Australian or overseas standards (where there are no Australian standards) should be conducted.

17. Studies should be undertaken to investigate second hand marketing. Compliance with standards, modifications to design, maintenance and general condition should be assessed.

18. In depth studies are required to conduct detailed tests of nursery furniture performance against test procedures, detailed in relevant standards, for current models in the market place.

19. A relative risk study should be undertaken for cots versus beds by age to determine the safest sleeping environment for children of different ages.

20. Follow-up case studies should be undertaken to determine whether child injuries associated with nursery furniture involve a range of factors which should be further investigated.

21. In depth investigations should be undertaken as coronial inquiries for all deaths involving nursery furniture.

22. Interventions should be evaluated:

    - The effectiveness of the letter sent to retailers by the former Minister for Consumer Affairs, regarding withdrawing baby walkers from sale could be investigated.
    - The effects of the introduction of new standards, and mandation of existing standards should be evaluated against injury data.

Dissemination of information

23. The findings of this report should be published in formats accessible to government, industry and other relevant professionals as journal articles on each of the major products and in Victorian Injury Surveillance System publications.

24. Point of sale information about the correct use of products and the associated hazards should be provided for parents and care-givers.

25. Community service TV advertisements should be produced to alert parents and care givers to nursery furniture risks at the time of implementing preventive measures such as mandatory standards or new voluntary standards.

1. INTRODUCTION

1.1 AIMS AND OBJECTIVES

1.1.1 Aim

Certain items of nursery furniture have been identified as potentially hazardous to children under five years of age. Bunk beds have also been shown to pose risks to children under ten years. The Monash University Accident Research Centre (MUARC) was invited by the Consumer Affairs Division of the Department of Industry, Science and Tourism to undertake research into the safety of nursery furniture and bunk beds to underpin a proposed injury reduction program for these products.

1.1.2 Objectives

1. To undertake a review of recent Australian and international literature on nursery furniture and bunk bed safety to:
    - identify the relevant nursery furniture products;
    - provide an overview of nursery furniture and bunk bed injury issues; and
    - review nursery furniture standards.
2. To identify the major data sources and provide, to the extent possible (given the constraints of time), a summary of data available in Australia and internationally.
3. To analyse available data to the extent possible (given the limitations of available data and time) to investigate:
    - the nature of injuries and possible product involvement;
    - ranking of occurrence and severity of injury by product; and
    - patterns and trends including age profiles.

1.2 METHOD

Requests for data relating to nursery furniture injuries were made to the Accident Compensation Commission (ACC) in New Zealand, the Consumer Product Safety Commission in the U.S. and the Dutch Injury Surveillance System (PORS/LIS) in The Netherlands. Data was also requested from the National Injury Surveillance System (NISU), the Queensland Injury Surveillance & Prevention Program (QISPP), the South Australian Health Commission and the New South Wales and Western Australian Health Department.

Data analysis was conducted using the relevant databases held at MUARC. Injury data from hospital emergency departments collected by the Victorian Injury Surveillance System (VISS) was the primary source of data for in-depth analysis with the new Victorian Emergency Minimum Dataset (VEMD) used for validation purposes.

Data from VISS, the VEMD and the Victorian Inpatient Minimum Dataset (VIMD) was used to establish the estimated number of injuries occurring annually in Victoria associated with nursery products. The injury rate was then derived from this figure which, when applied to Australian population figures, provides an estimate of the number of medically-treated injuries associated with these products Australia-wide. The data derived from Australian and international sources is presented in the following chapter.

Products that were identified as the major sources of nursery furniture-related injury have been researched and the information relating to each are presented in individual chapters thereafter. A

search of networked information services to identify Australian and international literature relating to injuries and safety related to these products was undertaken. Relevant journal articles, on-line information from the U.S. Consumer Product Safety Commission (CPSC), Choice articles, MUARC reports, articles from Hazard and other publications by relevant data collection systems were collected, reviewed and summarised. Australian and international standards relating to nursery furniture were collected and reviewed, particularly where no Australian/New Zealand standard exists. Data regarding injury issues and countermeasures derived from the literature and the standards are presented in this report as a reference table for each product.

The final chapter contains a summary of findings and recommendations that result from this research.

2. INJURY SURVEILLANCE SYSTEMS

2.1 U.S. CONSUMER PRODUCT SAFETY COMMISSION (CPSC)

2.1.1 National Injury Information Clearinghouse

In creating the CPSC in 1973, the U.S. Congress emphasised the importance of widespread sharing of information by the agency. The CPSC's National Injury Information Clearinghouse disseminates statistics and information relating to the prevention of injury and death associated with consumer products. It provides information from electronic data sources and distributes publications including hazard analyses, special studies and data summaries. Information specialists search agency data bases to provide tailored responses to individual requests from the consumer groups, manufacturers and industry associations, media, educators, researchers, attorneys and the general public.

2.1.2 Computerised Data Sources

The National Electronic Injury Surveillance System (NEISS)

NEISS collects injury data associated with 15,000 consumer products from hospital emergency departments across the United States. The system consists of a national probability sample of 100 hospitals that are statistically representative of hospital emergency rooms nationwide. CPSC is currently updating this sample, which ensures that NEISS data accurately reflects the numbers and types of injuries seen in hospital emergency departments.

Each sample hospital's ED records are reviewed daily by the on-site NEISS coordinator and, cases associated with consumer products are selected and the data entered onto computer. Each night, the central CPSC computer polls these hospital computers and updates CPSC's central database.

From the data collected, estimates can be made of the numbers of injuries associated with consumer products and treated in hospital emergency departments. Data is collected on a broad range of injury-related issues, covering hundreds of product categories, and provides national estimates of the number and severity of product-related injuries.

Whenever CPSC studies hazard patterns associated with specific types of injury in greater detail, the NEISS surveillance data serves as a source for in-depth follow-back studies (McDonald, 1996; Annest et al, 1996; CPSC, 1997a).

Death Certificate File

Death certificates where consumer products are involved are provided to the CPSC through state health departments. The CPSC provides summaries of these with victim information removed.

In-depth Investigations (IDNP) File

This file contains summaries of reports of investigations into the events surrounding product-related injuries or incidents. Based on victim/witness interviews, the reports provide details about incidence sequence, human behaviour and product involvement.

Injury/Potential Injury Incident File (IPII)

This file contains summaries, indexed by consumer product, of hotline reports, product-related newspaper accounts, reports from medical examiners and letters to CPSC (CPSC, 1997a).

2.1.3 Injury Data Publication

In 1996, CPSC introduced the *Consumer Product Safety Review.* Included is national injury data from NEISS hospitals, studies of emerging and continuing hazards, technical articles on injury/death topics and important recall and corrective action activities. (CPSC, 1997a)

2.1.4 Internet Services

The CPSC can be contacted via the Internet to get product recall information by gopher to : cpsc.gov or through its World Wide Web site at http://www.cpsc.gov. An internet e-mail subscription service for product recall and safety information is also available. Clearinghouse staff can be contacted to request information or report a product-related injury or incident by e-mail to : info@cpsc.gov. (CPSC, 1997a)

2.2 THE NETHERLANDS CONSUMER SAFETY INSTITUTE (CSI)

The Consumer Safety Institute (CSI) in Amsterdam was established in 1983 by the Dutch Ministry of Health and is a Government-sponsored body. The aim of the CSI is to reduce the number and severity of injuries due to home and leisure accidents in The Netherlands. Traffic and work-related injuries are excluded because they are the responsibility of other institutes in The Netherlands. The Institute works in close collaboration with the Department of Health, which is responsible for the general policy on safety and legislation on product safety and is also a WHO Collaborating Centre for Home and Leisure Accident Prevention.

The main activities of the Institute are :

- statistical and epidemiological research into injuries;
- technical studies to enable the drafting of safety standards for consumer products and
- educational and informational activities to increase awareness among risk groups.

2.2.1 PORS/LIS

The CSI operates an electronic injury surveillance system (LIS) similar to the NEISS sustem in the U.S. The LIS system collects data about all injury cases attending a representative sample of 15 hospitals throughout the country (approx. 135,000 injury cases annually). Data is coded into local data systems and transferred daily to the central computer where patient identifiers are removed and entries checked for completeness.

The LIS system replaced the previous Home and Leisure Accident Surveillance System (PORS) from January 1, 1997. The PORS system had been in operation since 1983 and was fully computerised in 1987/88 and only collected data about home and leisure injury cases.

Since the LIS system has not yet collected a full year of data, the information presented in this chapter from The Netherlands was provided from the PORS system.

2.3 AUSTRALIAN INJURY SURVEILLANCE SYSTEMS

2.3.1 Hospital Emergency Department Injury Surveillance Systems

Data was requested from all States of Australia except Tasmania (see Table 2:1). Only Victoria, South Australia and Queensland were are able to respond to requests for data at the level necessary to identify individual products. The National Injury Surveillance Unit (NISU) also provided historical data since the National Injury Surveillance & Prevention Project (NISPP) ceased collecting data in November, 1994.

While the New Children's Hospital in Sydney is able to supply some data in relation to children's injuries, the New South Wales Health Department is currently in the process of setting up an

injury surveillance system using the existing hospital data collection system (using HAS software). The Western Australian Health Department is already collecting injury data but the system is not yet set up to disseminate information.

Victoria currently has the largest injury surveillance system of any of the States. The Victorian Emergency Minimum Dataset (VEMD) began collecting data electronically from hospitals across Victoria in October, 1995. Hospitals have come onto the system over the past 18 months or so with 24 of the 25 intended hospitals now supplying data. To identify individual products in this system requires a text search of one-line case description narratives. Because of the newness of the system and the relatively small number of nursery product injuries identified, the reliance on the quality of the text description and the fact that 10 percent of cases (at January, 1997) did not record a text description, it was decided to only use the VEMD to validate the product rankings from the Victorian Injury Surveillance System (VISS).

The Victorian Injury Surveillance System is an historical paper-based collection which closed in mid-1996. The system allows identification of individual products via product codes as well as text search of the one-line case narratives. The system collected data from the Emergency Departments of four Melbourne metropolitan hospitals and a regional hospital in Gippsland at different times over an eight-year period. VISS holds approximately 170,000 cases, of which about 34,800 are in the 0-4 year age-group.

The National Injury Surveillance Unit collected data from the Emergency Departments of 50 hospitals nation-wide from 1986 to 1994 (some of which also provide data to State injury surveillance systems). Unlike the U.S. National Electronic Injury Surveillance System and the the Dutch Injury Surveillance system, the collection did not represent a probability sample of cases and cannot therefore be used to establish national estimates of injury associated with individual products. The system maintains information on approximately 700,000 injury cases of which almost 125,000 are in the 0-4 year age-group.

2.3.2 The Victorian Coroners Facilitation System

At present the only computerised systems in Australia that allow the identification of deaths resulting from incidents involving nursery furniture are injury surveillance systems and the Victorian Coroners Facilitation System (VCFS). Product involvement can be identified through coded breakdown factors or text searches. However, information about the circumstances of death are limited to one-line narratives. The VCFS allows identification of individual cases by case number so that researcher can track back to individual Coroner's case files for detailed information about the circumstances surrounding the injury death. It should be noted that cases are not included in the database until a Coroner's finding has been brought down. Therefore not all extant cases in a particular year may be identified.

In other states, product-related deaths may be identified through the injury surveillance system and followed up through the State Coroner's Office. However, not all deaths will be captured through this method given the relatively small samples that most State collections operate on. There is a movement towards establishing a national Coroners' database and information system.

Table 2:1 AVAILABILITY OF PRODUCT-RELATED DATA NATIONALLY

Data source	Contact	State	Hospitals	Dates	Comments
Research Centre for Injury Studies (Flinders University) (formerly NISU)	Stan Bordeaux	National	50 participating hospitals	1986 to Nov 1994	Not a probability sample of ED cases throughout Australia, therefore not representative of all injury cases in Australia. Computer software : ISIS 700,000 all age cases
Queensland Injury Surveillance Prevention Project (QISPP)	Elizabeth Freeman	Queensland	Mater Children's Hospital Logan Hospital Redland Hospitals Mater Private Care Centre QEII Acute Primary Care Centre	July 1994 -	Computer software : Injury-Ez
New Children's Hospital	Dr Ralph Hansen	New South Wales	New Children's Hospital		Computer software : HAS Data not yet available.
Epidemiology Branch, South Australian Health Commission	Anne Bowden	South Australia	Queen Elizabeth Hospital Adelaide Women's Hospital Children's Hospital	1994 -	Paper based collection
Western Australian Health Department	Guilietta Valuri	Western Australia	Princess Margaret Hospital Some rural collections	1 ½ years	Not yet set up for dissemination
Victorian Injury Surveillance System, Monash University Accident Research Centre	Virginia Routley Karen Ashby	Victoria	Royal Children's Hospital Western Hospital Preston & Northcote Community Hospital Royal Melbourne Hospital Latrobe Regional Hospital	1988-mid 1996.	Paper based collection Computer software : ISIS
			25 hospitals, statewide, all age	Oct 1995 -	Victorian Emergency Minimum Dataset (VEMD) Electronic collection.

3. NURSERY FURNITURE PRODUCTS DATA OVERVIEW

3.1 U.S. CONSUMER PRODUCT SAFETY COMMISSION DATA

3.1.1 Hospital Emergency Department Attendances

There were an estimated 86,100 children aged under 5 treated in U.S. hospital emergency rooms in 1995 for injuries associated with nursery products. The 1995 estimate is somewhat lower than estimates for the previous four years but the overall fluctuation in nursery product injury estimates is not statistically significant.

Most injuries appear to be relatively minor with about 2.7 percent of the victims requiring hospitalisation[1] compared to the overall NEISS hospitalisation rate in recent years of about 4 percent. About 80 percent (69,200) of the injuries were to the head area, reported as head, face, mouth, eye and ear. Of these head injuries, 43,100 (about 62 percent) were diagnosed as contusions and abrasions or lacerations.; about 20 percent were diagnosed as internal injuries,[2] and the few remaining victims with injuries to the head area were treated for dental injuries. Other body parts frequently injured were the upper and lower extremities with 6,500 and about 3,600 injuries respectively. The leading cause of injury was falls.

Estimated injuries associated with the following product categories had the largest number of hospital emergency room visits : baby walkers and jumpers (22,500), strollers and carriages (14,300), infant carriers and car seats[3] (13,200), cribs (10,500), and high chairs (7,300). These rankings are similar to those of the past several years, although the numbers have shown some fluctuation from year to year (CPSC, 1996a).

3.1.2 Average Annual Deaths : 1989-1993

CPSC's Death Certificate File for the years 1989 to 1993[4] had an annual average of about 64 deaths associated with nursery products, which is similar to the previous five-year annual average for 1988 to 1992. These deaths are not a statistical sample of known probability and do not include all nursery product-related deaths which may have occurred during the 1989-1993 period. They do, however, provide a minimum figure for average annual deaths associated with nursery products (CPSC, 1996a).

3.1.3 Summary

The following table (Table 3:1) provides a summary of nursery product-related injuries for 1995 and the average annual deaths for the period 1989-1993.

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1 The hospitalisation rate in the United States is much lower than in Australia suggesting a different pattern of hospital emergency department usage than in Australia.

2 Internal injuries reported include those cited as "head trauma", "closed head injury" or "blunt head injury".

3 Car seats are included in this estimate when it appeared that the injury was not related to the operation of a motor vehicle.

4 1993 is the latest year for which the death certificate file is complete.

Table 3:1 ESTIMATED NURSERY PRODUCT-RELATED INJURIES AND DEATHS TO CHILDREN UNDER AGE FIVE, 1995, U.S.A.

PRODUCT CATEGORY	ESTIMATED INJURIES (1995)[5]	AVERAGE ANNUAL DEATHS (1989-1993)
Baby walkers	22,300	0.2
Strollers & carriages (prams)	14,300	2.0
(strollers)	(13,214)	
(carriages)	(1,106)	
Carriers & car seats (excludes motor vehicle incidents)	13,200	5.0
Cribs (cots)	10,500	43.6
High chairs	7,300	3.0
(high chairs)	(6,359)	
(attachable high chairs)	(968)	
Changing tables	2,900	0.2
Playpens	1,800	4.8
Baby gates & enclosures	1,300	0.0
Other	11,500	5.6
TOTAL	**86,100**	**64.4**

Source : National Electronic Injury Surveillance System (NEISS), 1995; Death Certificate Files, 1989-93, U.S. Consumer Product Safety Commission.

3.2 THE NETHERLANDS CONSUMER SAFETY INSTITUTE (CSI) DATA

3.2.1 Hospital Emergency Department Attendances

The Dutch Injury Surveillance System provided all-age annual estimates for the years 1991-95 for selected nursery furniture products as well as the proportions of injuries in each age and gender group from their sample. Using this data an average annual estimate of the number of injuries associated with each product for children under 5 years was established. The estimated nursery furniture-related injury rate per 100,000 persons for this age-group was also established using mean population data supplied for the five year period.

There were an estimated annual average of 840 children treated in Dutch hospital Emergency departments between 1991-95. Cots were associated with the greatest number of injuries (271) in this age-group, followed by high chairs (85) then prams (62) (see Table 3:2).

[5] Column detail does not add to total since two or more nursery products are sometimes associated with a single injury. Also, those car seat injuries associated with motor vehicle incidents have been deleted.

Table 3:2 ESTIMATED ANNUAL AVERAGE NURSERY PRODUCT-RELATED INJURIES TO CHILDREN UNDER AGE FIVE, THE NETHERLANDS, 1991-1995, SELECTED PRODUCTS

PRODUCT CATEGORY	ESTIMATED ANNUAL AVERAGE (1991-95)			Injury Rate/ 100,000 population
	GENDER			
	Male	Female	TOTAL	
Cots	271	180	451	46.40
High chairs	85	84	169	17.38
Baby carriages (prams)	62	67	129	13.27
Strollers	31	26	57	5.86
Baby walkers	23	11	34	3.49
Changing table*	-	-	-	-
TOTAL	**472**	**368**	**840**	**30.01**

* Only one injury recorded in 5 years of data.

Note: The Dutch Injury Surveillance System does not have a category for 'baby bouncer' or 'baby exerciser'.

Source: Figures derived from data supplied by the Dutch Injury Surveillance System (PORS), 1991-95, Consumer Safety Institute, Amsterdam.

3.3 AUSTRALIAN INJURY SURVEILLANCE DATA

3.3.1 Hospital Emergency Department Attendances

An analysis of the VISS and VEMD databases revealed that the major nursery furniture products associated with injury in Victoria were : prams, cots, high chairs, baby walkers, strollers, change tables and baby exercisers (bouncers). The number of injury cases associated with each of the main nursery furniture products from each of the State injury surveillance systems and NISPP is presented in Appendix 1.[6] A comparison between the rankings of these nursery furniture products from the various State, national and international data sources is presented in Table 3:3. The variation in rankings may suggest different patterns of usage or changes over time (given the collections represent different time periods).

[6] In interpreting the data, it should be noted that when a product is mentioned in relation to an injury, it does not necessarily imply that the product caused the injury. This can only be established by referring to case narratives. However, these are not always clear in defining the nature of the relationship between the product and the injury. Unless otherwise stated, injury numbers presented here represent association rather than a causal relationship.

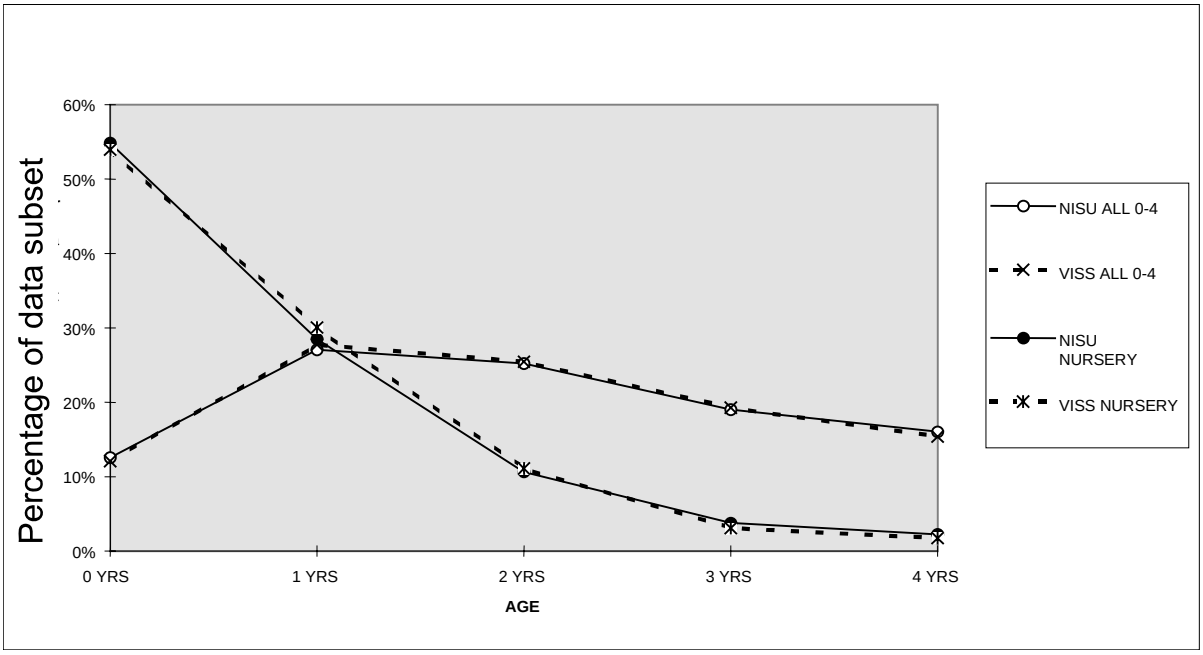
Table 3:3 COMPARISON OF SELECTED PRODUCT RANKING BETWEEN AUSTRALIAN AND INTERNATIONAL DATA SOURCES

RANK	AUSTRALIA	VICTORIA	VICTORIA	SOUTH AUSTRALIA	QUEENS-LAND	UNITED STATES	THE NETHER-LANDS
	NISPP (1986-94)	**VISS** (1988-96)	**VEMD** (1996)	(1994-)	**QISPP** (Jul 1994-Dec 96)	**NEISS** (1995)	**PORS** (1991-95)
1	Baby walkers	Prams	Prams	Prams	Baby walkers	Baby walkers	Cots
2	High chairs	Cots	Cots	Strollers	Change tables	Strollers	High chairs
3	Strollers	High chairs	Strollers	High chairs	High chairs	Cots	Prams
4	Prams	Baby walkers	High chairs	Change tables	Prams & strollers	High chairs	Strollers
5	Cots	Strollers	Change tables	Baby walkers	Cots	Change tables	Baby walkers
6	Change tables	Change tables	Baby walkers	Baby exercisers	Baby exercisers	Prams	Change tables
7	Baby exercisers	Baby exercisers	Baby exercisers	Cots			

Note : Baby exercisers or 'bouncers' are not a category of nursery product recognised by the Dutch Injury Surveillance System.

A comparison between the VISS and NISPP data was conducted to ensure that these variations did not reflect essential differences in the demography of the two collections. As can be seen in Figure 3:1, the distribution of cases by age, for both the under five age-group and all nursery furniture injuries in this age-group, is almost identical. The percentage of hospital admissions is also very similar in both the under 5 age group (NISPP = 18.32%; VISS = 18.89%) and in the nursery furniture injuries in this group (NISPP = 17.2%; VISS = 19.11%) reflecting similar injury severity levels. The very low admission rate for U.S. hospital Emergency Departments (3.1 percent for nursery furniture-related injury compared with around 19 percent in Victoria) suggests a different pattern of Emergency Department usage than that in Australia. It is important to note that the peak for nursery furniture-related injury occurs at age 0 (NISPP = 54.84%; VISS = 53.97%) compared to all 0-4 years injuries which peak at age 1 (NISPP = 27.09%; VISS = 27.78%). The United States has a much higher percentage of age 0 cases in their database, representing 68.8% of the under 5 age-group.

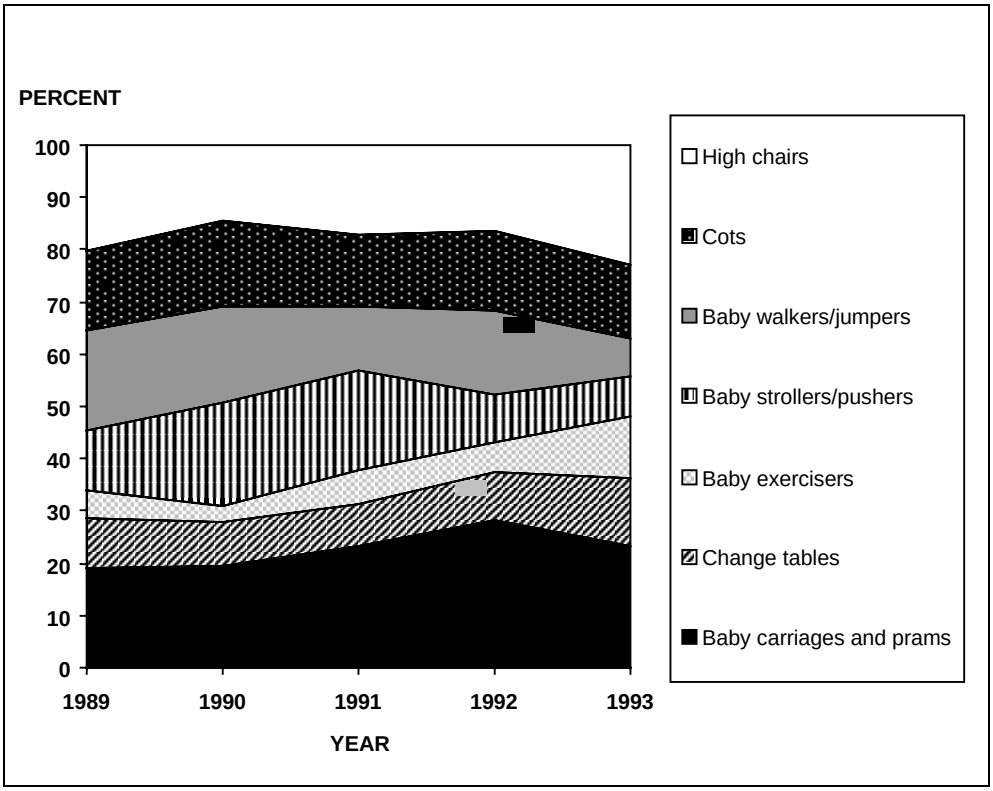
Figure 3:1 COMPARISON BETWEEN NISU & VISS DATA: ALL 0-4 YR AND NURSERY FURNITURE INJURIES



Source : Victorian Injury Surveillance System & the National Injury Surveillance & Prevention Project (NISU).

An analysis of data from three Melbourne metropolitan hospitals from which VISS collected data over a five-year period (1989-1993) indicates a change in the relative proportions of nursery furniture products associated with injury over that time (see Figure 3:2). In particular, the proportion of baby walkers has dropped from 18.97% of the total injuries associated with the products listed in 1989 to 7.14% in 1993. This downward trend began in 1991 and appears to have coincided with a strong intervention program in Victoria to discourage the use of baby walkers which resulted in Coles-Myer withdrawing the product from sale in 1992. Other major retailers followed in July 1995, when they agreed to a voluntary ban on the product. The intervention program used injury surveillance data to inform public and professional education and has attracted considerable media attention over this period.

Figure 3:2 NURSERY PRODUCT-RELATED INJURIES FROM 1989 TO 1993: MELBOURNE METROPOLITAN HOSPITALS, VISS



Source : Victorian Injury Surveillance System (1989 – 1993). Data from the Royal Children's Hospital, Preston & Northcote Community Hospital and the Western Hospital.

Australian nursery furniture-related injury rate estimate

Data from VISS, the VEMD and the Victorian Inpatient Minimum Dataset (VIMD) and the Extended Latrobe Valley Injury Surveillance (ELVIS) was used to establish the estimated number of injuries occurring annually in Victoria associated with nursery furniture products.

All unintentional injury cases in the 0-4 year age-group admitted to Victorian hospitals in 1993-94 through Emergency Departments was used as the basis for these calculations. By applying admission ratios derived from the VEMD the number of non-hospitalised Emergency Department presentations can be estimated. Using the ratio of Emergency Department to General Practitioner attendances derived from the ELVIS study, the number of non-hospitalised GP attendances can also be estimated to give the total number of non-hospitalised injury cases in this age-group. The percentage of nursery furniture injury admissions and presentations in the 0-4 age-group in the VISS database was than applied to the actual number of injury admissions (1993-94) and the estimated number of non-hospitalised cases to establish an estimate of the annual number of nursery furniture-related injuries.

The injury rate was then derived from this figure which, when applied to Australian population figures, provides an estimate of the number of medically-treated injuries associated with these products Australia-wide (see Table 3:4). It should be noted that the injury rate for Victoria is somewhat lower than other States so the estimate for Australia represents a minimum figure. Because of the variation in the proportion of products between the Victorian and the national data, no attempt has been made to estimate the injuries associated with individual products.

It was estimated that there is at least 6,540 injuries annually in the under five age-group associated with nursery furniture products that are treated in hospital Emergency Departments or by general practitioners. Of these, it is estimated that at least 540 cases result in hospital admission. Over

3,500 of all injury cases are aged under one year and of these, at least 270 result in hospital admission.

Given the apparent difference in hospital Emergency Department usage between Australia and the United States, the injury rate of 508 per 100,000 population for medically treated nursery furniture injuries is not too dissimilar from the U.S. rate of 431.3 per 100,000 population (CPSC, 1996b) which applies to treatments in hospital Emergency Departments only. However, the Dutch rate of 30.1 injuries per 100,000 population seems exceedingly low in comparison.

Table 3:4 ESTIMATED ANNUAL NUMBER OF INJURIES ASSOCIATED WITH NURSERY FURNITURE IN THE 0-4 YEARS AGE-GROUP, VICTORIA & AUSTRALIA (1993/94)

AGE	VICTORIA						AUSTRALIA		
	FREQUENCY			RATES			FREQUENCY		
	admissions	non-hospitalised	TOTAL	admissions	non-hospitalised	TOTAL	admissions	non-hospitalised	TOTAL
0	67	811	878	*105*	*1,275*	*1,380*	270	3,268	3,538
1	44	439	483	*68*	*688*	*756*	176	1,772	1,948
2	16	162	178	*25*	*255*	*280*	64	657	721
3	4	48	52	*7*	*75*	*82*	18	195	213
4	3	26	29	*5*	*41*	*46*	13	107	120
0-4 yrs	**134**	**1,486**	**1,620**	***42***	***466***	***508***	**541**	**5,999**	**6,540**

Sources : VIMD, VEMD, VISS, ELVIS.

Type and severity of injury

An examination of cases by severity of injury leads to a different ranking of products to that based on frequency of injury. Baby exercisers or bouncers, high chairs and strollers all had admission rates equal to, or higher than, that of the under 5 age-group in general (see Table 3:5).

The most common injuries associated with nursery furniture products in the 0-4 year age-group were bruising, inflammation and swelling (31.3%), followed by lacerations (16.1%) and concussion (11.2%) (see Table 3:6). Given the prominence of concussion among nursery furniture injuries, it is not surprising that injuries to the head and face represent the highest percentage of injuries in this group (63.5% in total). This reflects the fact that babies an toddlers are 'top heavy' and the majority of nursery furniture injuries result from falls. Injuries to the upper limbs are also prominent at 15.3% of all injuries associated with nursery furniture (see Table 3:7).

Table 3:5 PERCENTAGE OF CASES ADMITTED BY NURSERY PRODUCT INVOLVED

Product	% Admitted
Bouncers	32.5%
High chairs	21.6%
Strollers	18.9%
All injuries	**18.9%**
(0-4 yrs)	
Cots	17.1%
Change tables	17.1%
Prams	15.4%
Baby walkers	13.2%

Source : VISS (1988-96)

Table 3:6 NURSERY FURNITURE PRODUCT BY NATURE OF INJURY

Nature of Injury	Prams	High chairs	Cots	Baby walkers	Strollers	Change tables	Bouncers	TOTAL	% of total injuries
bruising/inflammation/ oedema/haemorrhage	119	82	56	75	58	38	26	**454**	**31.3**
cuts/lacerations/ amputations	52	34	43	39	50	12	4	**234**	**16.1**
concussion	36	39	21	19	14	18	16	**163**	**11.2**
fracture	19	21	41	6	12	14	8	**121**	**8.3**
superficial abrasions	27	9	6	20	25	4	6	**97**	**6.7**
burns	7	11	9	42	14	0	3	**86**	**5.9**
poisoning	4	7	22	7	1	2	2	**45**	**3.1**
sprain/strain	11	0	11	4	7	3	2	**38**	**2.6**
crushing	4	4	3	6	4	1	0	**22**	**1.5**
dislocation	5	2	9	0	2	1	1	**20**	**1.4**
foreign body	2	0	7	0	2	2	2	**15**	**1.0**
dental	5	1	3	2	3	0	0	**14**	**1.0**
bites/punctures	2	0	5	1	1	2	1	**12**	**0.8**
asphyxiation	0	1	1	0	0	0	1	**3**	**0.2**
unspecified/no injury	21	22	32	13	6	18	16	**128**	**8.8**
TOTAL	**314**	**233**	**269**	**234**	**199**	**115**	**88**	**1452**	**99.9***

*Due to rounding error

(No. of injuries, up to 3 recorded for each case)

Source : VISS (1988-96)

Table 3:7 NURSERY FURNITURE PRODUCT BY BODY PART INJURED

Body part	Prams	High chairs	Cots	Baby walkers	Strollers	Change tables	Bouncers	TOTAL	% of total injuries
Face	155	89	74	126	108	34	28	**614**	**42.3**
Head	76	70	35	28	35	36	28	**308**	**21.2**
Upper Extremities	43	29	60	42	30	12	6	**222**	**15.3**
Lower Extremities	10	8	29	8	15	7	3	**80**	**5.5**
Poisoning	4	7	22	7	1	2	2	**45**	**3.1**
Trunk	2	5	9	10	3	4	2	**35**	**2.4**
Internal Organs	1	2	4	0	1	1	2	**11**	**0.7**
Neck	2	1	2	1	0	1	0	**7**	**0.5**
Asphyxiation	0	1	1	0	0	0	1	**3**	**0.3**
No injury detected/specified	21	22	32	12	6	18	16	**127**	**8.7**
TOTAL	**314**	**233**	**269**	**234**	**199**	**115**	**88**	**1452**	**100.0**

(No. of injuries, up to 3 recorded for each case)

Source : VISS (1988-96)

3.3.2 Death data

A search of the Victorian Coroner's Facilitation System covering the years 1989-1994 revealed that, of the 230 injury deaths recorded during this period in children aged under five years in Victoria, four were related to nursery furniture. All were the result of asphyxia or suffocation in a cot and represent almost 25 percent of suffocation or asphyxia deaths in this age-group. The following narratives were extracted from the database and briefly describe the circumstances surrounding each incident :

1. The deceased (a seven month old baby) whilst in his cot, was caught between the base of the cot and side, with head between bars. Died of asphyxia due to chest compression. (male, 7 months)

2. Died from suffocation when his head was caught between metal bars of cot and mattress. (male, 4 years)

3. Deceased was playing in the cot with his brothers and caught his head on the bed end causing asphyxiation. (male, 1 year)

4. Deceased became entangled in the curtain draw string whilst standing in his cot and accidentally strangled himself. (male, 1 year)

Additional data supplied by the Victorian Consultative Council on Obstetric and Paediatric Mortality and Morbidity (Ozanne-Smith & Heffernan, 1990) for 1985 to 1988 (inclusive), indicate a total of 9 unintentional injury deaths associated with nursery furniture in that period. Six of these were associated with cots and their environs. Of these, one child fell from the cot and suffocated in the clothes basket into which it fell, three strangled as a result of the cot design or modification, including one whose clothing was caught on a wing nut. Another two children strangled, one as a result of accessing a blind cord and the other through access to elastic attached to a toy. One death was associated with a stroller, one with a changing table and the other with a high chair.

Although there may be some overlap between the Victorian data and that held by NISU, an examination of the narratives in the ten cases of death associated with nursery furniture in the NISPP database, for the period 1986 to 1994, revealed that six were directly related to the nursery furniture involved. Three involved cots, two pushers and one a high chair. The narratives are as follows :

1. Sleeping in hospital cot. Tonsillitis. Slipped between edge of cot, base. Suffocated. (male, 10 months)

2. Nap. Strangled by bead necklace hanging 20 cm away on wardrobe door. In cot. (male, 15 months)

3. Playing in cot. Slipped through gap between side rails and cot base. Head caught. (male, 8 months)

4. Undid herself from pusher, fell into bore hole 4" gap, drowned. (female, 29 months)

5. Sitting in pusher, stood up, fell head first on driveway, landed on concrete. (male, 6 months)

6. Fell from high chair onto slate floor. Not strapped in. (female, 32 months)

The relatively high injury mortality associated with cots is consistent with overseas reports (de Graaf, 1987; see also Table 3:1 for U.S. estimates) and further emphasises cot-related injuries as an important target for injury prevention.

3.4 INDIVIDUAL NURSERY PRODUCT DATA

Detailed examination of injuries in the VISS database associated with each of the nursery furniture products identified as priority safety problems are discussed below.

3.4.1 Cots

There were 252 cases of injury associated with cots recorded in the VISS database from 1988 to 1996 in the under 5 years age-group. Of these, 54 percent were male and 46 percent were female. The majority of cases were aged under two years of age (76 percent), with most of these aged one year (42 percent of 0-4 year olds).

The main cause of injury associated with cots was due to the child falling out (almost 47 percent of cases). There were at least 18 cases (over 7 percent) identified in the one-line narratives which indicated that a failure of the product or its design was the direct cause of injury to the child. These included 14 cases of entrapment. In at least one of the falls cases, the injury was due to a failure on the part of the cot (the side fell down when shaken by the child). There were also two cases in which the cot collapsed (including one porta-cot) and one in which a screw was accessible to, and subsequently swallowed by, a child (see Table 3:8).

Further research is necessary to determine the role of cot design in children getting out of cots and either falling or, accessing and, ingesting dangerous substances. While bruising and inflammation were the most common injuries (21 percent) followed by cuts, lacerations and amputations (16 percent), fractures (15 percent) and concussion (8 percent), poisoning was also prominent at 8 percent. The most commonly injured part of the body was the head and face accounting for 40 percent of all recorded injuries, followed by the upper extremities (22 percent). About seventeen percent of injuries associated with cots, attending a Victorian hospital Emergency Department, were admitted.

While there was only one case of near-asphyxia recorded in the VISS database it should be noted that all cases of death associated with cots noted in the previous section resulted from either suffocation or strangulation due to some form of entrapment. Furthermore, data from the United States (see Table 3:1) suggests that cots are associated with nine times as many deaths as any other single nursery furniture product.

Table 3:8 COTS - CAUSE OF INJURY

Cause of cot-related injury~	**n**	**%**
Fell out of cot (whilst climbing out/standing/jumping/ sleeping/playing)*	118	46.8
Caught body part in cot (finger/arm/leg/foot/penis/body)#	14	5.6
Fell whilst in the cot and hit body part	14	5.6
Reached out of cot/got out of cot, and accessed medication/buttons/pins/hot water/etc.	13	5.2
Bottom fell out of cot	1	0.4
Swallowed screw from cot	1	0.4
Porta cot folded up	1	0.4
Other**	90	35.7
TOTAL	**252**	**100.1##**

~ Includes 10 cases involving portable cots.

* Includes one case where the side of the cot fell down when the cot was shaken

Either caught in between rails, between mattress and rail, or caught in hinges, catches and joints.

** Includes: hitting body parts whilst in the cot; swallowing substances whilst in cot; playing outside the cot, falling and hitting it; dropped whilst being taken out of the cot; falling whilst climbing into the cot.

Due to rounding error

3.4.2 Prams

There were 285 cases of injury associated with prams recorded in the VISS database. Of these, 63 percent were male and 37 percent were female. The majority of cases (55 percent) were aged under one year.

The most common cause of injury was falls (74 percent). Of these cases, about 23 percent were due to the pram tipping over or rolling off stairs or verandahs. Almost 11 percent of all injuries were due the pram tipping over suggesting possible problems with stability. About 4 percent of cases involved part of the child's body being caught in the pram suggesting entrapment problems. Overall, about 6 percent of narratives identified a failure on the part of the product as the reason for the injury incident (see Table 3:9).

The most common injuries associated with prams were bruises and inflammation (38 percent), followed by cuts and lacerations (17 percent) then concussion (11.5 percent). Seventy four percent of all injuries sustained were to the head face and head with a further 14 percent affecting the upper limbs. Just over 15 percent of all injuries associated with prams resulted in hospitalisation.

Table 3:9 PRAMS - CAUSE OF INJURY

Cause of pram-related injury	n	%
Fell out of pram or backwards or forwards in pram	211	74.0
Pram tipped over/fell backwards or forwards	*(31)*	*(10.9)*
Pram rolled (including rolling downstairs/ off porches)	*(18)*	*(6.3)*
Buckle/strap/bar broke / jammed/came undone	*(7)*	*(2.5)*
Pram collapsed/disassembled/base dislodged going down stairs	*(6)*	*(2.1)*
Pram broke	*(1)*	*(0.4)*
Body part caught in pram	11	3.9
Pram collapsed/folded up, crushing finger in frame	*(2)*	*(0.7)*
Closed pram on arm while altering position	*(1)*	*(0.4)*
Child in pram hit by car	4	1.4
Other*	59	20.7
TOTAL	**285**	**100.0**

* Includes climbing into pram and falling; falling and hitting body part on pram; sunburn whilst in pram.

3.4.3 Strollers

There were 175 cases of injuries associated with stroller identified in the VISS database. Of these 48 percent were male and 52 percent were female. Seventy-six percent of cases were children aged under two years of age..

Again, the most common cause of injury was falls (63 percent of cases). Almost five percent of cases involved the stroller tipping over suggesting problems of stability and about seven percent of cases involved entrapment of a body part in the stroller. In at least four percent of cases, the cause of injury was attributed to a failure (eg. collapse) on the part of the stroller (see Table 3:10).

The most common injuries associated with strollers were bruises and inflammation (29 percent) and cuts and lacerations (25 percent). Seven percent of cases sustained concussion. Eighty-two percent of injuries sustained were to the face and head with a further 17 percent affecting the upper limbs. Nearly 19 percent of cases presenting to hospital Emergency departments required hospitalisation.

Table 3:10 STROLLERS - CAUSE OF INJURY

Cause of stroller/pusher-related injury	n	%
Fell out of stroller or stroller tipped over	111	63.4
Stroller rolled (including rolling down stairs/off porches)	*(9)*	*(5.1)*
Stroller tipped over/fell backwards or forwards	*(8)*	*(4.6)*
Seat not connected properly	*(1)*	*(0.6)*
Stroller collapsed going down stairs	*(1)*	*(0.6)*
Body part caught in stroller	12	6.9
Stroller collapsed/folded up, crushing finger in frame	*(5)*	*(2.9)*
Closed stroller on arm while locking arms of pusher	*(1)*	*(0.6)*
Child in stroller hit by car	7	4.0
Other*	45	25.7
TOTAL	**175**	**100.0**

* Includes climbing into stroller/pusher and falling; falling and hitting body part on stroller/pusher; sunburn whilst in pusher.

3.4.4 Baby Walkers

There were 205 cases of injury to children aged under 5 years associated with baby walkers in the VISS database. Of these, 54 percent were males and 46 percent were females. The great majority of cases involved children under one year of age (almost 85 percent).

An analysis of the narratives recorded for each case indicated that the majority of injuries to children occur when they move into dangerous situations in the walker (see Table 3:11). Almost 67 percent of all injuries associated with baby walkers were due to falls. Fifty-seven percent of these, recorded a fall down stairs or off a verandah. Another 19 percent of fall injuries occurred when the walker tipped over raising issues about the stability of the product even on flat surfaces. In a further 19 percent of all cases the child in the walker was in a variety of dangerous positions including accessing hot appliances or liquids, resulting in burns or scalds, or ingesting a dangerous substance.

Table 3:11 BABY WALKERS - CAUSE OF INJURY

Cause of baby walker-related injury	**n**	**%**
Fell*	137	66.8
Fell down steps/off verandah	*(78)*	*(38.0)*
Baby walker tipped over - inc. 8 cases where walker caught on rug/carpet/object on floor	*(26)*	*(12.7)*
Accessed hot liquid/heater/oven whilst in baby walker	31	15.1
Caught fingers in door	11	5.4
Ingested poison, cleaning powder etc	8	3.9
Pulled or knocked item onto self	8	3.9
Other	10	4.9
TOTAL	**205**	**100.0**

* Some falls were caused by the baby in the walker going through a front door, falling out of doorways (etc), but no mention of steps was made.

While bruising and inflammation were again the most common injuries sustained (32 percent), eighteen percent of injuries were burns or scalds, sixteen percent cuts and lacerations and eight percent concussion. Sixty-six percent of all injuries occurred to the face and head with a further 18 percent to the upper extremities. The admission rate for injuries associated with baby walker is lower than that for all under fives (18.9 percent) with just over 13 percent of baby walker injuries resulted in hospital admission.

3.4.5 High chairs

There were 212 cases of injury in children under five years associated with high chairs in the VISS database. Of these, 55 percent were male and 45 percent female. Seventy-nine percent of cases were aged under two years with just over half of these aged less than one year.

The main cause of injury is falls accounting for over 76 percent of all injuries associated with high chairs. A further 6 percent of cases involved children accessing hot or dangerous substances from the high chair. Of the four cases of entrapment recorded, three involved fingers being caught in part of the chair while the other involved a child sliding under the tray being caught and almost asphyxiating. In 8 percent of cases, the narrative attributed the incident to a failure on the part of the product (see Table 3:12).

The most common injuries sustained were bruising and inflammation (35 percent), followed by concussion (17 percent), cuts and lacerations (16 percent) and fractures (9 percent). The face and head sustained the most injuries (68 percent) followed by the upper extremities (12 percent). Almost 22 percent of injuries associated with high chairs presenting at hospital Emergency Departments were admitted (about 3% above the average for the 0-4 age-group).

Table 3:12 HIGH CHAIRS - CAUSE OF INJURY

Cause of high chair-related injury	**n**	**%**
Fell out of high chair*	162	76.4
Front tray fell off/came undone/ collapsed/pushed off	*(12)*	*(5.7)*
Chair wasn't put together properly	*(1)*	*(0.5)*
Accessed hot liquid/medication etc whilst sitting in/climbing up on high chair	12	5.7
Body part caught in high chair**	4	1.9
Strap holding base of high chair gave way	1	0.5
Attachable high chair came off when child wriggled	1	0.5
High chair tipped over	1	0.5
Other#	31	14.6
TOTAL	**212**	**100.1+**

* Includes cases where child stood up, climbed out or jumped out.

** Includes three cases of fingers being caught in high chairs, and one case where the child slid under the tray, got stuck and stopped breathing.

Includes cases where children playing near high chairs knocked themselves on the chair, and children trying to climb up on high chairs pulled the chair onto themselves.

+ Due to rounding error.

3.4.6 Baby exercisers (bouncers)

The VISS database recorded 83 cases of injury associated with baby bouncers in the period 1986-1994. Of these, 54 percent were male and 46 percent female. Over 90 percent of cases were aged under one year.

Most injuries were caused when babies fell from the bouncer (43 percent). However, most of these falls (75 percent) occurred from a height as the bouncer had been placed on a bench-top, table or similar. In a further 5 percent of cases, the baby fell while being carried in the bouncer. Another 17 percent of injuries occurred when the bouncer was on the floor and a person or object fell onto the baby (see Table 3:13).

The main injury sustained was bruising (30 percent) followed by concussion (18 percent) and fractures (9 percent). Sixty-four percent of injuries occurred to the face and head. The percentage of admissions for injuries associated with baby bouncers is particularly high at 32.5 percent, about 1.7 times the admission rate for the under 5 age-group.

Table 3:13 BABY EXERCISERS - CAUSE OF INJURY

Cause of baby exerciser-related injury	n	%
Fell/slipped out of bouncinette	36	43.4
Fell from bouncinette placed on table/bench, etc	*(27)*	*(32.5)*
Object/person fell onto/tripped over baby in bouncinette	14	16.9
Fell from bouncinette whilst being carried in it	4	4.8
Bouncinette tipped over (whilst at floor level)	1	1.2
Caught toe in baby exerciser	1	1.2
Design problem (press studs opened, and child fell out onto floor)	1	1.2
Other*	26	31.3
TOTAL	**83**	**100.0**

* Includes children tripping over bouncinettes or ingesting objects/poisons whilst in bouncinette.

3.4.7 Change tables

There were 111 cases of injury to children under five years of age associated with change tables in the VISS database. Fifty-two percent of these were female and 48 percent male. The majority of injuries occurred to children under the age of one year (68 percent) and were due to falls (77.5 percent) when the baby rolled off the table onto the floor or onto another piece of furniture (see Table 3:14). Again, the most common injury was bruising (33 percent), followed by concussion (16 percent) and fractures (12 percent). Over sixty percent of injuries were to the head and face and 17 percent of injuries associated with change tables resulted in hospitalisation.

Table 3:14 CHANGE TABLES - CAUSE OF INJURY

Cause of change table-related injury	n	%
Fell off change table*	86	77.5
Sibling pulled child off change table	2	1.8
Body part caught between legs of table	2	1.8
Playing under change table, got steel spring from table in eyes	1	0.9
Climbed on change table to reach medicine	1	0.9
Other**	19	17.1
TOTAL	**111**	**100.0**

* Includes one case where a baby was having his nappy changed in a plane during take off.

** Other includes cases where children were playing near change tables and fell, hitting a body part on the table.

3.5 BUNK BED INJURY SURVEILLANCE DATA

3.5.1 U.S. Consumer product safety commission

Hospital Emergency Room Attendances

There were an estimated 34,400 children aged under fifteen treated in U.S. hospital emergency departments for injuries associated with bunk beds in 1995. Almost 90 percent of injuries were sustained by children aged under ten years, with almost 50 percent of all injuries in the 5-9 year age-group. Bunk beds also account for more injuries in the under 5 age-group than do most nursery furniture products being exceeded only by baby walkers in the estimated number of injuries in 1995 (see Table 3:1).

Table 3:15 BUNK BED INJURIES, AGES 0-14, U.S. NATIONAL ESTIMATES, 1995. AGE BY GENDER

	GENDER		
AGE	**Male**	**Female**	**TOTAL**
0-4	7,739	6,214	13,953
5-9	9,606	7,357	16,963
10-14	1,936	1,576	3,512
TOTAL	**19,282**	**15,147**	**34,428**

Source : NEISS, U.S. CPSC.

Most injuries appear to be relatively minor with about 3.1 percent of injuries requiring hospitalisation. However, it is estimated that there were at least 17 deaths associated with bunk beds in the U.S. in 1995. All were children under the age of five. The majority of injuries, about 54 percent, were to the head area (18,600). Of these head injuries, 13,150 (about 71 percent) were diagnosed as contusions and abrasions or lacerations and almost 20 percent were diagnosed as internal injuries or concussion. Other areas of the body frequently injured were the upper and lower extremities with 7,500 and 4,200 injuries respectively. The leading cause of injury was falls.

Table 3:16 BUNK BED INJURIES, AGES 0-14, U.S. NATIONAL ESTIMATES, 1995. AGE BY DISPOSITION

	DISPOSITION				
AGE	**Treated/ released**	**Hospitalised/ transferred**	**D.O.A.**	**Unknown**	**TOTAL**
0-4	13,558	378	17	0	13,953
5-9	16,380	547	0	36	16,963
10-14	3,351	129	0	32	3,512
TOTAL	33,289	1,054	17	68	34,428

Source : NEISS, U.S. CPSC.

3.5.2 The Dutch injury surveillance system

Estimates derived from figures provided by the Dutch Injury Surveillance System suggest an average of some 623 injuries associated with bunk beds annually (1991-95). About 82 percent are sustained by children under the age of ten years with almost equal numbers in the 0-4 years and 5-9 years age-groups. It is interesting to note that the injury rate associated with bunk beds for children under five years is higher than for most nursery furniture products except for cots (see Table 3:2).

Table 3:17 BUNK BED INJURIES, THE NETHERLANDS, AVERAGE ANNUAL ESTIMATE, 1991-1995. AGE BY GENDER WITH INJURY RATES

	GENDER			Injury Rate/
AGE	Male	Female	TOTAL	100,000 population
0-4	154	97	251	25.82
5-9	163	98	261	28.28
10-14	66	45	111	12.27
TOTAL	**383**	**240**	**623**	**22.50**

Source : Figures derived from data supplied by the Dutch Injury Surveillance System (PORS), 1991-95, Consumer Safety Institute.

3.5.3 Australian data

Australian bunk bed-related injury rate estimate

Using the same method as described in the nursery furniture data section, an annual estimate of the frequency and rate of bunk bed injuries in Victoria and Australia was established for each five-year age-group up to 14 years.

It was estimated that there are at least 3,850 injuries annually in the under fifteen age-group associated with bunk beds that are treated in hospital Emergency Departments or by general practitioners (see Table 3:18). Of these, it is estimated that almost 390 cases result in hospital admission. Almost half of all bunk bed injury cases (over 1900) are in the 5-9 year age-group and of these, at least 180 result in hospital admission.

It should be noted that while bunk bed injuries peak in the 5-9 year age-group, they still account for a similar number of injuries as individual nursery furniture products in the 0-4 year age-group. From 1986 to 1994, VISS recorded 265 injuries associated with bunk beds in this age-group compared to 285 injuries associated with prams and 252 injuries associated with cots.

Of the 624 injuries associated with bunk beds in children under fifteen recorded in the VISS database, 364 (58 percent) were male and 260 (42 percent) were female. Eighty-six percent of injuries occurred in children under ten years with just over half of these being in the 5-9 year age-group.

Table 3:18 ESTIMATED ANNUAL NUMBER OF INJURIES ASSOCIATED WITH BUNK BEDS IN THE 0-14 YEARS AGE-GROUP, VICTORIA & AUSTRALIA (1993/94)

AGE	VICTORIA						AUSTRALIA		
	FREQUENCY			RATES/100,000 pop			FREQUENCY		
	admissions	non-hospitalised	TOTAL	admissions	non-hospitalised	TOTAL	admissions	non-hospitalised	TOTAL
0-4	29	302	331	*9*	*95*	*104*	116	1,224	1,340
5-9	45	420	465	*14*	*135*	*149*	183	1,726	1,909
10-14	21	125	146	*7*	*40*	*47*	88	517	605
0-14 yrs	**95**	**847**	**942**	***10***	***90***	***100***	**387**	**3,467**	**3,854**

Sources : VIMD, VEMD, VISS, ELVIS

Cause of injury

The main cause of injury associated with bunk beds is falls (see Table 3:19). Over 80 percent of all injuries were the result of a fall from the top bunk. In these cases, the most common activity associated with a fall is playing (32 percent of falls). Over half the falls associated with playing (55 percent) occur in the under five age-group, with about 40 percent in the 5-9 age-group then decreasing dramatically to around 4 percent in the 10-14 year-old group. Jumping from bunks as a cause of injury also decreases with age. The next most common activity associated with a fall from a bunk is sleeping (24 percent). About 64 percent of injuries due to falling off the bunk while sleeping occur in the 5-9 year-old age-group, 19 percent in the 10-14 year old group and 17 percent in the under five age-group. One would expect that the lower involvement of under fives is due to that fact that they are less likely to sleep in a bunk bed. However, the high number of 5-9 year-olds falling from bunks while sleeping (28 percent of all bunk bed injuries in this age-group) suggests that children of this age may not yet be ready to sleep in a top bunk.

For at least four of the nursery furniture products (cots, prams, strollers and high chairs) a small percentage of product failure was indicated as causal. For this group of products about 6 percent of cases could be clearly identified as product failure (collapse, malfunction or entrapment hazard). High chairs had the greatest percentage of product failure (8 percent) due mainly to the tray falling off allowing the baby to fall out. Seven percent of cot injuries were attributed to failure on the part of the product, mainly entrapment hazards. The main problem identified for prams and strollers was collapse of the product resulting in it folding up on the child. Almost half of identified malfunctions in prams involved the restraint breaking or coming undone.

Severity of injury

In children under 15 years, the admission rate for bunk bed injuries is 17.8 percent. Of the five-year age-groups, the admission rate is highest for 10-14 year olds at 22.1 percent (which is substantially higher than the all-injury admission rate for this age-group of 13.3 percent). While the admission rate for 0-4 year olds is similar to the overall admission rate for the age-group (17 percent compared to 18.9 percent), the admission rate for one-year-olds is particularly high at 27.5 percent (see Table 3:20).

Nature of injury and body part injured

The most common injury associated with bunk beds (see Table 3:21) are fractures (33 percent) - in particular, upper extremity fractures, which account for 75 percent of all fractures. Bruising (21 percent) is the next most common type of injury followed by cuts and lacerations (17 percent) and concussion (10 percent). Fractures and concussion result in the greatest number of hospitalisations (fractures accounting for 48 percent of all admissions and concussion, 20 percent). Injuries to the upper extremities are the most common (38 percent) followed by injuries to the face (27 percent) and the head (13.5 percent) (see Table 3:22).

Table 3:19 BUNK BED INJURIES - CAUSE OF INJURY

Cause of bunk bed-related injury	**0-4 yrs**	**5-9 yrs**	**10-14 yrs**	**TOTAL < 15 yrs.**	**% of total**
Fall	206	230	66	502	80.4
Playing	*(89)*	*(66)*	*(7)*	*(162)*	*(26.0)*
Sleeping	*(20)*	*(76)*	*(23)*	*(119)*	*(19.1)*
From ladder (climbing up or down)	*(27)*	*(22)*	*(8)*	*(57)*	*(9.1)*
Jumped	*(20)*	*(17)*	*(7)*	*(44)*	*(7.1)*
Pulled/pushed by other child	*(10)*	*(9)*	*(3)*	*(22)*	*(3.5)*
Making up/cleaning bunk	*(1)*	*(5)*	*(3)*	*(9)*	*(1.4)*
Failure(rail/ladder/slats collapsed)	*(6)*	*(3)*	-	*(9)*	*(1.4)*
Leaning over	*(1)*	*(4)*	-	*(5)*	*(0.8)*
Not specified	*(32)*	*(28)*	*(15)*	*(75)*	*(12.0)*
Hit against bunk/object	13	13	10	36	5.8
Entrapment	1	-	-	1	0.2
Not specified/other	45	30	10	85	13.6
TOTAL	**265**	**273**	**86**	**624**	**100.0**

Source : VISS, 1988-96, one-line text narratives.

Table 3:20 BUNK BED INJURIES, VISS, 1988-96. AGE BY GENDER BY DISPOSITION

Age	**DISPOSITION**								
	presented			**admitted**			**ALL**		
	male	female	total	male	female	total	MALE	FEMALE	TOTAL
0	*2*	*1*	*3*	*0*	*0*	*0*	*2*	*1*	***3***
1	*12*	*17*	*29*	*4*	*7*	*11*	*16*	*24*	***40***
2	*40*	*26*	*66*	*6*	*6*	*12*	*46*	*32*	***78***
3	*43*	*27*	*70*	*7*	*4*	*11*	*50*	*31*	***81***
4	*28*	*24*	*52*	*9*	*2*	*11*	*37*	*26*	***63***
0-4	125	95	220	26	19	45	151	114	**265**
5-9	137	89	226	25	22	47	162	111	**273**
10-14	37	30	67	14	5	19	51	35	**86**
<15	**299**	**214**	**513**	**65**	**46**	**111**	**364**	**260**	**624**

Source : VISS, 1988-1996.

Table 3:21 BUNK BED INJURIES, VISS, 1988-96. NATURE OF INJURY BY DISPOSITION

Nature of Injury	Presentations	Admissions	TOTAL	% of total injuries
fracture	159	70	**229**	**32.5**
bruising/inflammation/oedema/ haemorrhage	123	24	**147**	**20.9**
cuts/lacerations/ amputations	112	9	**121**	**17.2**
concussion	44	29	**73**	**10.4**
sprain/strain	65	1	**66**	**9.4**
superficial abrasions	14	3	**17**	**2.4**
dislocation	6	3	**9**	**1.3**
foreign body	4	1	**5**	**0.7**
dental	4	1	**5**	**0.7**
bites/punctures	3	0	**3**	**0.4**
crushing	3	0	**3**	**0.4**
burns	0	3	**3**	**0.4**
poisoning	0	0	**0**	**0.0**
asphyxiation	0	0	**0**	**0.0**
unspecified/no injury	22	1	**23**	**3.3**
TOTAL	**559**	**145**	**704**	**100.0**

Source : VISS, 1988-1996.

Table 3:22 BUNK BED INJURIES, VISS, 1988-96. BODY PART INJURED BY DISPOSITION

Body part	Presentations	Admissions	TOTAL	% of total injuries
Upper Extremities	210	61	**271**	**38.5**
Face	160	27	**187**	**26.6**
Head	57	38	**95**	**13.5**
Lower Extremities	74	11	**85**	**12.1**
Trunk	27	3	**30**	**4.2**
Neck	8	4	**12**	**1.7**
Internal Organs	1	0	**1**	**0.1**
Poisoning	0	0	**0**	**0.0**
Asphyxiation	0	0	**0**	**0.0**
No injury detected/specified	22	1	**23**	**3.3**
TOTAL	**559**	**145**	**704**	**100.0**

Source : VISS, 1988-1996.

4. COTS

Infants spend a considerable amount of times in cots, much of it unsupervised, so it is vital that cots provide a safe sleeping environment. The potential injury risks associated with cots that are identified in the research literature include entrapment, strangulation, suffocation, falls and bumps. Safe cot design plays a key role in preventing cot-related injury and death. Infants lack the muscular control and strength to be able to extract themselves from difficult situations and adventurous older infants often create such situations themselves. Therefore, the design of the cot must be such that it does not contribute to such situations.

4.1 KEY ISSUES

4.1.1 Scope of the problem

Cots are implicated in more infant deaths than any other nursery item (CPSC, 1995a). The fatalities have been associated with design flaws, incorrect usage, inappropriate modification and the absence of mandatory standards (Byard et al, 1996a; Nancarrow, 1996).

United States

Each year in the United States, 50 babies die when they become trapped between broken cot parts or in cots with older, unsafe designs. Since 1981 the CPSC has recorded 173 strangulation deaths associated with blind cords and, since 1985, at least 138 incidents where cot slats appeared to have disengaged from the side rails of cots, resulting in 12 deaths and 5 non-fatal injuries (CPSC, 1997b).

Of the 50 infant deaths in the U.S. each year, 32% occur when the side or end of the cot separated from the cot structure; 14% are due to entrapment between mattress and cot side; 11% are due to entrapment from failure of the cot support; 6% are due to entanglement of clothing or other material; 6% are due to entrapment in cot slats and 31% are due to miscellaneous or other causes (CPSC, 1996c).

Mortality data from the California mortality master computer file, 1960 to 1981, shows that infants between 6 and 8 months of age are at highest risk of cot strangulation and males are more frequently injured that females (ratio of 1.4 to 1; $P = .05$) (Kraus 1985). Rates per million children aged 0-4 years and ratios per million sales of full sized cots have not shown any significant changes since 1973, when the standard became effective. It appears that the mortality rates were declining between a peak in incidence in 1969-71 and the introduction of the 1973 standard (Kraus 1985).

Europe

A report from The Netherlands (de Graaf, 1987) combined data from HASS (Home Accident Surveillance System, United Kingdom), NEISS (National Electronic Injury Surveillance System, United States) and PORS (Prive Ongvallen Registratie Systeem, the Netherlands) to determine priority product-related issues in the 0-4 age group. The report identified cots in the top six items in terms of hospitalisations.

4.1.2 Causes of injury

The research literature shows that significant injury and death associated with cots are most often due to:

- entrapment
- strangulation
- falls
- suffocation

Entrapment

Entrapment most often involves the child's head, limbs and fingers and most frequently occurs between the vertical bars of the cot or between the mattress base and the cot frame (when the cot base collapses). Based on data from a range of sources (NISPP, the census, treated and untreated cases by general practitioners and in hospital departments) it was estimated that, nationwide, there are 50-100 finger and head entrapments per annum (Drake et al, 1989). The CPSC (1995b) warned against the entrapment hazard posed by ornamental cuts in heading and base boards.

Death is most often associated with head entrapment and is particularly associated with faulty, broken or modified cots (Choice, 1996; Byard et al, 1994; Variend & Usher, 1984; Ozanne-Smith & Heffernan, 1990).

Strangulation

Strangulation is most often associated with three scenarios:

infants' clothing catching on protruding cot parts, including decorative knobs and corner posts (Moore & Byard, 1993; CPSC, 1995c; Byard et al, 1994; Jackson & Ranasinghe, 1982; Woodhouse, 1982);

infants gaining access to cords or strings either in, or from the immediate surrounds of, the cot (CPSC, 1996c; Byard et al, 1994); and

collapse of portable cots.

Strangulation deaths associated with cot protrusions have been recorded in Australia (Choice, 1996; Moore & Byard, 1993). In the United States (CPSC, 1995c) two cases of brain damage and 48 deaths due to strangulation were recorded where projections on decorative knobs and corner posts were implicated.

Deaths from strangulation have also been associated with window blinds or shades when the cot was situated near window covering pull cords and infants were found hanging in the loop of the cord (CPSC, 1996d; Byard et al, 1994). The U.S. CPSC (1996b) have recorded 170 similar deaths in the United States since 1981.

The transfers and decals on the inside of the head and base of older cots also pose a choking hazard (Kidsafe, 1992) as does the ingestion of material that has flaked or been chewed off the top rail (CPSC, 1990; Choice, 1994a).

Falls

Falls from a cot most often occur when the infant is attempting to climb out of the cot. Thirty-six percent of cases recorded by NISPP involved attempts to climb from the cot (Ozanne-Smith & Heffernan, 1990). Climbing-related falls often involve older infants who also may use toys and pillows to assist their attempts to climb out. Based on NISPP data, census data, the number of injuries treated by general practitioners, in other hospital departments and those that remain untreated, it was estimated that low cot sides, which may enable infants to climb out of the cot and fall, are potentially responsible for 280-560 injuries nationally per annum (Drake et al, 1989).

Suffocation

The use of appropriate bedding plays a key role in preventing suffocation deaths associated with cots. A mattress of correct size is essential to prevent infants falling into the gaps between the mattress and the cot side, which can occur when mattresses are too small (Byard et al, 1994).

The distinction between mechanical suffocation and Sudden Infant Death Syndrome (SIDS) is not always clear. The use of soft bedding surfaces, such as sheepskins and underlays, are also associated with suffocation deaths. The U.S. CPSC reports that soft bedding may contribute to the death of as many as 1,800 infants each year whose noses and mouths are covered by soft bedding (CPSC, 1995d).

The use of plastic covering as mattress protection has also been implicated in infant suffocation (Baker & Fisher, 1980; Smialek et al, 1977). Smialek et al, (1977) claim that plastic coverings, when moistened by condensation from vapours of the breath, become easily adherent and can seal off respiratory passages.

Bumps

Cot protrusions are also associated with less severe bumps and scratches.

4.1.3 Type and severity of injury

Cot-related deaths are mostly associated with entrapment (Choice, 1996; Byard et al, 1994; Variend & Usher, 1984), strangulation (Choice, 1996; CPSC, 1995c; Byard et al, 1994; Moore et al, 1993; Kraus, 1985) and suffocation (Baker & Fisher, 1980; Smialek et al, 1977).

The Consultative Council on Obstetric and Paediatric Mortality and Morbidity (Victoria) reported that between 1985 and 1988 there were 6 unintentional injury deaths associated with cots and their environs (Ozanne-Smith and Heffernan, 1990). Of these six deaths, one infant fell from a cot into a basket of soft clothing, three strangled as a result of cot design or modification (one whose clothing caught on a wing nut) and two strangled as the result of accessing a blind cord and elastic on a toy.

While falls from cots resulting in death have been recorded in the literature (Ozanne-Smith & Heffernan, 1990; Smialek et al, 1977) they were more often associated with emergency department presentations (77% of NISPP and 59% of VISS recorded cot injuries).

National data on emergency department presentations, based on the NISPP database as at May 1989, was examined for children aged 0-3 years. Excluding portable cots, there were 60 cases of cot-related injury including one death and an admission rate of 11.7% (Ozanne-Smith & Heffernan, 1990).

Routley and Valuri (1993) reported on 135 cot-related injuries that resulted in presentations to selected Victorian emergency departments (VISS). The majority of injuries were associated with falls (59%). Fractures (21%), particularly to the upper limbs, lacerations (19%) and bruising (16%) both most commonly to the face and scalp, and concussion (11%) were the most common injuries sustained. The admission rate for these cases was 14%.

Lyons and Oates (1993) reported on 124 falls from cots in NSW. Fifteen percent occurred when the infant climbed over the cot rails, falling 4 ½ feet. There were 31 injuries, two of which were serious. One infant sustained a fractured clavicle after climbing the cot rails and falling onto his shoulder and another sustained a skull fracture from a fall from a cot. Twenty-six percent of all injuries were to the head. Seven of the nine lacerations were to the face.

4.2 DESIGN ISSUES

4.2.1 Entrapment

To avoid entrapment, the space between the vertical bars must be in the range 50mm to 85mm and should not flex enough to allow a babies head (represented by a 95mm diameter spherical probe pulled with a force equal to 5 kg weight) to pass through (Choice, 1989). Current standards provide safety specifications for this spacing, however it is impossible to apply this legislation to second-hand or broken cots (CPSC 1997b, Byard et al, 1994). The draft mandatory standard may apply to second-hand cots when sold.

While older cots have been the focus of much of the attention for entrapment hazards the CPSC reports that of 62 cot slat disengagement incidents reported between 1990 and 1995 (inclusive) only seven cots were purchased used, or were over 3 years old (US Federal Register, 1996).

Incorrect assembly has been associated with failure of the cot base. If the mattress base is inadvertently placed upside down, with staples or nails to face the wrong way, the base may fail under stress, presenting an entrapment hazard (Choice, 1991a). Provision of adequate labelling should prevent this occurrence.

4.2.2 Strangulation

Sharp edges, points or protrusions are potentially hazardous. Protrusions over 8mm long may catch on infant's clothing (Choice, 1991a). Anything tied in or near a cot creates a strangling hazard (Choice, 1990a).

The U.S. voluntary industry standard restricts the height of the corner post to 1/16 of an inch and consumers are urged to remove corner post extensions that exceed this height (CPSC, 1995c).

4.2.3 Falls

Cots should be deep enough to prevent an infant climbing out, and mattress thickness is important in minimising the chance of an infant climbing, and falling, from a cot. The distance from the top of the mattress to the top of the cot side should not be less than 500mm for cots with metal or timber sides and 350mm for portable cots with fabric sides (Choice, 1996). The distance from the floor to the top of a portable cot should not be more than 800mm (Choice, 1996).

Horizontal or cross bars should be discouraged as they can be used as foot or toeholds and assist infants to climb out of cots (Choice, 1991a). Too many toys or cushions in a cot may also assist an infant to climb out of a cot.

Adjustable base cots, if used incorrectly, also present a fall risk. These cots have a number of settings in which mattresses can be set to differing heights to assist carers to easily tend to the infant, without physical strain. This type of cot presents a fall risk if the adjustable base is left in the higher position once infants are old enough to pull themselves up against the cot bars (Choice, 1991a). The current voluntary standard sets out requirements for labelling which indicates that the cot should be adjusted back to the lower position before the infant is at the sitting-up stage of development (TAS, 1995).

4.2.4 Suffocation

Selecting a mattress of correct size is essential to prevent infants falling into the gaps created by mattresses that are too small. There should be no more than 25mm space all round to avoid risk of suffocation (Choice, 1996).

The firmness of the mattress is also important to ensure that the infant's face cannot sink into it (Choice, 1996). Soft bedding surfaces such as sheepskins and comforters should be avoided and plastic should never be used as mattress protection.

Portable cots with mesh sides have been associated with suffocation deaths (Byard et al, 1994; Byard et al, 1996; Baker & Fisher, 1980). The pliability of the woven mesh side of a cot may allow an infants head and upper body to slip into the space at the edge of the mattress, the elastic recoil of the mesh forces the infants head and face into the side of the mattress which may cause suffocation.

4.3 OTHER ISSUES

4.3.1 Second hand cots

Economic constraints or tradition may persuade a family to keep and use an old or second-hand cot (Smialek et al, 1977; Choice, 1996). The available literature cites the use of second-hand, broken cots or modified cots as an important risk factor in cot-related injury and death (Choice, 1996; Nancarrow, 1996).

A 1996 'Sunday Age' survey of second-hand cots offered for sale in the 'Trading Post' found many failed to meet the Australian Safety Standards. A check of 10 cots revealed 3 had castors on all 4 legs and one older cot had a bolting mechanism similar to one implicated in a death in South Australia in 1994. Three had unsuitable mattresses, which would allow an infant to slip between the mattress and the cot side, thereby posing a suffocation risk (Nancarrow, 1996).

4.3.2 Rocking cradles

Beal et al (1995) reported on rocking cradles which were associated with the suffocation death of two infants in South Australia. Two further deaths where infants were found in similar circumstances, were diagnosed as SIDS. In each of the four deaths the infant was found face down in the corner of the rocking cradle. In this position the excessive angle of tilt did not allow the infant to roll free (Choice, 1992a).

Beal et al (1995) reported on the subsequent testing of six commercially available rocking cradles in South Australia and found that the oval shape of an infant's head prevents the pivoting of the head when the side of the face is against the bar. At 5° tilt or less, a small amount of lateral flexion of the infant's neck was possible, but in situations where the tilt was in excess of 10°, gravity prevented lateral flexion and the infant is unable to pivot the head (Beal et al, 1995). Further testing showed that five of the models had insecure locking pins which could be easily disengaged.

Four of the cradles tested were banned from sale in South Australia. All have since been voluntarily modified to allow a maximum tilt of 10° with mechanisms to ensure that the locking pin cannot fall out or be easily removed by other young children. The authors identified the need for an Australian Standard for cradles and the widespread dissemination of information to parents and to health workers involved in the education of new and prospective parents (Beal et al, 1995; Moore et al, 1993). An Australian and New Zealand standard for rocking cradles was subsequently developed and published in 1996 (AS/NZS 4385 : 1996).

4.3.3 Sudden Infant Death Syndrome (SIDS)

SIDS and suffocation deaths (asphyxia) are typically indistinguishable at autopsy (Beal & Byard, 1995). One plausible mechanism offered for some of the SIDS deaths is suffocation through re-breathing of carbon dioxide which is particularly associated with soft bedding surfaces such as sheepskins and comforters (Scheers, 1995).

The use of soft bedding surfaces has been shown to be associated with suffocation deaths. A two year study in the U.S. found that up to 30% of the 6,000 babies that die from SIDS each year may have suffocated when placed on top of soft bedding such as pillows, comforters and sheepskins (CPSC, 1995d).

To help determine whether accidental asphyxia has occurred, death scene examination in cases of sudden infant death during sleep should include reconstruction of the position of the body in the cot, with careful examination of the cot to determine the possibility of suffocation death (Moore et al, 1993; Byard et al, 1996b).

4.3.4 Cot toys

Cot toys, designed to be suspended across the cot, have been associated with 49 strangulation incidents in the United States between 1973 and April 1987, 31 of which were fatal (CPSC, 1990). Such toys should be removed when an infant is beginning to push up on hands or knees or is five months old (CPSC, 1990).

4.4 INTERVENTIONS

Interventions promoted in the literature mainly relate to:

- mandation of standards
- increasing carers' awareness of cot-related risk factors
- increased and improved labelling

4.4.1 Regulation

Calls for the current voluntary standard to be made mandatory were made by various authors (Routley & Valuri, 1993; Choice, 1989, 1991a, 1996, 1997a).

Mandatory standards have been in place in the U.S since 1973. The U.S. CPSC claim a reduction from 150 to 200 deaths to 50 deaths annually since their inception (CPSC, 1996e). Kraus (1985), however, suggests that there has been no evidence of a statistically significant decline in strangulation cot deaths since the introduction of the standard.

The Australian Consumers' Association in their publication, Choice, also suggested the development of a Product Safety Law as it is currently not an offence in Australia to knowingly manufacture, or not to recall, an unsafe product (Choice, 1997a).

4.4.2 Awareness

Prevention depends upon increased public awareness of the sources of dangers (Smialek et al, 1977). Thus, carers need to be informed of the risks associated with cots, their modification, wear and tear, bedding requirements and placement which may create hazards (Kidsafe, 1992; Ozanne-Smith and Heffernan, 1990).

There is general support in the literature for education campaigns, including the availability of brochures supplying risk-related information, particularly if interventions are supported by health professionals (Byard et al, 1994; Variend and Usher, 1984; Smialek et al, 1977). Point of sale is recommended as an important distribution point for information about cot safety (Ozanne-Smith and Heffernan, 1990).

Baker and Fisher (1980) warn that while education of carers should not be neglected it should never be allowed to replace or delay design changes that will provide "passive" protection. Another article (Kraus, 1985) claims that educational efforts to encourage active countermeasures among parents appear to be ineffective.

4.4.3 Labelling

The current voluntary standard for household cots, AS/NZS 2172:1995, places greater emphasis on the importance of informative labelling in preventing cot-related injury. New labelling

requirements extend to cover assembly and maintenance instructions, warnings about placement of the cot and warnings about leaving small items in, or in reach of, the cot (Choice, 1996).

Information on mattress size and the required depth of the cot must now be given on the cot packaging, in an accompanying leaflet and be permanently marked on the top of the mattress base (Choice, 1996). If the height of the base is adjustable the base must also carry a warning that it should be placed in the lower position before the infant can sit up (Choice, 1996).

The Australian Consumers' Association suggests that cots should come with two sets of instructions, one you can hold for quick referral and one glued to the base of the cot, to make them accessible and clearly visible, even if a period of time has elapsed since initial assembly. To ensure maximum effectiveness in communicating instructions there should be accompanying illustrations to assist those with poor English language reading skills (Choice, 1996).

4.4.4 Other activities

The U.S. CPSC has been involved in efforts to address hazards associated with older cots, focusing on assembly and maintenance problems. Part of a national media campaign to highlight the hazards of older cots involved used cot round-ups in major U.S. cities (CPSC, 1995a) to coincide with 'Baby Safety Week'. During this week retailers offered discounts on new cots and selected manufacturers donated new cots to low income families (CPSC, 1995a).

Kraus (1985) suggests that a manufacturers' rebate incentive may encourage the removal of older cots.

4.4.5 Window cords

The U.S. CPSC and the Window Covering Safety Council urged parents to avoid strangulation risks by eliminating the loop in two-corded horizontal blinds by cutting the cord above the tassel, removing the equaliser buckle and adding a safety tassel at the end of each cord (made available free of charge from manufacturers) (CPSC, 1996d).

At the CPSC's urging, the industry has agreed to a voluntary standard that eliminates all loops on mini-blind cords and requires the use of a tension device on the continuous loop cords that are used primarily in vertical blinds. The industry expects all production to meet the new standard by September 1997 (CPSC, 1997c).

4.5 STANDARDS

Standards provide clear guidelines on safety and durability for manufacturers to refer to when designing their products (Choice, 1996). The age and requirements of Australian Standards in relation to cots vary depending on the cot type. Anecdotal evidence suggests that the current Australian and New Zealand standards effectively address the design issues associated with cot-related injury, however the voluntary nature of the standards negates their effectiveness and mandation is required.

4.5.1 Australia

In April 1997, *Choice* reported that the then Federal Minister for Small Business and Consumer Affairs, The Hon. Geoff Prosser, announced that he would be seeking agreement from all states and territories for the introduction of a mandatory standard for the safe design of cots. The Minister was also seeking agreement to develop general cot safety information for parents and carers and would include information on buying and maintaining a cot, safe sleeping positions and appropriate bedding and nightclothes (NISU, 1997).

The standards for cots and rocking cradles, as they currently stand, are as follows:

Cots for Household use AS/NZS 2172:1995.

This standard specifies material, constructional and design requirements for cots as well as performance criteria, labelling and marking, all of which are related to the infant's safety while in the cot. It excludes carry and portable cots. 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 the child and the recommended mattress weight and size is also specified (Ozanne-Smith & Brumen, 1996). Requirements for toys, if they are included with the cot, are also specified. This standard is the fourth revision of the original AS 2172-1978.

This standard also covers adjustable cots. The standard addresses concerns raised over an older infants ability to roll out of a cot left on the higher setting. It allows only two positions of the base, the "lower" being the normal position and the "upper" the elevated position. Extra labelling and marking requirements warn and remind the carer that the cot should be adjusted back to the lower position before the infant can sit up. The standard also sets out the maximum recommended mattress thickness and size, and includes a series of tests covering other potential hazards, including entrapment, impact, strength and durability of access fastening devices and stability (TAS, 1995).

Folding portable cots for use in domestic situations and day nurseries AS 2195 - 1978

Portable cots are designed to be a temporary sleeping place for infants weighing under 15kg (Scott, 1996). The standard specifies dimensions, materials, construction and assembly, finish, flammability and accessories where these relate to the safe use of a cot. Performance tests for strength and durability and the information to be given the purchaser regarding assembly, maintenance and use are specified.

An Australian Standards committee is currently revising the standard for portable cots, DR 96521, drawing on the UK standard and on one being developed in Europe (Scott, 1996). This revision is being accelerated following the death of an infant in NSW when its folding cot collapsed.

Carry cots and stands AS 2196 – 1978

This standard 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.

Infants' rocking cradles – safety requirements AS/NZS 4385:1996

This standard specifies the material, construction and design requirements, as well as labelling and marking requirements for rocking cradles all related to safety of the infant while in the cradle.

The standard recognises that the angle of tilt of an unattended cradle may be associated with babies rolling into the side of the cradle and suffocating. It states that cradles should incorporate a tilt limiter or self levelling device which, if omitted or incorrectly assembled, prevents the use of the cot (AS/NZS 4385:1996). Locking mechanisms are optional, but if in place have requirements in the standard.

4.5.2 United States

In the United States mandatory cot standards for full-size and non-full size cots have been in place since 1973 and 1976 respectively. The standards included requirements addressing side height, slat spacing, mattress fit, and other factors. In 1982, these standards were amended to include requirements that prohibited hazardous cut-outs in cot end panels (CPSC, 1997b).

Voluntary industry standards (ASTM), have also been developed (ASTM F 1169-88 Standard specification for full-size baby crib; ASTM F66-96 Full and non full size baby crib corner extensions). First published in 1986 and 1989, these standards address additional hazards such as entanglements on corner posts of cots and structural and mechanical failures of full-size cots (CPSC, 1997b).

Despite increases in the at-risk population of infants and young children, cot-related deaths have been reduced in the United States from 150 to 200 deaths to 50 deaths annually (CPSC, 1996e).

While the available U.S. standards have effectively addressed most safety hazards associated with new cots they do not address cots currently in use (Smialek et al, 1977), nor have they been adequate to deal with issues of structural integrity (CPSC, 1996c). Since 1985, CPSC has received reports, involving at least 26 different cot manufacturing companies, of more than 138 incidents where cot slats appeared to have disengaged from the side rails of cots. There were 12 deaths and 5 non-fatal injuries resulting from these reports (CPSC 1996b; CPSC, 1997b).

The U.S CPSC voted to address the hazard of slats falling out of side rails and an advance notice of proposed rulemaking (ANPR) was published which could result in a mandatory safety standard for the structural integrity of cot side rails and their slats (CPSC, 1997b).

4.5.3 Canada

MacKay (1985) reports that in Canada it has been illegal since 1985 to sell even a second-hand cot that does not comply with the safety standards of the Hazardous Products Branch of the Department of Consumer and Corporate Affairs.

4.5.4 European

The safety requirements for the construction of cots, set by the British Standards Institute, have probably resulted in a marked reduction in the number of accidents and fatalities from structural defects (BS EN 716-1: 1996- Furniture, Children's cots and folding cots for domestic use, test methods; BS EN 716-2: 1996- Furniture, Children's cots and folding cots for domestic use, safety requirements; and BS 7423: 1991- Specifications for safety requirements for children's travel cots of internal base length not less than 90cm). There is also a European German Standard (ISO Children's Cots; Safety requirements and testing, ISO/DIS 7175-1:1992 & 7175-2:1992). However, as with the U.S. standards, the use of broken cots in the home is outside such controls and it is not surprising that accidents occur from this cause (Variend and Usher, 1984).

4.6 RECALLS

If it is discovered that a product is unsafe, it is important that it be recalled from stores and from any consumers who own the product (Choice, 1989). In Australia, three cot-related recalls have been issued by federal authorities since 1987. These involved two standard and one portable cot. Two had entrapment hazards and the other loose side slats. The portable cot was recalled after a death where the infant slipped between the frame and masonite (hardboard) base of the cot.

In NSW there were 11 portable cots banned until further review by the Product Safety Committee. Five were permanently banned in 1996. These were effectively no longer on the market but this step was taken to ensure that they did not come back on the secondhand market.

The Australian Consumers' publication *Choice* (1997b) has tested cots four times over 12 years with the following results:

- in 1985, 16 out of 24 cots had major safety faults
- in 1989, 10 out of 16 cots had major safety faults
- in 1991, 15 out of 19 cots had major safety faults
- in 1996, 9 out of 10 cots had major safety faults

After the 1989 tests, nine of the ten manufacturers of cots with faults agreed to make changes. Similarly, all but two of the manufacturers undertook to rectify faults after the 1996 tests.

A selection of U.S. CPSC recalls, issued in the period January 1995 to July 1997, were examined and16 recalls of cots and cot-related products were identified. Risks most often associated with these products included entrapment, strangulation, choking and suffocation. Sixty-two models of product were involved and in excess of 2,700,000 units (see Table 4:1). There were 18 deaths, 148 injuries and 295 incidents of non-injury known to be associated with these products.

Table 4:1 SELECTED SUMMARY OF COT-RELATED PRODUCT RECALLS (UNITED STATES) 1995 - 1997

DATE	ITEM	NO. OF MODELS	HAZARD	NO. OF UNITS INVOLVED IN RECALL	NO. OF DEATHS	NO. OF INJURIES	NO. OF INCIDENTS (NON-INJURY)
7/97	Crib toys	1	Strangulation	747	3	n/a	n/a
7/97	Full-size crib	14	Entrapment	390,000	1	27	47
6/97	Portable play yard	3	Entrapment	1,200,000	3	107	n/a
6/97	Full-size crib	2	Entrapment and fall	800	0	0	5
5/97	Full-size crib	2	Entrapment and choking	1,856	0	0	n/a
12/96	Portable play yard	1	Choking and sharp edges	205,000	0	0	n/a
11/96	Portable crib	3	Strangulation	13,000	7	n/a	n/a
11/96	Portable crib	2	Strangulation	212,000	1	n/a	n/a
10/96	Portable crib	1	Choking and entanglement	133,000	0	9	n/a
3/96	Baby pillow	1	Suffocation	3,800	0	0	n/a
12/95	Full-size cot	7	Entrapment	190,000	0	0	230
12/95	Full-size cot	3	Strangulation and entrapment	2,288	n/a	n/a	n/a
10/95	Foldaway crib	3	Strangulation	17,043	0	0	11
3/95	Full-size crib	2	Entrapment	7,000	0	0	2
2/95	Full-size crib	14	Entrapment	278,000	1	3	n/a
1/95	Portable crib	3	Strangulation	100,000	2	2	n/a
TOTAL		**62**		**2,754,534**	**18**	**148**	**295**

4.7 SUMMARY OF RECOMMENDATIONS FROM THE LITERATURE

Common recommendations for the prevention of cot-related injury are found within the available literature and are summarised below:

4.7.1 Design

Make sure that:

- the cot meets the Australian and New Zealand Standard
- joints and brackets are secure with an overall sturdy construction
- the distance from the top of the mattress to the top of the cot side is not be less than 500mm for cots with metal or timber sides and 350mm for portable cots with fabric sides.
- the distance from the floor to the top of a portable cot is not more than 800mm.
- the space between the vertical bars in the cot sides and ends is between 50 and 85mm.
- the space between the base frame and the cot sides and ends is less than 15mm.
- the space between the mattress and the cot sides or ends is less than 25mm.
- the cot side locks securely, operates smoothly and is not able to be opened by a child
- if the cot has wheels that it preferably has only 2 wheels at one end, or, if it has four wheels, two of them have brakes.
- there are no horizontal bars or decorations which may assist an infant to climb out of the cot
- there are no knobs or protrusions that could catch an infant's clothing, posing a strangulation hazard, or that an infant could roll against.
- there are no strings, ribbons or elastic on bumpers, toys or infants' clothing which may pose a strangulation risk
- there are adequate and informative labelling on the cots
- there are no cut-outs or transfers on the cot
- edges are smooth and round and there are no protrusions

4.7.2 Safe practice

Make sure that:

- the manufacturer's instructions are followed during cot assembly
- a firm, flat mattress is used
- soft fluffy products such as sheepskins or comforters are not used as a sleeping surface
- the cot is placed away from windows to prevent possible falls
- the cot is placed away from window and blind cords to avoid strangulation
- small objects or food and drink which may cause choking are not left in the cot
- cot toys and mobiles are out of infant's reach and are removed before the infant can push up on hands or knees or is 5 months old (whichever comes first)
- there is not too many large toys or loose cushions inside the cot as older infants may pile them up and use them to climb over the cot side
- cradles are tied or locked into a level position unless it is actively being rocked by the carer

4.7.3 Portable cots

Make sure that:

- edges are smooth and rounded with no sharp protrusions that could cause injury or snag clothing
- there are no items that could come loose and become a choking hazard
- the cot is sturdy and does not collapse when pushed
- the base does not sag or collapse when pushed down
- the mattress fits snugly into the base
- if using an inset bassinette, check the mechanism that holds the frame up carefully for stability

4.7.4 Used cots

Furniture and accessories must be checked regularly for damage or weakness as normal wear and tear can cause it to become faulty and unsafe to use.

Make sure that :

- the cot meets all the safety specifications of the Australian and New Zealand standard and (if second-hand) it is free from excessive wear
- there are no missing or loose parts
- repairs are made immediately
- there are no protrusions such as splinters or bolts which could snag clothing and pose a risk of strangulation, or that a infant could roll against
- there are no areas where fabric or plastic materials are tearing
- there is no rust or corrosion of metal nor splitting or knots in timber
- there is no wear or tear on locking devices
- there are no modifications which could be hazardous

Table 4:2 SUMMARY OF LITERATURE - COTS

Publication	Country	Study Type	Subjects	Setting/Data Source	Measures	Results
Choice (1996, October) How safe are children's cots? *Australian Consumers' Association*	Australia	Test Report	10 cots, the cheapest model of regular cot brands available in 3 or more states ($139 to $450)			❑ Only 1 cot recommended ❑ 9 out of 10 cots had major safety faults ❑ All but one cot was easy to assemble however, 8 could be assembled incorrectly ❑ 8 models had an adjustable base, 3 of which were not deep enough to be safe in the upper position ❑ Only 2 of the models with adjustable bases warned of the need to move the base to the lower position once the child can sit up ❑ None had protrusions which could snag a child's clothing and pose a strangulation hazard ❑ 4 had protrusions which could injure a child ❑ 8 failed for limb entrapment and 9 failed for finger entrapment ❑ 4 had horizontal bars, brackets or knobs that could be used as foot or toeholds for climbing ❑ 9 had drop sides, 3 of which failed testing ❑ 3 failed impact resistance testing
Beal SM, Moore M, Collett M, Montgomery B, Sprod C & Beal A (1995) The danger of freely rocking cradles *Journal of Paediatric and Child Health*, Vol. 31, pp. 38-40	Australia (South Australia)	1. Weight test of rocking cradles 2. Observation of infants in test cradles	1. Each brand of new cradle commercially available in South Australia (n=6) 2. 11 infants aged between 44 and 82 days		1) ❑ Measure of angle of tilt caused by a 5kg weight placed at the side of the cradle 2) ❑ Examination of video and still photos for movement and reaction to different positions	❑ Infants in a cradle tilted at 10° or greater, face down with the side of the face against the bars, and an arm trapped between the body and the bars or through the bars, were unable to obtain a clear airway unless a dummy was in the mouth ❑ 5 of the rocking cradles had insecure locking pins which could be shaken out by movement of the baby or easily removed by a toddler

Publication	Country	Study Type	Subjects	Setting/Data Source	Measures	Results
Scheers NJ (1995) SIDS or Infant Suffocation: The Interaction of Hazardous Sleeping Environments and Sleeping Position *ECOSA Proceedings*, 3rd Conference, 6/7 March 1995	United States	Analysis of death circumstances	176 cases of infants found in a potentially suffocating environment	17 study sites throughout the United States	❑ Death scene re-creations ❑ Parent and care giver interviews ❑ Laboratory testing of product samples	❑ 30% of infants diagnosed as SIDS were found in potentially suffocating circumstances with their airways covered by soft bedding ❑ CO_2 was consistently high for bean bags, cushions and sheepskins; varied from low to high for pillows and comforters; and consistently low for blankets and sheets
Byard RW, Beal S & Bourne AJ (1994) Potentially dangerous sleeping environments and accidental asphyxia in infancy and early childhood *Archives of Diseases in Childhood*, Vol 71, No. 6, pp. 497-500	Australia (South Australia)	Case review of necropsy and consultation files	30 cases of accidental asphyxia occurring in infants and young children who had been left to sleep unattended	Necropsy and consultation files of the Adelaide Children's Hospital, Department of Histopathology, 1966-93	Causes of accidental death from asphyxia of infants and children left alone to sleep	❑ Ages ranged from 1 month to 3 years with an average age of 10 months ❑ Male to female ratio was 16:14 ❑ Causes of death included hanging (n=12), positional asphyxia/wedging (n=16) and suffocation (n=2)
Lyons TJ and Oates RK (1993) Falling out of Bed: A Relatively Benign Occurrence *Pediatrics*, Vol. 92, No. 1, pp. 125-127.	Australia (NSW)	Case study of hospital records	Two hundred and seven children less than 6 years of age	Hospital records from the Children's Hospital, Camperdown	Injuries resulting from falls from cribs or beds where the children were immediately assessed and examined after the fall	❑ 124 falls from cribs ❑ Height of falls from cribs: 32 inches from cribs or 54 inches for those falling after climbing crib rails ❑ 26 (84%) injuries were to the head ❑ 29 superficial injuries such as contusions and minor lacerations, 7 of the 9 lacerations were to the face ❑ One skull fracture and one clavicle fracture ❑ Calculation of the momentum of impact between injured and non injured showed no significant differences

Publication	Country	Study Type	Subjects	Setting/Data Source	Measures	Results
Moore L and Byard RW (1993) Pathological findings in hanging and wedging deaths in infants and young children *American Journal of Forensic Medicine and Pathology*, Vol. 14, No. 4 pp. 296-302.	Australia (South Australia)	Case review of death records of a Histopathology Department	14 cases of accidental death as the result of hanging of wedging occurring in early childhood and infancy.	Death records of the Department of Histopathology, Adelaide Children's Hospital.	Causes of accidental death associated with hanging and wedging	❑ Mean age of death was 14 months ❑ Male to female ratio was 9:5 ❑ 11 cases occurred in a baby's crib ❑ Mechanism of injury in 8 of the crib-related deaths was hanging with partial suspension, including 6 cases in which part of the infants clothing became caught on the crib
Routley V & Valuri J (1993) Home Injuries *Hazard, Edition No. 14, Victorian Injury Surveillance System*	Australia (Victoria)	Injury surveillance database	135 children under 3 years of age injured in the home	Victorian Injury Surveillance System (VISS) (1989-92)	Emergency department presentations	❑ 90% of children aged less than 3 years with a peak at one year ❑ 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% if the injuries were fractures, primarily to the radius/ulna, clavicle and humerus
Choice (1991a, March) Cot Cases *Australian Consumers' Association*	Australia	Test Report	19 cots, the cheapest model of cot brands, including regular, folding and portable ($65 to $475)		Tests for: ❑ strength ❑ durability ❑ suffocation hazards ❑ entrapment hazards ❑ protrusions	❑ Of the 19 cots tested only one portable cot is recommended and three (2 regular and one portable) are rated acceptable. ❑ 15 out of 19 cots had major safety faults ❑ 4 failed for head entrapment , 10 for limb entrapment and 12 for finger entrapment ❑ 12 had protrusions that were potentially hazardous for head injury and 6 for strangulation ❑ All passed strength and stability testing ❑ 2 of the 12 regular cots failed impact testing ❑ 2 of the 12 regular cots failed drop side testing

Publication	Country	Study Type	Subjects	Setting/Data Source	Measures	Results
Ozanne-Smith J & Heffernan C (1990) Child Injuries Associated with Nursery Furniture *Monash University Accident Research Centre, Report No. 12*	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	❑ 63% of cot-related injuries occurred in the second year of life ❑ 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)
Drake et al (1989) An Arm and a Leg: The Human and Economic Cost of Unsafe Products *Australian Consumers' Association*	Australia	Injury surveillance database and product testing	21 cases of injury, 18 involving falls and 3 entrapments	National Injury Surveillance and Prevention Program (NISPP) and *Choice* product tests (1985 & 1989)	Emergency department presentations and *Choice* product testing	❑ 55% of injured children were aged 1 year ❑ Estimated 280-560 falls from cots and 50-100 entrapments p.a. ❑ Entrapment hazards in 15 or 18 cots tested in 1985 and 8 of 16 in 1989 ❑ Cot sides too low in 7 of 18 cots tested in 1985 and 2 of 16 in 1989. ❑ Of 16 cots tested in 1989, only 1 regular and 1 portable met all the safety requirements of the Standard.

Publication	Country	Study Type	Subjects	Setting/Data Source	Measures	Results
Choice (1989, July) Cots *Australian Consumers' Association*	Australia	Test Report	16 cots (10 regular, 6 portable), the cheapest model from every available brand of cot ($70 to $290). A standard 100mm think density foam mattress was used for testing of regular cots, portable models came with their own mattresses.		Tests for: ❑ safety ❑ stability ❑ durability ❑ ease of use ❑ entrapment hazards ❑ suffocation hazards ❑ protrusions ❑ drop sides ❑ labelling ❑ As per AS2172-1983 for regular cots and AS2195-1978 for folding portable cots	❑ Only two cots recommended (one regular, one portable) and 4 are rated acceptable ❑ Five of the regular cots had bases comprising wooden slats stapled to a frame, if the base was put in upside down, there is a risk the staples and base may come out ❑ 8 failed for limb entrapment and 4 failed for head entrapment ❑ Three of the portable cots did not have locking mechanisms for hinges, legs or bases ❑ Three of the portable cots didn't withstand being pushed or knocked around by outside forces without the cot collapsing
Choice (1985) cited in Choice (1989, July) Cots *Australian Consumers' Association*	Australia	Test Report	18 regular and 6 portable cots			❑ All failed at least one safety requirement

Publication	Country	Study Type	Subjects	Setting/Data Source	Measures	Results
Kraus J (1985) Effectiveness of measures to prevent unintentional deaths of infants and children *Public Health Reports*, Vol. 100, No. 2, pp 231-40	United States (California)	Review of mortality data	1) ❑ 969 deaths from suffocation and strangulation by external cause	1) ❑ California mortality master computer file 1960 to 1981 2) ❑ U.S. 1950, 1960, 1970 and 1980 Census reports for California 3) ❑ Crib sales based on data from the Juvenile Products Manufacturing Association 4) ❑ U.S. Consumer Product Safety Commission	1) ❑ Mortality data: death certificates with following ICD codes - ICD7 (1960-68) E924 & E925 and ICD8 & 9 (1969-81) E913 AND ❑ Coroners reports for cases to verify cause of death 3) ❑ Crib sales used as and indexes of exposure for wedging deaths 4) ❑ Details on hazard reduction countermeasures	❑ 126 infants who became wedged between mattress and bedframe, bedslats or other crib parts resulting in strangulation ❑ 19% of total 498 strangulation involved objects such as pacifier cords or venetian blinds ❑ infants between 6 and 8 months of age are at highest risk of crib strangulation ❑ males are more frequently injured that females (ration of 1.4 to 1; *P = .05*) ❑ Rates per million children aged 0-4 years and ratios per million sales of full sized cribs have not shown any significant changes since 1973 ❑ No evidence of a significant reduction in deaths from mechanical strangulation in cribs since the introduction of the 1973 standard
Baker SP and Fisher RS (1980) Childhood Asphyxiation by Choking or Suffocation *JAMA*, Vol. 244, No. 12, pp. 1343-1346	United States (Maryland)	Case review of Medical Examiner reports	42 cases of asphyxiation or suffocation in children less than 10 years of age	Medical Examiners records for Maryland between 1970 and 1978	Causes of accidental death from asphyxia by food or non food objects or by suffocation	❑ Four infants died when plastic bags in their cribs or playpens pressed against their faces, 2 of which were plastic bags used as mattress protectors

Publication	Country	Study Type	Subjects	Setting/Data Source	Measures	Results
Smialek JE, Smialek PZ and Spitz WU (1977) Accidental Bed Deaths in Infants due to Unsafe Sleeping Situations *Clinical Paediatrics*, Vol. 16, No. 11, pp. 1031-6.	United States (Detroit)	Case study of Medical Examiners reports	Sixteen accidental deaths of infants as the result of unsafe sleeping environments	1) Medical examiners reports for Wayne County Detroit, 1974-75 2) Population data Wayne County (Detroit)	Cause of accidental deaths of infants due to unsafe sleeping conditions	❑ Based on population figures for Wayne County, it is estimated that there are 600 such deaths in the United States each year ❑ Thirteen of the deaths resulted from different modes of asphyxia, two from falls and one from drowning

5. PRAMS AND STROLLERS

This section focuses on nursery equipment designed to allow the transportation of infants and toddlers by caregivers on foot. Such conveyances are known variously as perambulators, prams, strollers, pushers, push chairs, buggies and carriages. For the purposes of this report, however, two general design categories identified in the literature will be referred to:

1. Prams - usually of a more sturdy construction, sometimes collapsible, with larger wheels, designed to allow the infant to lie in a horizontal position
2. Strollers - more often of a collapsible design, with smaller wheels, designed to keep the infant in an upright or semi-upright position

5.1 KEY ISSUES

5.1.1 Scope of the problem

Due to the nature of Australian injury surveillance data, the overall burden of injury arising from the use of prams and strollers in this country is difficult to quantify. The earliest attempt appears to be in a report by the Australian Consumers' Association which estimates the total number of pram and stroller-related injuries in Australia to be between 740 and 1480 per year (Drake et al, 1989). This estimate, which is based on National Injury Surveillance and Prevention Program (NISPP) data, is somewhat imprecise and relies on a number of assumptions about hospital capture rates and rates of injury across the country. Nonetheless it provides a useful context for assessing the importance of pram and stroller-related injuries.

5.1.2 Causes of injury

The major causes of injury associated with the use of prams and strollers appear to be falls and entrapment (Ozanne-Smith & Heffernan, 1990; Couper et al, 1994). Of the 287 cases reviewed by Ozanne-Smith and Heffernan, 215 (75%) were falls and 25 (8%) involved entrapment of a body part. The most common precipitating or 'breakdown' factors referred to in the literature leading to these types of injuries include the following (more than one factor can be implicated in any one incident):

- Deficient, non-existent or inappropriate use of safety harnesses
- Loss of control when negotiating steps or escalators
- Overloading with shopping bags leading to the conveyance tipping over
- Insecure locking mechanism or structural deficiencies leading to collapse of the conveyance
- Inadequate or deficient braking mechanism leading to the conveyance tipping over or getting out of control
- Inadequate or non-existent parental supervision

These findings are consistent with design hazards known to be associated with pram and strollers. For example, various consumer surveys have shown a number of prams and strollers available on the Australian market to be of unstable design and equipped with inadequate harness and locking mechanisms (Choice, 1991b, 1994b). Equally important, however, is the way in which these conveyances are used. In an observational study of 150 strollers in Adelaide shopping malls, Couper et al. (1994) found that only 9% were being used correctly (ie. with a correctly fitting harness and no shopping bags hung on the handles), whereas 40% of children wore loose fitting harnesses, 18% were unrestrained and 80% of stroller handles

carried shopping. These figures emphasise the importance of an approach to injury prevention that includes both design modification and behaviour modification.

5.1.3 Types and severity of injury

In a telephone follow-up study of 23 children presenting to the emergency department at the Royal Children's Hospital, Melbourne as a result of falls from prams or strollers, Watson & Ozanne-Smith (1993) found that all the injuries sustained were to the head (except one case where no injury was detected). Four of these cases required admission to hospital, two for concussion, one for lacerations and one for bruising of the face.

The severity of injuries resulting from prams and strollers is variable ranges from insignificant to fatal. In a review of paediatric autopsy records at the Adelaide Women's and Children's Hospital over the period 1986 to 1995, Byard et al (1996a) found two accidental infant deaths associated with strollers and prams, one from accidental positional asphyxia and the other from hanging. Both infants had moved down towards the front of the conveyance: the younger one fell out when the footplate collapsed and he was found hanging from a metal bar on the side; the older one had partly slipped through the front and was suspended with his head and arms within the conveyance and with his face pushed firmly into the mattress by a horizontal metal bar. The researchers concluded that strollers and prams are a potentially dangerous sleeping environment unless infants are closely supervised, gaps in the front of stroller/prams closed and upright footplates stabilised.

Two recent asphyxiation deaths involving a particular brand of pram (one each in Victoria and New Zealand) have raised questions regarding the adequacy of the current standard AS/NZS 2088-1993 to address fixing of the base cover for structural/support parts of the pram.

In terms of non-fatal injury, Ozanne-Smith and Heffernan (1990) found that, of 287 emergency department presentations to Victorian hospitals associated with prams and strollers, 34 (11.8%) were admitted to a ward, 71 (24.7%) had significant treatment and 62 (21.6%) had minor treatment. According to Ozanne-Smith and Heffernan, these figures rank pram and stroller-related injuries fourth behind those associated with baby exercisers, high chairs and baby walkers in terms of severity. This ranking differs from international data which exclude prams and strollers from the six priority areas set by highest hospitalisation rates, possibly reflecting different patterns of usage from Australia.

Of course, a large proportion of pram and stroller-related injuries do not present to hospital or result in death. Many of these are treated by general practitioners or receive no professional attention and are treated at home. Due to the current limitations of injury surveillance data, however, no comments can be made regarding these cases.

5.2 DESIGN ISSUES

Various checklists regarding design issues for consumers to consider when purchasing prams and strollers have been developed, the most comprehensive of which are from the US Consumer Product Safety Commission and Kidsafe (1992).

The US Consumer Product Safety Commission poses the following questions to 'would be' purchasers of a new stroller or pram:

- Does the conveyance have a wide base to prevent tipping?
- Are seat belts and crotch straps securely attached to frame?
- Is the seat belt buckle easy to use?

- Do the brakes securely lock the wheel/s?
- Is the shopping basket low on the back and directly over or in front of the rear wheels for stability?
- When used in carriage position, can the leg hole opening be closed?

Kidsafe suggests consumers look for the following features:

- A parking device that is out of reach of the child
- A main locking device and at least one other separate automatic safety device to stop the stroller or pram from collapsing
- A child safety restraint on strollers (shoulder harness)
- Permanently attached crotch and waist straps of not less than 20mm
- Straps and fittings attached to the frame so the seat cannot be detached if the straps are pulled
- The buckle must prevent the strap from slipping and must not be able to be operated by the child
- Where the backrest can recline more than 150 degrees to the seat, the stroller should have the shoulder straps or a box-like structure behind the head of the child
- A footrest on strollers to prevent the feet of the child from reaching the ground
- A detachable seat, if included with the stroller, must have the mechanism for detachment out of reach of the child when the seat is in use

Other design considerations not identified by these organisations but mentioned elsewhere in the literature (Couper et al, 1994) include:

- The incorporation of a one-piece bar handle thereby making it difficult to carry shopping bags on handles (not an appropriate design consideration for 'umbrella style' collapsible strollers)
- The incorporation of a parcel tray which increases stability and reduces the need to carry shopping bags on handles (not an appropriate design consideration for 'umbrella style' collapsible strollers)

A further design consideration that is rarely mentioned in the literature but which is implicated in some of the 'breakdown' factors identified above is durability. This factor has been highlighted by the consumer magazine *Choice* as being particular relevant considering the large second hand market for prams and strollers and the common expectation that this type of equipment will last children from birth through their toddler years (Choice, 1991b; Choice, 1994b). Whilst recognising that poor durability is often difficult to judge, *Choice* warns consumers to look for the following indicators:

- Does the frame feel flimsy?
- Do the materials used look as if they would wear out easily?
- Is the design complicated with many pivots points and small parts that could deteriorate quickly?

5.3 INTERVENTIONS

Table 5:1 SUMMARY OF PRAM AND STROLLER INTERVENTIONS

Countermeasure	Proven scientifically	Good potential based on scientific principles	Not yet proven or proven ineffective
Regulation		❑ Voluntary Australian standard to be made mandatory (Choice, 1994b)	
Design changes (general)	❑ Stroller with continuous handle to prevent bags being hung from the handle (Couper et al, 1994) ❑ Parcel tray installed at the base of the unit and longer wheel base to ensure stability when fully loaded (Couper et al, 1994)	❑ Barrier behind child's head when in layback position to prevent the child slipping out of the stroller - lay back stroller not suitable for children under 6 months (Choice, 1994b) ❑ Design that allows for easier negotiation of steps and stairs (Watson & Ozanne-Smith, 1993) ❑ Use of alternative child restraints for infants aged less than 6 months when lying down (harness similar to those used in infant capsules) (Watson & Ozanne-Smith, 1993)	
Design change (full shoulder harness)	❑ Promotion and correct use of a full 5-point shoulder harness could prevent up to 80% of child falls from prams and strollers (Watson & Ozanne-Smith, 1993)	❑ Hiring schemes (Watson & Ozanne-Smith, 1993) ❑ Rebate schemes (supported by appropriate advertising) to encourage the purchase of safe equipment (Watson & Ozanne-Smith, 1993) ❑ Attachment points for the shoulder straps that can be adjusted according to weight and height (Choice, 1994b)	❑ 3-point harnesses which buckle across the waist and incorporate a crotch strap are ineffective in preventing falls to children as young as 9 months (Watson & Ozanne-Smith, 1993) ❑ South Australian study found an 81% non -compliance figure for restraint use (Couper et al, 1994)
Warning labels		❑ Bold warning labels on the back support of the stroller to remind consumers to restrain their child properly (Watson & Ozanne-Smith, 1993)	
Education		❑ Educate caregivers and the public about the safe and correct use of prams and strollers, eg. not overloading the handles with shopping , avoidance of steps and strairs etc (Couper et al, 1994) ❑ Provision of safety information at the point of sale, maternity hospitals and Maternal and Child Health Centres (Watson & Ozanne-Smith, 1993; Ozanne-Smith & Heffernan, 1990; Choice, 1991b) ❑ Information about the safety requirements of second-hand products (Routley & Valuri, 1993)	
Market based		❑ Convince manufacturers and retailers to conform to best practice (ie. Australian standards) (Kidsafe, 1997)	

5.4 STANDARDS

5.4.1 Australia

The following Australian standards are relevant to 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
- AS 3747-1989 Requires a 3-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 backward more than 15 degrees

The main requirements of AS/NZS 2088:1993 are as follows:

- a parking device
- a main locking device and at least one other separate automatic safety feature
- a permanently attached harness (shoulder, waist and crotch straps). Specified size: Crotch straps 20mm; Shoulder straps 15mm.
- straps and fittings attached to frame
- a buckle to prevent strap slipping and not able to be operated by child
- a footrest on stroller
- a detaching mechanism for seat not quick-release and out of reach of child
- no sharp edges or points, or projections which could be broken off
- shoulder straps or box like structure behind head of child if backrest declines more than 150 degrees
- informative labelling:
    a) name of manufacturer
    b) warnings and instructions for safe use
    c) recommended are for strollers (not recommended for children under 6 months)
    d) details of maximum loading

5.4.2 International

The following international standards are relevant to prams and strollers:

- BS 7409:1996 (British) Specification for safety requirements for wheeled child conveyances. Conveyances carrying more than one child.
- DIN 66068-1:1989 (German) prams, push-chairs, carry cots; dimensions, safety requirements
- DIN 66068-2:1989 (German) prams, push-chairs, carry cots; test methods
- ASTM F833-95a (US) Carriages and strollers
- pr EN 1888 (Preliminary European) Child care articles - Wheeled child conveyances

5.5 RECALLS

Prams and strollers are the subject of product recall proceedings as is any other product produced in mass quantities. Examples of reasons for the recall of prams and strollers in the US market include:

- faulty restraint buckles and fold locks
- inadequate braking mechanisms
- defective recline brackets that could cause finger tip fracture, laceration or amputation

In the final example cited above the company agreed to pay the Consumer Product Safety Commission $100,000 to resolve allegations that it failed to report a defect in one of its products in accordance with that country's consumer product safety legislation.

Three strollers have been recalled in this country since 1987. Two involved entrapment hazards - in the first instance, some strollers of one model did not have a safety catch fitted causing collapse and, in the other, an opening was apparent when the seat reclined which may have allowed a child's head or body to protrude. In the third case, the buckle on the harness may have been faulty resulting in it releasing under minimal pressure.

Table 5:2 SUMMARY OF LITERATURE - PRAMS AND STROLLERS

Publication	Country	Study Type	Subjects	Setting/Data source/ Measures	Results
Byard et al (1996a) Accidental infant death and stroller-prams. *Med J Aust*, Vol 165, pp. 140-141.	Australia (SA)	Case reports	2 cases of stroller/pram-related infant death	❑ Death-scene investigations ❑ Autopsy findings ❑ Event reconstruction	❑ Stroller/prams are a potentially fatal sleeping environment unless infants are closely supervised, gaps in the front of conveyance are closed and upright footplates are stabilised
Couper et al (1994) Stroller safety. *Med J Aust*, Vol 160, pp.335-338.	Australia (SA)	❑ Injury surveillance data ❑ Observational survey ❑ Safety feature testing	❑ 200 cases of stroller and pram-related injuries ❑ 50 strollers at 3 economically diverse Adelaide shopping malls ❑ 23 models from 7 Adelaide retailers	❑ Age of child in months, agency on injury, type of injury and admission status ❑ Presence of shopping bags placed on the handles and admission status ❑ A variety of safety features, the propensity of the stroller to tip	❑ 149 injuries, 56% of which required treatment and 7% of which required admission ❑ 9% of strollers were used correctly (ie. children appropriately harnessed and no shopping handles) ❑ 5 strollers tipped over while carrying an 8kg load when a 5kg shopping bag was placed on their handles; 1 tipped when a 2kg weight was applied on a 12 degree slope
Routley & Valuri (1993) Home Injuries. *Hazard*, Vol 14, pp 1-14.	Australia (VIC)	VISS (1989-1992)	114 children (under 3 years of age) injured in the home	❑ Emergency department presentations ❑ Injuries in the home	
Watson & Ozanne-Smith (1993) The use of child safety restraints with nursery furniture. *J Paed Child Health*, Vol 29, pp. 228-232.	Australia (VIC)	Follow-up telephone survey of children who fell from prams or strollers	37 children under 3 yrs	❑ 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%)

Publication	Country	Study Type	Subjects	Setting/Data source/ Measures	Results
Ozanne-Smith & Heffernan (1990, March) Child injuries associated with nursery furniture. Monash University Accident Research Centre.	Australia	Injury surveillance database	287 cases of pram and stroller-related injuries to children under 3 yrs	❑ Emergency department presentations ❑ Injuries associated with nursery furniture	❑ 75% of injuries were fall-related ❑ of these 11% involved the pram tipping or falling, suggesting problems with stability of design ❑ steps, strairs or escalators involved in 7% of cases ❑ failure to use an appropriate child restraint was a major factor associated with injury risk ❑ 12.2% hospital admission rate (includes deaths)

6. BABY WALKERS

6.1 KEY ISSUES

Baby walkers generally consist of a seat with leg openings, a supporting rigid frame attached to a base with wheels, and often, a plastic feeding or play tray (Committee on Injury and Poison Prevention, 1995; Weiss, 1996). They are designed to support a perambulatory infant, and allow mobility while the infant is learning to walk (Committee on Injury and Poison Prevention, 1995). It has been estimated that a baby walker can cover 1m in 1 second (Lang-Runtz, 1983), outpacing the reaction time of an occupied parent (Stoffman et al, 1984). Access to steps, stairs and other changes in level or surface are the most common hazards for infants in walkers. The postural support of the walker also allows infants to reach heights far beyond their natural capability and therefore other hazards, such as hot ovens, heaters, irons, kettles and poisonous substances become accessible (Laffoy, 1995; Inwood & Downer, 1989; CPSC, 1994a). It is this advanced degree of mobility, speed, height, and freedom of movement, at an age when the baby is not developmentally ready, that contributes to the high frequency and often seriousness of injuries associated with baby walkers (Petridou, 1996; Thein et al, 1997; Laffoy, 1995; Gleadhill et al, 1987).

Attitudes to baby walkers

It is also the attitudes and knowledge of caregivers using baby walkers, that increase the dangers associated with this product. Some studies have found that despite previous accidents, up to 76% of parents continue to place their infants in baby walkers (Boudreault, 1995; Rieder et al, 1986; Stoffman et al, 1984; Fazen et al, 1982; CPSC, 1994a). Rieder et al (1986) found that of infants who sustained a serious baby walker injury, only one third of families stopped walker use immediately, another third stopped use within 2 months (usually because infants began walking on their own) and the remaining third were still using a walker 2 months after the injury. Other studies however, suggest that some parents may change behaviour after a baby walker-related incident (Morrison et al, 1996; Thein et al, 1997).

It appears that some parents or caregivers may use baby walkers as a substitute for supervision (Thein et al, 1997). Many parents state that baby walkers are a place to put the child, or help manage the child when they are occupied (74%: Boudreault, 1995; 76%: Trinkoff and Parks, 1993; CPSC, 1994a), and even that they are most useful in a babysitting capacity (29.5%: Reider et al, 1986). Other perceived functions of baby walkers include: keeping the child happy/quiet/entertained/occupied; helping the child exercise; giving the child freedom and providing a feeding place (Boudreault, 1995; Trinkoff and Parks, 1993; Reider et al, 1986; Board of Trustees, 1991; Stoffman et al, 1984; CPSC, 1994a).

Developmental issues

Many parents are also under the impression that baby walkers facilitate the onset of walking in their infant (Reider et al, 1986; Stoffman et al, 1984; Trinkoff and Parks, 1993). The name baby walker itself, suggests such a benefit. Some manufacturers in the USA are reinforcing the belief that walkers promote the onset of walking in their advertisements, with slogans such as “our training wheels for tots” (Trinkoff & Parks, 1993). It has been shown, however, that baby walkers are of no benefit to development or locomotion, and they do not help the child learn to walk earlier (Kauffmann & Ridenour 1977; Mayr et al, 1994). Some studies have even suggested that they may adversely effect the development of normal gait patterns (Kauffmann & Ridenour, 1977; Crouchman, 1986; Thein et al, 1997). A recent study found that infants who used the walker longer than one hour per day, on average, had an elevated risk of having an abnormal or questionable development score and a gross motor delay compared to those who used the walker for less than one hour per day (Thein et al, 1997). These parents were subsequently advised not to place their baby in a walker, and at a two month follow up, all infants had reverted to normal

development (Thein et al, 1997). Although this abnormal gait is probably a transient phenomenon in a developmentally normal baby (Rieder & Newman, 1987; Committee on Injury and Poison Prevention, 1995), this may not be the case in neurologically compromised children (Holm et al, 1983; Inwood & Downer, 1989). For premature infants, walkers seem detrimental to normal development. Due to the postural support offered by the walker, the child fails to sit erect, the muscles are not exercised, poor trunkal tone develops and protective responses are diminished (Inwood & Downer, 1989). Thus, it is clear that walkers do not provide appropriate exercise for the baby, and that infants do not learn to walk faster or better with a walker.

6.1.1 Scope of the problem

Rates and numbers

Baby walkers have been ranked (based on emergency department data), as the third most common cause of accidents to 7-14 month olds (Mayr, 1994), and the third most common cause of head injuries to infants less than 24 months (Partington et al, 1991). The CPSC's National Electronic Injury Surveillance System (NEISS) in the US, shows that the rate of baby walker injuries (per 1000 walkers) has steadily increased since 1984, and the absolute numbers of injuries have increased 12% between 1993 and 1994 (CPSC, 1994a). The rates increased from 4.6 per 1,000 live births in 1982 to 6.9 per 1,000 in 1991 (Weiss, 1996). A Virginia based study reported that the annual incidence of walker-related injuries resulting in an emergency department visit was 8.9 per 1,000 infants <1 year of age, and the incidence of serious injuries was 1.7 per 1,000 (Chiavello et al, 1994).

According to NEISS, around 25,000 children in the US, almost all between the ages of 5 and 15 months, are treated in hospital emergency departments with baby walker-related injuries each year (CPSC, 1994a; Committee on Injury and poison prevention, 1995). Population surveys suggest that there may be as many as 10 times more injuries which are treated in physician's offices or do not require medical attention (Stoffman et al, 1984). Baby walker-related emergency department visits are estimated to cost the US $90,000,000 annually (Committee on Injury and poison prevention, 1995). Almost 10 years ago, baby walker-related injuries were estimated to cost Canada's health care system more than $2 million annually (James, 1988; Inwood & Downer, 1989).

The CPSC is aware of 11 baby walker-related deaths occurring between 1989 and 1993 (CPSC, 1994a). They stress that this figure is probably an undercount of these fatalities as the deaths reported to CPSC do not represent a statistical sample of known probability of selection, nor do they include all relevant deaths that may have occurred during this period (Boudreault, 1995). Four of these deaths were due to drowning (in a pool or toilet), 4 from suffocation (compression of the neck against the feeding tray) and 3 from falls (CPSC, 1994a). Chiavello et al (1994) reported one death in their Virginian study, and recently, a death occurred in Singapore (Thein et al, 1997).

Exposure

The annual US production of baby walkers is estimated at almost 2 million units per year, (cited in Weiss, 1996). In Australia, an estimated 40,000 baby-walkers are imported each year (Hewitt, 1994).

The Australian Bureau of Statistics (ABS) completed a Home Safety Survey in Melbourne in 1992, (published 1993) and found that 30% of all households with children under the age of one year possessed a baby walker, whilst 19% had a baby walker in use. This represents 13,900 baby walkers in Melbourne for this age group, with 8,900 in use. Only 30% of those with baby walkers in use, claimed to have stair guards or gates at the top and bottom of the steps/stairs. Figures from Greece, Ireland, Austria, England, Singapore, and USA, suggest that a much higher proportion of families use baby walkers overseas than in Australia (Board of Trustees, 1991; Laffoy et al, 1995; Mayr et al, 1994; Petridou et al, 1996; Stoffman et al, 1984; Thein et al, 1997; Trinkoff & Parks,

1993). The lowest proportion reported for these countries was 55% (Laffoy et al, 1995; Mayr et al, 1994), with the highest being 90% (Thein et al, 1997). The proportion of baby walker use in households where the head or spouse of the household head was from a non-English speaking background, was also found to be higher in the ABS Melbourne survey.

According to the ABS survey (1993), the ownership of high chairs and prams/strollers is higher than that of baby walkers. Yet Australian figures show that baby walker-related injuries are more common than injuries from prams, strollers, high chairs, cots and changing tables (Moller, 1994). Williams (1994) reported that the risk of injury from baby walkers is 4.4 times higher than the risk of injury from prams/strollers, and 3.8 times higher than the risk of injury from high chairs, (and these figures are considered to be under-estimates).

Studies have found that between 12.5% and 40.0% of infants using baby walkers have an accident (Laffoy et al, 1995; Mayr et al, 1994; Stoffman et al, 1984; Thein et al, 1997; Board of Trustees, 1991), with infants using the walker > 2 hours per day, at greater risk than those using it < 1 hour per day (Thein et al, 1997). Victorian hospital based figures estimate a risk of 1 in 192 baby walkers causing significant injury to children under 1 year of age, with this estimate increasing to 1 in 96 when general practitioner data is included (Ozanne-Smith & Brumen, 1993). Although many of the injuries sustained are minor, the potential for serious injury is always present (Laffoy, 1995).

6.1.2 Causes of injury

The majority of baby walker-related injuries are caused by falls, either from the walker, or while the infant is still in the walker (Committee on Injury and Poison prevention, 1995; Ozanne-Smith & Heffernan, 1990). Steps and stairs are the major cause of these falls, and are implicated in up to 95% of baby walker-related injuries (Boudreault, 1995; Chiavello et al, 1994; Committee on Injury and Poison Prevention, 1995; CPSC, 1993, 1994a; Mayr et al, 1994; Ozanne-Smith & Brumen, 1993; Ozanne-Smith & Heffernan, 1990; Partington et al, 1991; Petridou et al, 1996; Reider et al, 1986; Wellman & Paulson, 1984). Most studies found stairs contributed to around three quarters of baby walker-related injuries. Whilst it may be suggested that these accidents are stair-related and not walker-related, data indicates that over 90% of all stairwell injuries among infants less than 12 months of age, are related to the use of walkers (Board of Trustees, 1991; Reider et al, 1986).

Smaller numbers of baby walker-related injuries are caused by walker tip-overs (Boudreault, 1995; Chiavello et al, 1994; CPSC, 1994a; Mayr et al, 1994; Ozanne-Smith & Heffernan, 1990), burns (Boudreault, 1995; CPSC, 1994a; Chiavello et al, 1994; Ozanne-Smith & Brumen, 1993; Ozanne-Smith & Heffernan, 1990; Petridou et al, 1996; Reider et al, 1986; Wellman & Paulson, 1984; Williams, 1994), poisonings (CPSC, 1994a; Gaudreault et al, 1986; Ozanne-Smith & Brumen, 1993; Ozanne-Smith & Heffernan, 1990), and other mechanisms (such as slipping through the seat of the walker, colliding with objects, pulling objects onto themselves, climbing on walkers, pinching fingers and toes etc) (CPSC, 1994a; Boudreault, 1995; Ozanne-Smith & Brumen, 1993; Ozanne-Smith & Heffernan, 1990; Reider et al, 1986).

6.1.3 Type and severity of injury

The head, face and to a lesser extent, neck, are the body parts most frequently injured (Boudreault, 1995; Chiavello et al, 1994; Mayr et al, 1994; Ozanne-Smith & Brumen, 1993; Petrodiou, 1996; Wellman & Paulson, 1984), with only small numbers of injuries involving extremities (Boudreault, 1995; Chiavello et al, 1994). This is understandable given the walker's design. The frame of the walker surrounds most of the infant's body, leaving the head as the protruding body part in most falls (Chiavello et al, 1994; Petridou et al, 1996).

Approximately three quarters of baby walker-related injuries are considered "less severe", and include injuries such as lacerations, contusions, abrasions, hematomas, punctures, sprains or

strains (Board of Trustees, 1991; Boudreault, 1995; Chiavello et al, 1994; CPSC, 1994a; Committee on Injury and Poison Prevention, 1995).

The US reports that the proportion of "more severe" injuries related to baby walkers is similar to that of other commonly used juvenile products, such as cribs, playpens, high chairs and changing tables (CPSC, 1993).

About one quarter to one third of baby walker-related injuries are considered "more severe" or serious (Boudreault, 1995; Chiavello et al, 1994; Committee on Injury and Poison Prevention, 1995; CPSC, 1993, 1994a). These injuries include concussion, fractured skulls, intracranial hemorrhages, burns and internal organ injuries (Boudreault, 1995; Chiavello et al, 1994; Committee on Injury and Poison Prevention, 1995; CPSC, 1994a; Mayr, 1994). The majority of serious injuries are head injuries resulting from infants in walkers falling down stairs (Board of Trustees, 1991; Chiavello et al, 1994; CPSC, 1994a; Reider, 1986). It has been suggested that walker-related stairway falls predispose children to more severe injuries than other stairway falls, (DiMario, 1990; Partington et al, 1991), as the walker increases the mass of the falling child, and gives them a higher initial velocity. Infants also tend to remain in the walker as it falls. This results in the head being the largest exposed and unprotected part, and therefore increases the likelihood of it coming into contact with other objects (Partington et al, 1991). The mechanism of the fall down stairs also differs for babies in walkers. The bouncing of a walker down steps may result in an initial backward thrust of the head as the walker descends the steps followed by a forward head thrust. This is in comparison to the milder "tumbling" experienced by babies falling down stairs independent of walkers (CPSC, 1994a). One study reported that skull fractures resulting from these falls required up to 14 days of hospitalisation (Reider et al, 1986).

Smaller numbers of serious baby walker-related injuries are caused by burns (Chiavello et al, 1994; CPSC, 1994a; Reider et al, 1986). A serious case occurred in Liverpool when an infant in a walker tipped backwards into an open fire. The infant sustained full thickness burns over two thirds of his scalp, and underwent seven major surgical procedures (Gleadhill et al, 1987). The scenario of infants accessing hot objects normally out of reach, is more common, as depicted by a recent death that occurred in Singapore. A 6 month old baby was put in a walker in the living room, and the mother left the room for a few minutes. "The baby in the walker wheeled himself into the kitchen, pulled the porridge pot, which was on the fire, and was scalded. The baby was rushed immediately to hospital, but died a few days later" (Thein et al, 1997).

6.2 DESIGN ISSUES

A number of issues need to be addressed in order to develop safer baby walker designs.

6.2.1 Preventing falls down steps and stairs

Manufacturers need to address the primary hazard of babies toppling down stairs in their walkers. Four major designs have been suggested (CPSC, 1994a).

Walkers with a "wheel stop" mechanism

In the US and Australia, designs are now available with automatic wheel stop mechanisms, where if one wheel drops off the riding surface (such as a step), a second wheel retracts, causing the base ring to drop, grip the floor surface, and restrict further mobility of the walker (CPSC, 1994a). Such a modification remains to be evaluated, as in the US this product was discontinued due to limited sales. It is also suggested that if the one or more of the wheels are already in the air, gravity would carry the child and walker down the stairs (Committee on Injury and Poison Prevention, 1995), however, this would depend on the speed and strength of the gripping mechanism. The new ASTM standard specifies a test to determine the effectiveness of a walker stopping once passing over a platform (ASTM: F 977-96). Walkers with wheel stop mechanisms would provide all the utility and features of traditional baby walkers (CPSC, 1994a).

Wide base walker

The main aim of a walker with a wider base, is to prevent injuries that result from the passage through doorways leading to falls down stairs or steps. Results of one study suggest that 82% of stairway accidents may be prevented with a walker greater than 36 inches (Boudreault, 1995). This would add approximately 6 to 10 inches to the diameter of walkers currently on the market (CPSC, 1994a). The problem with this design, is that may be too big to fit between furniture in most households, and too large for convenient storage or transportation (CPSC, 1994a). Consumers may see the device as unwieldy and unacceptable (Committee on Injury and Poison Prevention, 1995; Ozanne-Smith & Brumen, 1993). As previously mentioned, the standard for a wider base in Canada, had the same effect as a defacto ban. It also doesn't address the issues of walkers going through large patio doors, or bringing child too close to plants or hot beverages on tables, or falling down stairs that are not guarded by a door (James, 1988).

Walkers with mobility limited to a confined space

These walkers would allow children to walk, clockwise or counter-clockwise around the circumference of a 36 inch stationary base. In one US design, the child can also rotate the seat 360 degrees (CPSC, 1994a). Other designs may include pivot points and adjustable control arms that convert traditional walkers into tethered walkers. The child can travel in a circle around the weighted central pivot point, and the control arm can be adjusted to increase or decrease the circumference of the walker's path (CPSC, 1994a).

"Stationary" walkers

These include designs with treadmills upon which the infant can walk, (Committee on Injury and Poison Prevention, 1995), and those that allow the infant to bounce up and down and/or rotate 360 degrees (CPSC, 1994a). Theoretically, walkers with limited mobility or stationary alternatives could address almost all risks associated with baby walkers, however, these have not been available long enough to compile data on injury rates.

6.2.2 Preventing pinching, scissoring, shearing or amputation of digits

- The older X frames can unexpectedly collapse, causing scissoring of body parts in the frames (Chiavello et al, 1994). Other designs apart from x-frame designs should be used (CPSC #4200)
- Coil springs that have spaces greater than 0.125 inches when fully extended should be covered (16 CFR 1500.86 (a) 4; CPSC, 1994a; CPSC #4200).
- Any holes, slots, cracks, open ended tubes greater than 0.125 inches in diameter or width should be guarded (16 CFR 1500.86 (a) 4; CPSC, 1994a; Kidsafe, 1992).
- Walkers that fold or can be adjusted to various heights should have a locking system to prevent the walker from accidentally folding or collapsing during use. This locking mechanism should be out of reach of the child in the walker. There should also be a secondary safety catch on adjustable walkers (Kidsafe, 1992).

6.2.3 Preventing tip-overs

- The diameter of the castor wheels should be at least 50mm: wide wheel base for stability (Kidsafe, 1992; CPSC #4200)
- The wheels should not lock sideways (Kidsafe, 1992)
- The walker should remain stable so that it will not overturn during normal use (Kidsafe, 1992)

6.2.4 Preventing other injuries

- Metal parts of the walker should be free of rough surfaces and sharp edges, corners, points and projections (Kidsafe, 1992)
- All joints should be smoothly finished and all parts rigidly constructed (Kidsafe, 1992)
- The seat should not show visible distortion, tearing or, other faults when a child up to 12kg uses the walker. The seat should be securely attached to the frame or walker (CPSC #4200). If it is held in place by a fastening device, the device should be designed so that accidental separation cannot occur (Kidsafe, 1992).
- Designs which reduce the speed of baby walkers have also been suggested (Trinkoff & Parks, 1993). The Canadian standard suggested that the walker should not be able to attain a speed of more than 1 metre per second on a 12-degree incline. This design consideration would reduce the "crash forces", as well as incidents that occur because the child moves too quickly for a nearby adult to prevent the accident (Boudreault, 1995).

6.3 INTERVENTIONS

6.3.1 Product ban

This measure should be considered as a longer term solution to baby walker injuries. In Canada, despite the fact that walkers are no longer sold, injuries associated with their use continue (Morrison et al, 1996). Their survey showed that most of the walkers were second hand, with smaller numbers having been purchased in America. Other studies have also found that many of the walkers owned are hand-me-downs or are bought used (Boudreault, 1995; Reider et al, 1986). The durability of baby walkers suggests that incentive driven recall campaigns should also compliment product bans (Reider et al, 1986).

6.3.2 Mandatory standards

Current mandatory standards do appear to be effective. Since the introduction of the mandatory US standard in 1971 (16 CFR 1500.86 (a)4) pinching and shearing injuries, and finger and toe entrapments and amputations are rare (Chiavello et al, 1994; Committee on Injury and Poison Prevention, 1995). It is crucial though, that these standards specify more than just labelling and instructional requirements. They must also address the serious problems of falls down stairs, as well as burns and poisonings.

6.3.3 Voluntary standards

It is generally considered that a voluntary set of regulations to make walkers safer are not enough (Inwood & Downer, 1989). CPSC data indicates that in spite of the existence of a voluntary walker safety standard, injuries related to walker use continue to occur in large numbers (Trinkoff & Parks, 1993). The use of voluntary standards, in contrast to a mandatory standard, may contribute to the high level of walker-related injuries (Trinkoff & Parks, 1993). Others suggest that even voluntary standards undoubtedly improve safety margins, although they do not present evidence to support this view (Gleadhill et al, 1987). The same authors, reported an investigation of baby walkers by the Trading Standards Department, which found that none of the models examined complied fully with the standard. Compliance with voluntary safety standards obviously depends on the benefits and costs involved. Labelling requirements, for example, involve little cost and effort, both of which may be outweighed by the benefit of indicating compliance with a voluntary safety standard. In line with this proposition, US data suggests that most manufacturers comply with the voluntary labelling requirements (CPSC, 1994a). However, these labels may not be in view when the walker is in use (Trinkoff & Parks, 1993), and may not be legible after a period of time (Boudreault, 1995).

6.3.4 Education

Most reports suggest that warnings and education do not influence the use of baby walkers. Despite previous accidents, even serious ones, many parents continue to place their injured child or subsequent siblings in baby walkers, often without taking further safety precautions (Boudreault, 1995; Committee on Injury and Poison Prevention, 1995; CPSC, 1994a; Fazen et al, 1982; Kidsafe, 1994; Rieder et al, 1986; Stoffman et al, 1984). Fewer studies suggest that some parents may change behaviour after a baby walker-related incident, or parent education talks (Morrison et al, 1996; Thein et al, 1997). Thus, whether public education produces any real benefit or not remains a matter of some contention. It is suggested that such efforts may have longer term effects, including heightened awareness among health care workers and, perhaps the public (Gleadhill et al, 1987).

6.3.5 Increased vigilance

Some reports suggest that increased supervision is still powerless in preventing injuries (Boudreault, 1995; Scott, 1994). Many accidents still occur despite the caregiver being in the same room or area as the child (Boudreault, 1995). Parents state they looked away momentarily or were distracted by another child and in that brief period, the incident occurred. In other cases, parents could see an accident about to occur, but the child moved too quickly for them to prevent it.

6.3.6 Instructions and warning labels

Labelling and instructions alone do not appear to be effective at reducing the risk of baby walker-related injuries, and should only be used in conjunction with product modifications (Boudreault, 1995; CPSC, 1994a). In NSW, despite the use of warning labels on walkers since 1978, unacceptable rates of injuries are continuing (Kidsafe, 1994; Ozanne-Smith & Brumen, 1993). Other reports also suggest that warning labels are not effective (Boudreault, 1995; Committee on Injury and Poison Prevention, 1995; CPSC, 1994a; Mayr et al, 1994). In particular, Boudreault (1995) found that of the parents whose infant fell down stairs in a walker, 21% reported that their walker had a stairs warning label, yet did not report any precaution such as a closed door, latched gate or other restraining item in use. Also, although warning labels urge parents to supervise their children in walkers, many injuries occur when children are left alone in the room, or when parents in the room are momentarily distracted (Committee on Injury and Poison Prevention, 1995).

6.3.7 Responsible retailer approach

In 1995, the then Federal Consumer Affairs Minister, The Hon Jeanette McHugh, wrote to more than 350 nursery product retailers asking them not to sell baby walkers (Choice, 1995a). As a result of this, many had undertaken not to sell them (The Age, 1995). Myer and Grace Bros ceased ranging baby walkers in about 1992 (Scott, 1994). In November 1995, a Victorian Injury Surveillance Survey of 13 major retail outlets in a cross section of Melbourne suburbs, found that several other chains (Target, K-Mart and Toys R Us) had also withdrawn baby walkers from sale, as had some specialist nursery furniture retailers (Cassell et al, 1995). Two of the 5 specialist nursery furniture retailers that still sold baby walkers reported that they only stocked models which they perceived to have special safety features (eg, eight wheels and a high padded back or wheels that could be locked). These results suggest that this method may be effective.

6.3.8 Stairway gates

Stair gates do not abolish the risk of walker injury, especially if infants are not watched with vigilance (Reider et al, 1986). Many baby walker-related falls down stairs occur despite the presence of a gate at the top of the stairs (Boudreault, 1995; Reider et al, 1986). This is commonly because the gate is left open by a parent, sibling, or other child, or the gate is not properly latched (so the child can push it open).

6.4 STANDARDS

6.4.1 United States

Both mandatory and voluntary standards regarding baby walkers exist (Committee on Injury and Poison Prevention, 1995).

- 16 CFR 1500.86 (a)4: Mandatory standard that has been in effect since 1971. This standard primarily addresses injuries to digits caused by scissoring, pinching or shearing in the frame of the walker and by collapse of the walker (CPSC, 1994a; Committee on Injury and Poison Prevention, 1995).
- ASTM: F 977-96. Standard Consumer Safety Performance Specification for Infant Walkers: Voluntary standard (compliance is not monitored). Addresses seating systems, folding mechanisms, and the more difficult problem of tipovers and falls down stairs. It outlines stability tests for tipping resistance against immovable objects and occupants leaning over the edge. It also details forward, sideways and rearwards facing step tests. In addition, instructional literature must accompany the walker, and one or more warning labels must be attached to the walker. A stairs warning label reading "WARNING: Avoid serious injury. NEVER use near stairs" shall be on each product. Although the CPSC recommended revision to the label in 1994, telling consumers to block stairway openings, rather than to tell them never to use walkers near stairs, the wording of that used in the earlier (1989) standard was not changed.

6.4.2 Canada

A voluntary safety standard was published by the Canadian Juvenile Products Association in June 1989 which attempted to deal with the problem of walkers falling down basement stairs. The standard, required that the walker base was at least 900mm (35.4 inches), which is larger than the standard basement door opening. This standard had the same effect as a ban of the sale of baby walkers, because manufacturers were not willing to redesign the walker for the relatively small number of sales in that country, and Canadians could easily obtain walkers from America (Committee on Injury and Poison Prevention, 1995; CPSC, 1994a). The standard also included: regulation details on labelling and instructions; height and weight limits for children using the walker; speed limits (no more than 1 metre per second on 12-degree incline); tip tests and safeguards to prevent fingers from being caught in latching mechanisms.

6.4.3 Britain

BS 4648 Voluntary safety standard by the British Standards Institution, recommends that safety warnings be placed on both the packaging and the product instruction sheet of baby walkers. These instructions should include specific advice about never leaving the infant unattended and never using the device near steps, stairs, domestic fires or hot appliances. The standard also recommends that a safety warning be inscribed or stamped in permanent bold red lettering on a white background on the baby walker itself (WARNING: NEVER LEAVE YOUR BABY ALONE IN THIS WALKER). The standard also has basic tests for the static and moving stability of the walker. There is no obligation for designers or manufacturers of baby walkers to comply with the recommendations of the BSI, nor on the part of the retailers to ensure they have been met.

6.4.4 Europe

prEN 1273: 1993. Child care articles- Baby walking frames- Safety requirements and test methods. This standard addresses entrapment hazards, sharp edges and corners, stability, strength and folding mechanisms of baby walkers.

6.4.5 NSW, Australia

On 1st September, 1978, legislation was passed under the Consumer Protection Act (Section 39E (1)) that baby walkers must have the following words permanently displayed in upper case: "**CAUTION**: BABIES CAN MOVE FREELY IN THIS PRODUCT. MAINTAIN CAREFUL SUPERVISION. DO NOT ALLOW NEAR FIRES, RADIATORS OR STAIRWAYS.

6.5 RECALLS

United States data from the CPSC website indicates that there were at least five baby walker-related recalls from August 1990 to October 1992 (# 92-33; #90-144; #91-39; #A93-04; #96-177). Three walkers were recalled because small parts (labels, steering wheel horns, and music buttons from the plastic tray) could break off the walker and cause ingestions or choking hazards (# 92-33; #90-144; #91-39). Another walker was recalled because it could collapse (due to the brackets that hold the baby walker in position breaking) (#A93-04).

Two Australian recalls of baby walkers were identified. Both occurred in 1991. In both cases, the seat may have detached causing a fall and a rattle attached to the walker could have broken releasing small parts and posing a choking hazard.

6.6 SUMMARY OF RECOMMENDATIONS FROM THE LITERATURE

6.6.1 Product ban

- Prior to the emergence of baby walker designs and performance standards for prevention of falls down steps, a number of organisations called for product bans (Choice, 1995a; Committee on Injury and Poison Prevention, 1995; Laffoy, 1995; Ozanne-Smith & Brumen, 1993; Partington et al, 1991; Reider et al, 1986; Trinkoff & Parks, 1993). It is expected that the health outcome of this measure would be almost entirely positive, with the only cost to parents and care givers of increased demands to stimulate the child by other means (Ozanne-Smith & Brumen, 1993). There are, however, some legal impediments to a product ban, as some people consider that it is inappropriate use, rather than the product itself, that is unsafe, (Biggs, 1995; Cassell et al, 1995; Scott I, 1994; Stone, 1992.).

6.6.2 Product recalls

- If new safer designs of baby walkers are introduced, there is still a need to prevent injuries from older designs of baby walkers. Incentive driven recall campaigns to retrieve circulating baby walker should compliment product ban (Reider et al, 1986). However, this could be difficult to administer (Ozanne-Smith & Brumen, 1993).
- Community programs should be developed to encourage proper disposal of walkers so that they can be destroyed and the materials recycled (Committee on Injury and Poison Prevention, 1995)

6.6.3 Design change

- Improve the design of current walkers to prevent the potential for injury (see design issues above) (Biggs, 1995; Trinkoff & Parks, 1993). Current U.S. designs, other potential designs discussed above, and the 1996 ASTM standard overtake many of the design problems of earlier walkers. These design changes have excellent potential for reducing or eliminating many of the baby walker-related injuries caused by traditional baby walkers.
- Design changes should be supported by mandatory standards (Ozanne-Smith & Brumen, 1993).

6.6.4 Development of standards

- Develop a baby walker standard (preferably mandatory) for manufacturing safer baby walkers (Biggs, 1995; Gleadhill et al, 1987; Petriodou et al, 1996). This should be based on overseas standards, problems identified in the literature, and potential new designs.
- Adopt a mechanism for compliance of this standard (Trinkoff & Parks, 1993)

6.6.5 Education

- All health professionals should inform parents and caregivers of the potential risks associated with baby walkers, and stress that their use is not a substitute for supervision of their children (Committee on Injury and Poison Prevention, 1995; Inwood & Downer, 1989; Partington et al, 1991; Petriodou, 1996; Reider et al, 1986). They should also inform them of the lack of benefits of baby walkers, particularly for enhancing co-ordination (Stoffman et al, 1984), and strongly discourage their use (Committee on Injury and Poison Prevention, 1995; Laffoy, 1995).
- An aggressive public education campaign, highlighting the dangers of baby walkers and discouraging their use is needed (Laffoy, 1995; Reider et al, 1986).
- Ongoing community education is recommended, and brochures on the matter should be developed for maternity hospitals, ante-natal clinics and community centers (Choice, 1993a).

6.6.6 Instructions and warning labels

- At the very least, a statement concerning the risks of walker-related injuries should be enclosed with every walker sold (Reider et al, 1986).
- All walkers should carry Government health warnings, labels, or swing tags to alert anyone buying a baby walker to the dangers associated with unsupervised use. (Laffoy, 1995; Choice, 1993a).
- Labels must be positioned in a prominent place, so that they can be seen at all times while the walker is in use.

6.6.7 Responsible retailer approach

- Encourage retailers not to stock baby walkers, thereby reducing or eliminating baby walker sales.

6.6.8 Safety checklists

- Parents should consider the key design issues highlighted above (derived primarily from the Kidsafe Furniture: A Safety Guide brochure, 1992) when purchasing a baby walker.

6.6.9 Safe Practice

(from CPSC, 1993; CPSC #5082; CPSC #4200; Kidsafe, 1992; Ozanne-Smith & Heffernan, 1990; Restel, 1987; Stoffman et al, 1984;Trinkoff & Parks, 1993).

- block off stairways and exit doorways (place gates or guards at top of stairs and close doors) and access to them
- avoid areas where there are uneven floors (such as carpet edges, throw rugs, or raised thresholds) or objects (electrical cords that may cause the walker to tip over)
- clear away objects (such as kettles, pots, irons and poisonous substances) on tables, countertops, or stove tops that a child in a baby walker might be able to reach
- to avoid burn injuries, don't let child use a baby walker near stoves, heaters, or fireplaces

- after putting a child in a baby walker, watch the child constantly because a child can move very fast in a baby walker
- do not use walkers as baby sitters; closely supervise at all times
- do not carry the walker with a child in it
- make sure the child's feet can touch the floor when placed in the walker
- children who cannot sit up without assistance must not use a walker
- the child's weight must not exceed the manufacturer's recommended maximum
- once the child can walk unaided, the walker should not be used
- do not use the walker if it becomes damaged or broken
- do not use the walker as a push-along toy
- put the walker away when it is not in use
- parents should use a crib or playpen when it is necessary for the infant to be out of their sight

Table 6:1 SUMMARY OF LITERATURE - BABY WALKERS

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Thein MM, Lee J, Tay V, Ling SL. (1997) Infant walker use, injuries and motor development. *Injury Prevention*, Vol. 3, pp. 63-66.	Singapore	Survey of parents	n=185 parents or primary caregivers of infants aged 7 to 10 months	Caregivers of infants who attended a government clinic for a developmental assessment session from Sep 1993 to Feb 1994.	❑ Effect of duration of walker use on injury and delay in development	❑ 90% used walkers regularly, 12.5% of these had one or more injuries (all minor: needing no treatment, or at most, only self treatment) (absence of stairs in many of these homes, and children presented to "well clinic" and not emergency dept) ❑ Two reasons given for not using walkers were that some parents had experienced injuries with their older children, or that they had attended parent education talks that highlighted the dangers of walkers ❑ Infants who used walkers for > 2 hours per day were, on average, 1.43 times more likely to have incurred an injury than one who used the walker < 1 hr per day. ❑ Infants who used the walker longer than one hour per day, on average, showed an elevated risk of having abnormal or questionable development score and a gross motor delay compared to those who used the walker for less than one hour per day ❑ These parents were advised not to place their child in walkers, and at a two month follow up, all had reverted to normal development. The delay may or may not be due to the effect of the walker alone, may also be due to familial delay.
Morrison CD, Stanwick RS, Tenenbein M. (1996) Infant walker injuries persist in Canada after sales have ceased. *Pediatric Emergency Care*, Vol. 12, No. 3, pp. 180-182.	Canada	1) Retrospective review of walker-related cases and 2) survey of their parents	1) n=36 cases with walker-related injury 2) n=26 patients reached by telephone	Walker-related emergency department presentations of a children's hospital, over a 42 month period.	❑ Source of acquisition of infant walker ❑ Use of walker after accident	❑ Eight walkers purchased in US, and 18 were second hand acquisitions. ❑ Only two families continued using their walkers in the same fashion as prior to the injury

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Petridou E, Simou E, Skondras C, Pistevos G, Lagos P, Papoutsakis G. (1996) Hazards of baby walkers in a European context. *Injury Prevention*, Vol 2, pp. 118-120.	Greece	1) Injury surveillance database and 2) Survey of parents	1) n=49 babies with baby walker-related injuries 2) n=200 guardians of children (18 to 23 months old)	1)Injury surveillance database at the Center for Research and Prevention of Injuries among the Young 2) Families who contacted the outpatient clinic of the same hospital for conditions other than injury	❑ Emergency department presentations to Aglaia Kyriakou Children's Hospital ❑ Some exposure information	❑ Skull (46.9%) and face (42.9%) most frequently injured ❑ Most injuries minor (42.9% contusions/bruise/open wound; 22.5% abrasions), but 3 cases of bone fractures and one with 2nd degree burns ❑ Stairs (indoor and outdoor) were involved in 67.3% of cases ❑ In non-injured sample, about two-thirds used baby walkers for an average of four months. Incidence of these injuries was 16 per thousand person years of users, or 3.5 per thousand babies per year.
Weiss HB. (1996) Limitations of child injury data from the CPSC's NEISS: the case of baby walker-related data. *Injury Prevention*, Vol. 2, pp. 61-66.	USA	Examination, reclassification and analysis of NEISS data	n=3928 (once reclassified false positives and negatives)	NEISS data from 1982-1991: children less than 24 months of age mentioning baby walkers in code or narrative of data	❑ True number of NEISS baby walker cases ❑ More accurate population rates (projected for US) ❑ Trend analysis of rates per 1000 live births	❑ Data showed an increase in reported baby walker-related injury rate over the 10 year period, from 4.6/1000 in 1982 to 6.9 per 1000 in 1991 (however, not significant). ❑ Trends affected by differing NEISS sample selection processes each year...however, they do not explain all the variation ❑ False negatives (4%) outnumbered false positives (1%), with a net effect of the reclassification being a minor upward correction. ❑ Information on rate of baby walker ownership and the length and frequency of use was not available.

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Boudreault MA. (1995) An analysis of baby walker injuries. In *ECOSA Proceedings from 3rd Conference, 6 & 7 March, 1995.*	USA	1) Retrospective review of emergency department data 2) Follow up telephone survey/visits	1) n=8460 2) n=128 telephone investigations and 17 on-site visits	1) NEISS data from 15/8/93 to 28/2/94.	❑ Emergency department presentations ❑ Location of caregiver ❑ Presence of steps, safety measures ❑ Time spent using walker ❑ Perceived function of walker	❑ Based on the NEISS sample, in 1993, there were an estimated 23,400 injuries to children under 15 months of age treated in emergency rooms ❑ 79% were due to falls down stairs or between levels, 3% due to burns, 3% due to walker tipovers, 15% due to other hazard patterns (eg. hitting head on walker tray, climbing on walkers) ❑ About 75% were considered “less severe” (eg hematomas, contusions, abrasions and lacerations); 23% considered potentially “more severe” (eg concussion, burns, fractures, internal organ injuries). ❑ Body part most often injured was the head or face area (92%): 4% were skull fractures. Most injuries to head and face were considered “less severe”. Remainder of injuries were nearly all to the arm, hand, shoulder or leg areas. ❑ 10% reported a previous baby walker incident: for those injuries classified as potentially “more severe”, over half used the walker again following the incident. 76% of parents continued to place the child in the walker after the incident ❑ About half of the caregivers were in the same room or area as the child, and only 43% of these reported that they witnessed the incident. 52% were in another room or area at the time of the incident (some could still see the child) ❑ Stairway falls: Of the respondents who greed to take measurements, 82% reported the width as 36 inches or less, and the remaining 18% reported widths ranging from 37 to 54 inches (but some of these may be estimates). Using this data, approximately 80% of stair or step fall injuries may have been prevented with a walker greater than 36 inches. ❑ 61% of stair or step incidents reported a closed door (78%) gate (16%) or some other barrier in use (6%) prior to or around the time of walker use. In 45% of these cases, the door, gate, or other barrier had been moved, left ajar, or not latched properly by an adult. In an additional 45% of these incidents, a sibling or other child had left the door or gate open, or had moved the restraining item. ❑ 15% of stair/gate fall incidents reported that there was a gate at the top of the stairway, but only 66% of these reported that the gate had been closed before the incident. For those that had a closed gate before the incident, over half reported that a sibling or other child left the gate open or did not properly latch the gate. Only 7% suggested that the gate may have failed, this was reported solely as “the walker pushed the gate open”. ❑ Perceived functions: 84% keeps child happy/quiet, 82% helps the child exercise, 79% gives the child freedom, 74% is a place to put the child while the caregiver is occupied, 66% keeps the child safe, 55% teaches them to walk, 42% provides a feeding place.

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Laffoy M, Fitzpatrick P, Jordan M, Dowdall D. (1995) Attitudes to and use of baby walkers in Dublin. *Injury Prevention*, Vol 1, pp. 109-111.	Ireland	Survey of parents	n=158 parents/guardians of babies aged approx 9 months	Babies completing a developmental assessment at clinics in North Dublin (2 month data collection period)	❑ Rate of baby walker use ❑ Parental attitudes ❑ Injuries associated with these walkers	❑ 55% were currently using, or once used a baby walker for this baby: mean age of starting use, was 6 months. Use rates similar for boys and girls. ❑ Large differences between attitudes of users and non-users: most users felt that walkers were beneficial, a source of enjoyment, and safe: reasons non-users gave for resisting use of walker included safety (77%), the feeling that it was of no benefit and that their home was too small ❑ None of the parents whose baby had an injury in a walker said they stopped using for safety reasons: 2 were continuing use. ❑ However, 21.1% of non-users gave an accident with an older sibling as their reason for not using a walker with the study baby. ❑ Nearly one in eight of the babies in this study who used walkers, had experienced a related injury. ❑ Findings suggest that the potential for injuries due to walkers are not yet clear to many parents
Chiavello CT, Christoph RA, Bond GR. (1994) Infant walker-related injuries: A prospective study of severity and incidence. *Pediatrics*, Vol 93, No. 6, pp. 974-976.	Virginia, USA	Prospective study of emergency department cases	n=65 infants aged from 3 to 17 months	Infants presenting to the University of Virginia Pediatric Emergency Department with walker-related injury from March 1989- October 1992	❑ Demographic and epidemiological information ❑ Annual incidence and significance of walker-related injuries in infants	❑ 71% were injured by falling down stairs in a walker, 21% tip-overs, 5% burns, 3% falls from a porch ❑ Majority of injuries to head and neck region (97%), injuries to extremities occurred in only 6% and truncal injuries in only 3% ❑ Most injuries were soft tissue trauma, but 29% sustained serious injuries (15% skull fractures, 12% concussion, 8% intracranial hemorrhage, 2% full-thickness burns) ❑ One death occurred ❑ Excluding the burn patients, all serious injuries resulted from falling down stairs in the walker ❑ Annual incidence of walker-related injuries resulting in emergency department visit was 8.9/1,000 infants <1 year of age, and the incidence of serious injuries was 1.7/1,000

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Mayr J, Gail M, Purtscher K, Noeres H, Schimpl G, Fasching G. (1994) Baby walkers- an underestimated hazard for our children? *Eur J Pediatrics*, Vol 153, pp. 531-534.	Austria	1)Random sample survey and 2)retrospective study of baby walker-related cases	1) n=240 families with children aged 2-6 years. 2) n=172 children with baby walker-related injuries	1) Families presenting to outpatient clinic with non-walker-related injuries 2) Children who had presented to the Department of Pediatric Surgery with baby walker related-injuries	❑ Use of baby walkers ❑ Number of baby walker-related accidents	1) ❑ Of those sampled, 54.6% (n=131) had used baby walkers, and 26% (n=34) of these had had accidents. ❑ No significant difference in the onset of free walking for those who had or hadn't used baby walkers 2) ❑ 83.1% of cases were caused by falls down stairs, 15.1% the baby walker tipped over (often caused by uneven patches on the floor or by objects lying on the floor). One case had a faulty wheel, one collided with table. ❑ Most children suffered injuries of the head (all but 3): all serious injuries were of the head, and 48 patients of this group were admitted to hospital with a mean duration of 6.6 (1-13) days: 23 had brain concussion, 19 fractured calvariaum/base of skull. ❑ Baby walkers ranked third amongst the most frequently occurring types of accidents (in 7-14 month olds
Williams F. (1994) The risk of baby walkers: an update. *Hazard*, Vol. 20, pp. 12-13.	Australia	1) Retrospective review of emergency department cases 2) Risk comparisons	Infants aged 6-11 months injured as a result of baby walkers (n=115), prams/strollers (n=86), highchairs (n=67)	1) VISS data from 1989-1993. 2) ABS Safety in the Home Survey (1993)	❑ Relative risk ratios for injury for 3 types of nursery furniture: baby walkers, prams/strollers/ high chairs	❑ Burns and fractures appear specific to baby walkers and high chairs ❑ Stairs and steps were specific to injuries associated with baby walkers ❑ Risk of baby walker 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 J, Brumen I. (1993) The safety of babywalkers. *Hazard*, Vol. 16, pp. 1-4.	Australia	1) Retrospective review of emergency department cases 2) Estimation of risk	1) n=133 cases with baby walker-related injury	1) VISS data from 1989-1992. 2) ABS Safety in the Home Survey (1993)	❑ Emergency department presentations ❑ Use of exposure information to determine level of risk (by extrapolation and assumption)	❑ 13% of injuries required hospital admission ❑ 77% involved some type of fall, smaller numbers (n=3) chemical ingestions, and n=19 gained access to other hazards eg ovens, irons, kettles, cleaning products ❑ 38% involved stairs and steps ❑ 28% lacerations or abrasions, 27% bruising, 12% burns, 10% concussion, 4% fractures ❑ 59% injuries were to the head region ❑ Estimated risk of 1 in 192 baby walkers causing significant injury to children under 1 year of age. ❑ Estimate increases to 1 in 96 if general practitioner data is included

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Trinkoff A, Parks PL. (1993) Prevention strategies for infant walker-related injuries. *Public Health Reports*, Vol. 108, No. 6, pp. 784-788.	Baltimore, USA	1) Retrospective review of emergency department cases 2) Survey of parents	1) n=22,925 projected estimate for 1990, n=27,804 estimate for 1991 2) n=108 parents of infants aged between 3 and 12 months.	1) NEISS data for 1990 and 1991 2) Caregivers of prewalking infants visiting large pediatric practice in Maryland for well-child care	❑ Use of walker ❑ Reasons for using walker ❑ Examined walkers on sale in two Maryland retail stores	❑ 66% were currently using or had used a baby walker before the survey ❑ Greater weekly use was associated with the infant being older and the parent having less than a college degree ❑ In homes with stairs where walkers were in use, 29% of parents reported that they were not using gates to block the stairwells ❑ Parents used walkers because: infants enjoyed them (77%); they entertained the infants (71%); they helped infants learn to walk (49%) and they helped mange the baby when the parents were busy (76%). ❑ Data indicates injuries related to walker use are continuing to occur in large numbers ❑ Walkers on display: of 12 models, 3 were not tagged as "in compliance". Instructional literature was not displayed with any of the walkers, even those tagged as complying with the standard. Warning labels on all complying walkers were affixed underneath the tray portion of the walkers (could not be seen when the walker was in use)
Australian Bureau of Statistics (1993, November) *Safety in the Home* and *Supplementary Tables: Safety in the Home*.	Australia (VIC)	Random sample survey	n=approx 4,000 random sample households in Melbourne (sample scaled up to include all of Melbourne)	ABS Home Safety Survey (1992)	❑ Exposure to baby walkers	❑ 19% of all households with children under the age of one year had a baby walker in use (representing 8,900 baby walkers in use in Melbourne for this age group) ❑ Steps and stairs in 65% of these households ❑ Only 30% of the households with a baby walker in use claimed to have stair guards or gates at the top and bottom of the steps/stairs (thus 70% had no safety measures to prevent falls form one level to the next)
Partington MD, Swanson JA, Meyer FB. (1991) Head injury and the use of baby walkers: a continuing problem. *Annals of Emergency Medicine*, Vol.20, pp. 652-654.	Minnesota	Retrospective review of hospital charts	n=129 total cases of head injuries, (n=19 baby walker-related cases)	Mayo Clinic emergency department patients less than 24 months old who had suffered head injuries (exclusive of facial trauma or birth injury) (over 3 year period)	❑ Number and severity of baby walker-related cases	❑ n=19 cases of baby walker-related injuries, representing the third most common mechanism of head injuries in this age group ❑ n=17 cases less than 12 months old. ❑ 18 of the 19 walker accidents involved falling down stairs (the other case slipped through the seat of the walker) ❑ Skull fractures occurred more often in walker-related stairway falls than other stairway falls (not sigif. but may be due to sample size)- suggests greater severity of walker injuries ❑ Walkers accounted for 45% of falls down stairways causing head injury in children younger than 24 months.

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Ozanne-Smith J, Heffernan CJ. (1990, March) Child injuries associated with nursery furniture. *Monash University Accident Research Centre, Report No. 12.*	Australia	Retrospective review of emergency department cases	n=168 infants < 3 years old with baby walker-related injuries	National Injury Surveillance and Prevention Program (NISPP) data	❑ Emergency department presentations	❑ 57% of cases resulted from falls from one level to another ❑ Most of these falls were down stairs and steps ❑ 88% of injuries were to the head and face ❑ n=7 cases of walker tipovers, n=2 cases of walker collapse, n=6 cases of burns and scalds, n=2 cases of poisonings, n=3 cases pulled down other objects ❑ 11.9% hospital admission rate
Gleadhill DNS, Robson WJ, Cudmore RE, Turnock RR. (1987) Baby walkers...time to take a stand? *Archives of Disease in Childhood*, Vol 62, pp. 491-494.	Liverpool	1)Description of three hospitalised cases, and 2) Home Accident Surveillance System	1) n=3 detailed cases	1) Cases presenting to Royal Liverpool Children's Hospital, 2) HASS figures from 20 accident and emergency departments in England and Wales	❑ Comparison of numbers of baby walker accidents to other accidents (HASS)	❑ Number of baby walker accidents rose dramatically (235%) from 1977 to 1984 (much larger factor than all child and baby furniture (118%) or child and baby transport devices (128%)) ❑ Discusses British Standard

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Rieder MJ, Schwartz C, Newman J. (1986) Patterns of walker use and walker injury. *Pediatrics*, Vol. 78, No. 3, pp. 488-493.	Toronto, Canada	Prospective study, and follow-up telephone survey	n=139 cases with baby walker injuries	Children presenting to The Hospital for Sick Children emergency department with baby walker-related injuries	Before, and 8 weeks after, the accident: ❑ pattern of baby walker use ❑ child's condition ❑ presence or absence of stair gates	❑ Mean age of injured was 9 months; 64% boys ❑ 89% fell down stairs, 7% fell from walker; 2% burnt; 2% object pulled onto ❑ 18 of 19 fractures, and 85 of 93 closed head injuries, were due to falls down stairs ❑ Parents were asked the most useful function of the walkers: 27 stated that they thought walkers taught infants to walk earlier; 41 said they thought the walkers were most useful in a babysitting capacity; 50 said the walkers made the infants happier by giving them enhanced mobility. ❑ 20 hospital admissions: most serious injuries were caused by falls down stairs and burns. One burn (where the infant pulled a newly brewed coffee onto himself) required 38 days of hospitalisation. Skull fractures required 1 to 14 days of hospitalisation. ❑ 81 of 123 stair cases, occurred in homes in which the stairs were unguarded by gates; 42 took place in homes with stair gates. Most commonly, the gate had been left open by a sibling or parent (in several instances the child was responsible for pushing down an inadequately fastened gate /improperly attached to the wall at the head of the stairs) ❑ The majority of infants (2/3rds) continued to use their walkers, despite the accidents. (Only one third of families stopped walker use because of the accident). In fact, the commonest reason for stopping walker use was that the child had begun to walk (this accounted for virtually all of the cases in which the walker was used for a period of time after the accident, and then stopped). Two months after the injury, one third of patients were still using their walkers. ❑ Of the 65 homes in which infants had fallen down stairs without gates, 27 homes had acquired stair gates since the time of injury, but 38 still did not have gates. (More than half of the homes that lacked gates prior to the injury had not acquired them at the time of follow-up). Stair gates were more likely to be present in homes in which a fracture had occurred. 18 with closed head injury had installed gates, but in 34 of these homes, they were still absent. ❑ Skull fractures were most common fractures (75%) but also observed fractures of the forearm, clavicle and nose. These are all body parts exposed and vulnerable in a fall down stairs in a walker, whereas the trunk, abdomen, and lower limbs are protected by the frame of the walker. ❑ In 21 cases, infants were alone in the room at the time of injury, attended to by "no-one" ❑ Suggestion that accidents are stair-related and not walker-related. However, in the same period of data collection, only one infant was seen for a fall down stairs.

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Stoffman JM, Bass MJ, Fox AM. (1984) Head injuries related to the use of baby walkers. *Can Med Assoc J*, Vol. 131, pp. 573-575.	London, England	1)Retrospective review of hospital charts 2) postal survey of parents	1) n=52 total cases of head injuries 2) n=152 parents responded (of n=175)	1) Cases less than 24 months of age presenting to the emergency department of a large London hospital 2) Parents of all children aged 3-18 months cared for in a London pediatric practice.	❑ Involvement of baby walkers in head injury cases ❑ Walker use, reasons for use, time used, and prevalence of falls involving baby walkers among patients in a private practice (no info on stairs)	1) ❑ Walkers involved in 42% of head injuries in children under 12 months of age, and in none of those in the children aged 12 to 24 months. ❑ All walker-related head injuries involved stairs, while most of the non-walker head injuries did not involve stairs. 2) ❑ 82% of parents said they were using or had used a walker for their child, another 7% said they had a walker but it was never used. ❑ 45 of these parents reported that their child had a fall while in a walker, (but only 4% brought to ED, and 4% phone contact with Dr) ❑ Walker-related falls were associated with the time spent in the walker: the more time spent in the walker per day, the more likely the child was to have a fall ❑ Reasons for use of walkers: 75% keep baby quiet and happy; 59% help baby learn to walk; 33% keep baby safe; 15% encourage motility; 10% provide exercise; 8% provide feeding place.
Wellman S, Paulson JA. (1984) Baby walker-related injuries. *Clinical Pediatrics*. Vol. 23, No. 2, pp. 98-99.	Cleveland, USA	Retrospective review of emergency department charts	n=38 infants with baby walker-related injuries	Infants presenting to the Rainbow Babies and Children Hospital between August 1979 and July 1981	❑ Emergency department presentations	❑ 97% had injuries to head or face ❑ 1 child pulled an iron onto his hand ❑ Only one case was hospitalised ❑ 78% were a result of falling down stairs ❑

7. HIGH CHAIRS

7.1 KEY ISSUES

A high chair is normally used for children between six months and three years of age so that they can sit and play securely and join the family at meals, (Kidsafe, 1992). Injuries are most commonly caused by children falling out of high chairs which are often due to:

- restraints not being used
- inadequate restraints.
- lack of adult supervision

There are several types of high chairs and according to Choice (1995b), these can be broken into the following broad categories:

1. Regular high chairs - have a fixed height
2. High-low chairs - can be adjusted to different heights
3. Convertible high chairs - are able to be converted into a chair and a table
4. Hook-on high chairs - these chairs hook onto the edge of a table and are held in place by the weight of the child
5. Normal chair adaptors - equipment that is designed to fit on normal chairs

The majority of the literature relating to high chairs focuses on the first two categories. Several test reports have been published on high chairs but very few epidemiological studies. This makes it difficult to assess exposure rates and relative injury rates. However, several injury surveillance databases are able to provide some descriptive information on the numbers and types of injuries involving high chairs.

7.1.1 Scope of the problem

Numbers

Drake et al (1989) estimates the total number of injuries Australia-wide by making several assumptions about the NISPP data, census data and the number of injuries that are untreated, treated by GPs or by other parts of hospitals. This gives a total figure of approximately 740 to 1,500 medically treated high chair injuries, Australia-wide, per year. Cases with minor to moderate injuries do not all necessarily present to emergency rooms or GPs, ie. treated at home, and since this number is unknown, the number of high chair injuries reported is an underestimate.

Exposure

Very little data is available regarding exposure or level of use for high chairs. However, a household survey conducted by the Australian Bureau of Statistics in 1992 of a representative sample of 4,000 Melbourne households provided valuable data on high chair use (ABS, 1993):

50.5% of households with children aged 4 years or less owned a high chair

33.2% of households with children aged 4 years or less owned a high chair with a harness; 17.2% did not have a harness.

Proportion of households with a high chair with at least one child aged less than 1 year is 65%.

Proportion of households with a high chair with at least one child aged 1 year is 81.5%.

Proportion of households with a high chair with at least one child aged 2 years is 53.4%.

Proportion of households with a high chair with at least one child aged 3 years is 38.5%.

Using the same age breakdown as above, the proportion of high chairs fitted with harnesses for each age group was approximately 60-70%.

Although the majority of householders indicate that they own high chairs with harnesses it is possible that some confusion existed between harnesses and lap and crotch straps. It is unknown what proportion actually use them at all times, if at all. Further population based studies are required to investigate the use of high chairs.

7.1.2 Causes of injury

Falls

The causes of most of the injuries described are falls. Children who are inadequately restrained may stand up in the high chair or attempt to climb out (Ozanne-Smith & Heffernan, 1990). Practising motor skills is part of a child's developmental sequence and once they have accomplished sitting they will progress to practice standing (Ridendour, 1984). A high chair must have restraints adequate to prevent the child from standing or climbing out of the high chair and these restraints must be used correctly at all times.

Entrapments and other injuries

Injuries are also caused by malfunction or collapse of the high chair, which was found for 6% of 154 Emergency department presentations for one hospital (Routley & Valuri, 1993) and 2 cases recorded by NISPP (Ozanne-Smith & Heffernan, 1990). Other reported causes of injury included instances where the child was attempting to climb into the high chair or pulled the chair on top of themselves (Ozanne-Smith & Heffernan, 1990). This highlights the problem of instability in high chairs. The same report also mentioned problems with the tray section being pushed out or collapsing. Other causes of injury included finger/toe or flesh entrapments, cuts and lacerations from sharp edges or splinters from wooden high chairs.

7.1.3 Types and severity of injury

The combination of the height of a high chair (approx. 1m), the young age of users and the dynamics of a fall add to the risk of injury from a high chair, (Drake, 1989). A report by the Australian Consumers' Association (Drake, 1989) reported 47 cases of high chair injury presenting to emergency departments of 12 participating hospitals from five states of Australia over a 12 month period, (Mar 1987-Feb 1988, NISPP). Forty five per cent of the cases involved head injuries, while 23% involved concussion which is consistent with the fact that falls from a high chair are likely to be head first, (Drake, 1989). A report in Hazard (Routley & Valuri, 1993) described high chair injuries collected by VISS as mainly falls causing bruising, cuts and lacerations to the face, scalp, nose and mouth. Slightly more serious injuries included concussion and fractures.

A follow up study of 20 cases collected by VISS (Watson & Ozanne-Smith, 1993), found that 83% of injuries were due to falls with injuries being mainly to the head (75%). Approximately 50% sustained a significant injury requiring hospital admission or follow up visits to outpatients/GP. One death was recorded in Victoria between 1985 and 1988 as the result of a child falling from a high chair and onto a hard surface, (Ozanne-Smith et al, 1991).

Severe injuries include a case reported to the Injury Information System of the Japanese Consumer Information Centre (Kataoka & Miyauchi, 1996) whereby a three and a half year old boy was left unattended for a few minutes. The child's toe had become entrapped between the footrest and part of the high chair frame. The child then kicked the footrest with his other foot and caused it to fold up and sever his toe.

7.2 DESIGN ISSUES

Problems associated with high chairs are primarily related to the design of the chair. Several improvements have been made, however, there are still products on the market that do not pass basic safety requirements (Choice, 1990b, 1993b, 1995b). These problems concern structural safety, tray safety, stability, finger and toe hazards, adequate restraints and safety warnings. The following are design problems reported by Choice:

- sharp edges
- trays that came loose too easily when pulled
- inadequate locking mechanisms
- inadequate waist and crotch restraints
- lack of harness anchor points to attach a full harness
- shallow trays which are unable to contain any spills
- potentially dangerous limb entrapment hazards
- relatively narrow based - unstable
- weak footrests
- insecure or unstable legs
- poor or no safety warnings.

7.3 INTERVENTIONS

There are two main interventions that need to be implemented and evaluated. The first being the requirement that all high chairs be sold with a full shoulder harness in place. The promotion and correct use of a full 5 point shoulder harness could prevent up to 80% of all child falls from high chairs (Watson & Ozanne-Smith, 1993). Choice found that out of 16 chairs tested, only 3 came with full safety harnesses and 9 chairs had harness anchor points to attach a full harness (Choice, 1995b).

The second intervention concerns education. Consumers need to be informed of the safe and correct use of high chairs. Safety warnings need to be explicit, detailing the safe use of high chairs and the likely hazards and consequences of incorrect use. A study conducted in the Netherlands (Trommelen, 1995) to test the effectiveness of various types of warnings on child care products, including high chairs, found that explicitness lead to a higher intention to comply with warnings and a better recall of the warnings. The ISO standard requires the following warnings to be displayed: (a) DO NOT LEAVE CHILD UNATTENDED; (b) CHILD SHOULD AT ALL TIMES WEAR A SAFETY HARNESS CORRECTLY.

A useful method for testing the stability of a product was reported by van Aken et al. (1993), who used three parameters, (destabilising moment, tilt angle, overturning energy), in his assessment. This method also took into account foreseeable loads and circumstances of use which may be useful when writing stability requirements in standards.

7.4 STANDARDS

There are no Australian Standards for high chairs except for harnesses for use in prams, strollers and high chairs (Ozanne-Smith & Brumen, 1996). Relevant international standards include:

- ASTM F404-89 (American) Standard consumer safety specification for high-chairs

- ASTM F1235-89 (American) Consumer safety specification for portable hook-on chairs
- BS 7495: 1991 (British) Specification for safety requirements for children's table-mounted chairs for domestic use
- BS 5799-1986 (British) Specification for safety requirements for children's high chairs and multi-purpose high chairs for domestic use
- DD ENV 1178-2:1995 (European) Furniture - Children's high chair for domestic use - Test methods
- DD ENV 1178-1: 1995 (European) Furniture - Children's high chairs for domestic use - Safety requirements
- ISO 9221-1:1992 Furniture - Children's high chairs - Part 1: Safety requirements
- ISO 9221-2: 1992 Furniture - Children's high chairs - Part 2: Test methods
- DIN V ENV 1178-1: 1995 (German) Furniture - Children's high chairs for domestic use - Part 1: Safety requirements (ISO 9221-1: 1992, modified); German version of ENV 1178-1:1994
- DIN V ENV 1178-2: 1995 (German) Furniture - Children's high chairs for domestic use - Part 2: Test methods (ISO 9221-2: 1992, modified); German version of ENV 1178-2:1994
- 90/35653 DC: 1990 (British draft) Furniture - Children's high chairs - Safety requirements and testing - Part 1 - Safety requirements (ISO/DIS 9221-1)
- 90/35654 DC: 1990 (British draft) Furniture - Children's high chairs - Safety requirements and testing - Part 2 - Safety requirements (ISO/DIS 9221-2)
- DENORM EN 1887:1995 (Austrian) Child care articles - Convertible high chairs - Safety requirements and test methods
- DENORM ENV 1178 Teil 1: 1995 (Austrian) Furniture - Children's high chairs for domestic use - Part 1 - Safety requirements (ISO 9221-1 modified)
- DENORM ENV 1178 Teil 2: 1995 (Austrian) Furniture - Children's high chairs for domestic use - Part 2 - Safety requirements (ISO 9221-2 modified)
- SN ENV 1178-1:1995 (Swiss) Furniture - Children's high chairs for domestic use - Part 1 - Safety requirements (ISO 9221-1 modified)
- SN ENV 1178-2:1995 (Swiss) Furniture - Children's high chairs for domestic use - Part 2 - Safety requirements (ISO 9221-2 modified)
- prEN 1887:1992 (European draft) Child care articles - Convertible high chairs - Safety requirements and test methods
- BS 3785:1964 (British) Specification for webbing safety harness for baby carriages and chairs and walking reins

7.5 RECALLS

Two recalls of high chairs have occurred in Australia since 1987. Both related to the same brand and model of high chair. The first, in 1995, had faulty "knuckles" (the plastic joint that holds the chair's legs together) (Choice, 1995c). These plastic pivot joints at the top of the high chair legs could develop cracks which could result in the chair collapsing. The second recall, in 1997, was due to the possibility of the restraint bar cracking which could result in a child falling from the high chair. Product recalls reported by the CPSC are very few and are mainly physical faults relating to parts (CPSC release #93-098, #96-003,#97-056).

7.6 SUMMARY OF RECOMMENDATIONS FROM THE LITERATURE

The following safety recommendations for high chair design have been repeatedly stated in several reports and journal articles (Choice 1993b, 1995b; Kidsafe, 1992; Watson & Ozanne-Smith,1993):

- The chair is sturdy with a wide stable base to stop it from collapsing or tipping over under the weight of the child.
- Ideally the chair should come supplied with a full safety harness; if not, it should at least have the facility for attaching a harness and come supplied with a restraining device that will prevent the child from slipping or climbing out.
- The chair is designed in such a way to prevent scissoring, shearing or pinching when the chair is erected for use.
- A folding high chair can be locked in the open position and remain locked under the weight of the child.
- There are no open-ended tubes, projections, holes, loose washers, nuts or crevices in which a child's finger or flesh could be trapped.
- Any caps on the metal tubing of legs and arms must be fitted tightly.
- Provision of information re safety to parents/caregivers at point of sale.
- It should be easy to put a child into the chair & fasten the restraint.
- There should be warnings that in the instructions and on the chair itself that a child should always be secured in a restraining device and should never be left unattended in the chair.
- An adult can adjust the tray easily and it can be locked securely in place.
- If the chair has a removable tray it must not expose any holes with sharp edges or holes that could trap a finger when the tray is removed.
- There are no sharp edges or points which could injure the child.
- Continual development and review of safe design and performance standards.

The following information on the safe use of high chairs is recommended in the literature for inclusion on safety warning labels:

- Do not allow a child to stand or climb in or out of the chair. It can easily tip over.
- Place the high chair in a safe position so that a child cannot push with the legs against nearby furniture or walls and topple over.
- Ensure that the chair is used on a level stable surface.
- All additional hazards such as electric cords should be kept out of reach.
- The child must be supervised when in a high chair.
- Don't use highchairs without their trays. Trays offer some restraint, especially those where the crotch strap is attached to the tray itself.
- Make sure there is no foam exposed by splits in the chair's seat or back which the child could chew or pull off and cause choking.
- Use caution with high chairs on castors - always lock the castors while a child is in the chair.
- Don't adjust the seat height while a child is in a high-low chair.

Table 7:1 SUMMARY OF LITERATURE - HIGH CHAIRS

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Kataoka S, & Miyauchi Y. (1996, February) Injury Cases Reported from the Injury Information System of JCIC. (Japan Consumer Information Centre) *ECOSA Proceedings 4th International Conference on Product Safety Research. Canberra, 15-16.*	Japan	Injury Surveillance Database - Single case description	1208 chair-related injuries	Consumer Injury Information System (JCIC) ❑ 1975 to present ❑ 20 "cooperating" hospitals ❑ 320 local consumer centres - consumer complaints	❑ Description of a case involving a three and a half year old boy and a highchair (April 1994) ❑ The mother left the child unattended for a few minutes and when she came back, the child's toe was bleeding. She then discovered that the child's third toe on the right foot had been cut off at the first joint. ❑ The child's toe had become entrapped between the footrest and part of the chair frame. The child then kicked the footrest with his other foot and caused it to fold up and sever his toe. ❑ The manufacturer of the chair has responded by implementing a fastening mechanism on the footrest to prevent it from being moved by a child's foot.
Standards Australia (1995) Catalogue of Australian Standards and other Products. *Standards Association of Australia: NSW*	Australia	Catalogue of Australian standards			❑ The catalogue only contains a standard for harnesses used for highchairs ❑ **AS 3747 - 1989. Harnesses for use in prams, strollers, and highchairs:** Specifies requirements for materials, construction, and performance of children's harnesses comprising a shoulder harness and side straps.

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Trommelen M. (1995, March) Testing Warnings for child-care products in the Netherlands. *ECOSA Proceedings 3rd International Conference on Product Safety Research. Amsterdam*, pp. 6-7.	The Netherlands: (Centre for Safety Research, Leiden University)	Pilot study: Tests the effectiveness of a various types of warnings provided with child care products.	Two groups of respondents: 1) 96 Parents to be (average age 30 years, 57% were females) 2) 48 Students (average age 22 years, 60% female) Six child care products, incl. high chairs	(PORS) Dutch Home & Leisure Accident Surveillance System was used to select products with relatively low & relatively low accident frequencies for 1993. Each subject was given a drawing of each product with either of the following ❑ no warnings ❑ non-explicit warnings ❑ explicit warnings nd were asked to rate the perceived hazardousness of the product, perceived likelihood of injury, perceived severity of injury, intended compliance, comprehension of the warnings and to reproduce the warnings from memory.	❑ High chairs had the highest accident frequency, corrected for the Netherlands at 242 cases for 1993 ❑ There was some difference for perceived severity of injury and intended compliance with each warning type. ❑ Regarding the parents to be, only one statistically significant difference was found in perceived severity of injury between the no warning condition and the other two conditions (non-explicit & explicit). ❑ 64% of parents and 53% of students preferred the explicit warnings, no one preferred having no warnings at all. ❑ Results also showed that explicitness leads to a higher intention to comply with warnings and a better recall of the warnings (for both groups). ❑ Explicit warnings should inform the consumer on; 1) What to do/avoid in order to use a product safely 2) The nature of the product-related hazard 3) The consequences of unsafe behaviour in terms of injuries.

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Choice. (1995b, September) Chairs for Children. *Australian Consumers' Association*, pp. 40-45.	Australia	Test report	16 High-low chairs (adjustable highchairs)	High-low chairs were tested on the following ten points: 1) Folding 2) Height positions 3) Tray height 4) Tray spill capacity The following relate to performance and involve tests and assessments based on American and British highchair standards: 5) Structural safety 6) Tray safety 7) Stability 8) No finger or toe hazards 9) Safe restraint 10)Full safety harness	❑ Found an overall improvement since the last test (July, 1993) ❑ 7 out of the 16 high-low chairs tested did not meet Choice's safety requirements and did not recommend buying them. ❑ 3 of the chairs came with full safety harnesses, however, all of the other chairs (except for 4), came with harness anchor points. Main safety problems with each chair: ❑ The brace between the legs of two of the chairs (same manufacturer), bent during testing of the locking device, which meant that if accidentally knocked, the chair would fold up. ❑ 4 chairs failed the vertical tray pull test - tray could be easily knocked off the chair ❑ Few chairs came with information about their suitability for children of different ages and sizes. Those that did recommended the age range of 6 months to 3 years of age. ❑ Choice states that age is not a good guideline; a highchair shouldn't be used until the a child can sit up unassisted. Guidelines for highchair use: ❑ Always secure your child in a restraint; ❑ Full safety harnesses offer the best protection ❑ Never leave a child unattended in a highchair ❑ Don't use highchairs without their trays. Trays offer some restraint, especially those where the crotch strap is attached to the tray itself. ❑ Don't adjust the seat height while your child is in a high-low chair ❑ Use caution with a highchair on castors - always lock the castors while your child is in the chair.
Routley V, & Valuri J. (1993) Home Injuries: Nursery Furniture *Hazard*, No. 14, pp.7.	Australia (VIC)	Injury Surveillance Database	154 children (under the age of 3 years) injured in the home	VISS (1989-92) ❑ Emergency department presentations ❑ Injuries in the home	❑ 67% of injuries caused by falls ❑ 40% resulted from a fall under 1 metre ❑ 21% from a fall greater than one metre ❑ 6% from a malfunction or collapse of the highchair ❑ Bruising accounted for 29% of injuries, cuts & lacerations 22% (face, scalp, nose & mouth) ❑ Concussion accounted for 18% of injuries, fractures 11% ❑ No standard at time of publication ❑ VISS recommends that highchairs be required to have rounded edges with no projections, secure locking mechanisms to prevent collapse of either the chair itself or the tray, stability and effective child restraints

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Watson WL, & Ozanne-Smith J. (1993) The Use of Child Safety Restraints with Nursery Furniture. *J. Paediatr. Child Health* , Vol. 29, pp. 228-232.	Australia	Case series - follow up of cases identified by VISS	20 children under 3 years of age	VISS (1989-90) ❑ Survey of children attending the emergency department of RCH re. details of injury event	❑ 83% of injuries associated with highchairs were the result of falls ❑ Only 25% of children who suffered an injury by falling from a highchair were wearing a form of safety restraint; 80% of the sample had safety restraints fitted ❑ Injuries were mainly to the head (75%) ❑ Almost 50% sustained a significant injury, (ie. admission to hospital, follow-up visits to outpatients/GP ❑ One death recorded between 1985-88 - fall from highchair onto hard surface ❑ 16 out of 20 chairs were fitted with a restraint(lap type) ❑ Only 5 (31%) in use at time of injury ❑ The use of shoulder harnesses to restrain children in highchairs - based on results of the Victoria College survey ❑ Continual development & review of safe design and performance standards ❑ Provision of information re safety to parents/caregivers at point of sale
Choice. (1993b, July) High Chairs *Australian Consumers' Association,* pp. 17-21.	Australia	Test report	Range of 15 high chairs priced under $200	Highchairs were tested on the following nine points: 1) Tray spill capacity 2) Adjustable height 3) Safety warnings 4) Harness anchor points The following relate to performance and involve 22 tests and assessments based on American and British standards: 5) Structural safety 6) Tray safety 7) Stability 8) No finger or toe hazards 9) Safe restraint	❑ Only 4 out of the 15 chairs tested were recommended. ❑ Most of the chairs tested had a restraint that could easily allow a small child to slip out. 10 out of 15 chairs failed the safe restraint test. ❑ None of the chairs had a full safety harness. ❑ 5 chairs failed the finger/toe hazard tests. ❑ Out of 12 chairs with a tray, 8 failed strength tests on the tray. ❑ 9 out of the 15 chairs had poor or no safety warnings. ❑ It should be structurally strong, stable and free of sharp edges & entrapment hazards for fingers and toes. ❑ Ideally the chair should come supplied with a full safety harness; if not, it should at least have the facility for attaching a harness & come supplied with a restraining device that will prevent the child from slipping or climbing out. ❑ There should be warnings that in the instructions and on the chair itself that a child should always be secured in a restraining device & should never be left unattended in the chair. ❑ The tray should be large, well secured to the chair in normal use & have a lip that will prevent eating implements and spilt food or drink finding their way to the floor too easily. ❑ The seat should be comfortable, with a back that leans slightly backwards (preferably around 15°). ❑ It should be easy to put a child into the chair & fasten the restraint. ❑ The chair should be easy to assemble and easy to clean.

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Van Aken D, Biswell KJ, & Evans T. (1993, November) Assessment of Product Stability *ECOSA Proceedings International Conference on Product Safety Research. Amsterdam.*	The Netherlands & UK: (Consumer Safety Institute, The Netherlands & Consumer Research Laboratory, UK)	Test report	12 product types (including high chairs) - 4 brands of each	Parameters used to assess the stability of a product (values at which the product overturns), taking into account the foreseeable loads and circumstances of use: 1) Destabilising moment 2) Tilt angle 3) Overturning energy.	❑ Method can be used to test the stability of a range of products. ❑ Can also be used as a basis when writing stability requirements in standards. ❑ All four brands of high chairs varied for each of the three measurements ❑ Concluded that the current models of high chairs lack stability ❑ When loaded with a dummy (representing a child), the high chairs generally overturned at a tilt angle of 20 degrees, a destabilising moment of 52 Nm, or an overturning energy of 9.3 J.
ABS (Australian Bureau of Statistics) (1993) *Safety in the Home* and *Supplementary Tables: Safety in the Home*. (1992, November)	Australia (Melbourne)	Cross-sectional survey (descriptive)	4000 households	Information from householders regarding safety hazards and the prevalence of safety products.	❑ 50.5% of households with children aged 4 years or less owned a high chair ❑ 33.2% of households with children aged 4 years or less owned a high chair with a harness; 17.2% did not have a harness. ❑ Proportion of households with a high chair with at least one child aged less than 1 year is 65%. ❑ Proportion of households with a high chair with at least one child aged 1 year is 81.5%. ❑ Proportion of households with a high chair with at least one child aged 2 years is 53.4%. ❑ Proportion of households with a high chair with at least one child aged 3 years is 38.5%. ❑ Using the same age breakdown as above, the proportion of high chairs fitted with harnesses for each age group was approximately 60-70%.

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Kidsafe (1992, October) Kidsafe Furniture: A Safety Guide *Child Accident Prevention Foundation of Australia & the Office of Fair Trading.*	Australia	Safety guide			Safety checklist: ❑ The manufacturer's instructions are supplied ❑ The chair has attachment points which can be used for fitting a harness ❑ There are no sharp edges or points which could injure the child ❑ The chair is sturdy, with a wide stable base to stop it from collapsing or tipping over under the weight of the child ❑ An adult can adjust the tray easily and it can be locked securely in place ❑ The chair has a strap that goes between the child's legs to stop the child from slipping out. The waist and shoulder straps are vital to stop the child from standing up or climbing out. Design: ❑ There are no open-ended tubes, projections, holes, loose washers, nuts or crevices in which a child's finger or flesh could be trapped ❑ The chair is designed in such a way to prevent scissoring, shearing or pinching when the chair is erected for use ❑ Any caps on the metal tubing of legs and arms must be fitted tightly ❑ A folding high chair can be locked in the open position and remain locked under the weight of the child ❑ If the chair has a removable tray it must not expose any holes with sharp edges or holes that could trap a finger when the tray is removed. Safe use: ❑ The child must be supervised when in a high chair. ❑ Always fasten the waist and crotch straps. ❑ A shoulder harness should be used when a child is no longer able to be restrained by the waist and crotch straps. ❑ See that the hands, fingers or head cannot become entrapped when the tray is raised or lowered. ❑ Make sure there is no foam exposed by splits in the chair's seat or back which the child could chew or pull off and cause choking. ❑ Do not allow a child to stand or climb in or out of the chair. It can easily tip over. ❑ Place the high chair in a safe position so that a child cannot push with the legs against nearby furniture or walls and topple over. ❑ Ensure that the chair is used on a level stable surface. ❑ All additional hazards such as electric cords should be kept out of reach.

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Ozanne-Smith EJ, & Heffernan CJ. (1990) Child Injuries Associated with Nursery Furniture *Monash University Accident Research Centre, Report No. 12.*	Australia	Injury surveillance 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	The following were noted upon visits to 2 Melbourne department stores: ❏ light weight ❏ relatively narrow based - unstable ❏ instability also due to high centre of gravity ❏ lap restraints of variable quality ❏ Causes of injury are suggestive of physical failure or inadequate design, especially in terms of stability ❏ 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 injury ❏ Failure to use an appropriate child restraint was a major factor associated with injury risk ❏ 12.2% hospital admission rate (includes deaths) ❏ 8.6% were injured by trying to climb into the highchair or pulled the highchair on top of themselves ❏ 4.3% of injuries involved the tray section being pushed out or collapsing ❏ 2 cases where the highchair collapsed and caused the child to fall ❏ Follow up study using VISS data to determine whether children who fell from highchairs were restrained and if they were, what went wrong ❏ Instruct parents to use restraints and supervise the child at all times while in the highchair ❏ Need to develop an Australian Standard which should cover stability, no sharp edges or projections, secure locking mechanisms, effective restraining systems ❏ Advise parents to consider purchasing a low chair - less risks

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Choice. (1990b, January) Sitting High in Safety *Australian Consumers' Association*, pp. 42-45.	Australia	Test report	18 highchairs ranging in price from $40 to $200. 10 were fold-up & 7 were convertible. Most were made of steel with a plastic tray; 4 were made of wood.	1) Safety: ❑ stable ❑ free of sharp edges and possible entrapment hazards ❑ durable ❑ will hold the child securely ❑ appropriate advice on the label 2) Quality of construction 3) Practicality	❑ 4 chairs were recommended ❑ 6 were found to be acceptable ❑ 8 highchairs were not recommended (all but two of these were Australian made) ❑ Problems such as sharp edges, trays that came loose too easily when pulled and inadequate locking mechanisms. ❑ All models came with a crotch strap, however, 7 didn't have a lap strap, and only 4 had labels recommending the use of a full harness, of which 2 didn't have the anchor points to attach one. ❑ Choice recommends that consumers rigorously check highchairs before they buy ❑ Avoid highchairs with sharp edges, gaps where small fingers may get caught, ie. under the tray. If the chair is made of wood, look out for splinters. ❑ Check that the tray, footrest, restraints are firmly attached ❑ Look for anchor points for the attachment of a safety harness ❑ Test the chair's stability by leaning on it, or casually kicking it. ❑ The highchair should also be relatively light and easy to move. It should also be easy to clean
Drake R, Moller J, Taylor A, Sartor F, Hodge W. (ACA) (1989) An Arm and a Leg: The Human and Economic Cost of Unsafe Products *Australian Consumers' Association.*	Australia	Descriptive Study: Report on product-related injuries in Australia (all ages)	20,000 cases (aged <15 yrs) & 8000 cases (aged 15 yrs & over) over a 12 month period - March 1987 - February 1988. ❑ 47 high chair injury cases	National Injury Surveillance and Prevention Program (NISPP) ❑ Emergency department presentations to 12 hospitals (4 NSW, 1 VIC, 4 QLD, 2 SA & 1 WA) *Choice Magazine*	❑ Choice magazine report on 15 chairs in July 1983 and tested to the ASTM standard. Seven chairs had safety faults, 5 had problems with the safety harness; 2 had insecure or unstable legs. Other problems included splinters, sharp edges, & weak footrests and trays. ❑ 3 chairs passed safety tests; 25 potential safety faults were revealed in the other 12 chairs ❑ See appendix 3 - p.3 for product listing and corresponding faults ❑ 45% of the 47 cases involved head injuries, 23% involved concussions ❑ 47 cases of injury (highchairs) which is equivalent to approximately 740-1,500 injuries Australia-wide per year

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Ridenour MV. (1984) Are high chairs in restaurants safe for children? *Perceptual and Motor Skills* , Vol. 58, pp. 164-166.	Philadelphia, PA. US	Cross-sectional survey: Inspection of highchairs in restaurants	54 highchairs in 54 restaurants located in Philadelphia during 1983.	54 restaurants randomly selected from the 1982 telephone directory. Two parts of the ASTM F404-75 specifications were noted/recorded: ❑ presence of a child's restraining system ❑ presence of a permanent warning label	❑ Did not look at adequacy of restraining systems ❑ Restraining straps were found on 59% of the 54 chairs ❑ 14% had the permanent warning labels ❑ 20% of chairs had no tray ❑ 55% of chairs had footrests ❑ 85% of chairs did not meet the voluntary specifications in one or both of the two categories ❑ Restaurants' highchairs should be replaced at regular time intervals, as safety specifications are modified.

8. BABY EXERCISERS: BOUNCINETTES AND "JOLLY JUMPERS"

8.1 KEY ISSUES

The bouncinette and the "jolly jumper" are two types of baby "exercisers". The bouncinette is a capsule or netted sling on a wire frame which the baby can rock back and forth. The Jolly Jumper is essentially a spring-supported harness which can be attached to a door frame with a clamp. The baby is fastened into the device, with his or her feet just touching the ground. They can then push off the ground and learn to bounce (Choice, 1993c). It is suggested that these pieces of equipment may help "lively" children settle for sleep. There has been little research investigating the injuries associated with them, and there are no records of any injuries resulting from jolly jumpers.

8.1.1 Scope of the Problem

There was a report of one death occurring in Adelaide in 1993 (Byard et al, 1994). The three-month old girl was found dead hanging from the loose harness of her baby bouncinette. She had slipped down in the baby bouncinette. Another incident occurred in Wales, where a fall from a baby bouncinette caused a fatal extradural haemorrhage (Clayton, 1996). In this case, the baby's head was only about two feet from the ground, and he landed on thick carpet. The latter case highlights the fact that serious head injuries can result from relatively minor falls.

8.1.2 Causes of injury

Most injuries from bouncinettes are due to the bouncinette falling from a height, typically a table, bench, worktop, freezer, bed or washing machine (Ozanne-Smith & Heffernan 1990; Kidsafe, 1992). Typically the parent or caregiver places the bouncinette on the elevated surface, and the bouncing child causes the bouncinette to fall off the edge (ACC, 1994). This is particularly a hazard if the child is left unattended.

8.1.3 Type and severity of injury

Data from the National Injury Surveillance and Prevention Project, indicated that although baby exercisers or bouncinettes were the least likely of a number of nursery products to be associated with injury, they ranked the highest in terms of injury severity (Watson & Ozanne-Smith, 1993). Seventy-five per cent of bouncinette incidents resulted in head injuries (VISS, cited in Carter, 1994).

8.2 DESIGN ISSUES

Since the main problems are caused by placing bouncinettes in elevated positions, design issues are secondary to the need to alert the public of this hazard. Some design considerations may be the provision of straps to secure the child and the strength and stability of the bouncinette.

In terms of Jolly Jumpers, the strength of the harness and the lace sewn to the crotch strap need to be considered. The lace is placed under considerable tension when the baby is bouncing. If it breaks on one side of the harness, this would cause the child to tilt. If both sides break, the crotch strap is freed, and the child may slip through the waistband, risking injury (Choice, 1993c).

8.3 INTERVENTIONS

There has been little research on baby exerciser-related injury and no research on the effectiveness of interventions. Recommendations from the literature are summarised in Section 7.5.

8.4 STANDARDS

There are no standards for bouncinettes either in Australia or internationally.

8.5 RECALLS

Only one recall of baby bouncers has occurred in Australia since 1987. This involved defective stitching on the crotch strap which could come loose causing the infant to become entangled.

8.6 SUMMARY OF RECOMMENDATIONS FROM THE LITERATURE

8.6.1 Design

- The bouncinette should have a broad stable base to prevent it tipping over (Kidsafe, 1992)
- The bouncinette should have straps to secure the child (Kidsafe, 1992)
- The stitching of the bouncinette should be strong (this is particularly important if buying the bouncinette second hand (Nancarrow, 1996)
- There should be no sharp edges or points that could injure the child (Kidsafe, 1992)
- The straps of the jolly jumper should be strong and secure (Choice, 1993c)

8.6.2 Education

- Educate parents and care-givers never to place the child on an elevated surface in a bouncinette (Ozanne-Smith & Heffernan, 1990)

8.6.3 Instructions and warning labels

- A warning label on the bouncinette (concerning the risks of heights) may alert parents to this hazard (Ozanne-Smith & Heffernan, 1990)

8.6.4 Safety checklists

- Make sure that the manufacturer's instructions are supplied (Kidsafe, 1992)
- Parents should also check for the design issues outlined above

8.6.5 Safe Practice

(from ACC, 1994; Choice, 1993c; Kidsafe, 1992; Ozanne-Smith & Heffernan, 1990).

- Bouncinettes should never be placed on elevated surfaces (e.g. tables or benches) where they can fall off. They should always be used at floor level
- Children in bouncinettes should never be left unattended
- Bouncinettes should not be used when the child can sit up and/or make vigorous movements
- Children should never be carried in bouncinettes, to avoid the risk of falling out
- Babies in jolly jumpers should be carefully supervised
- Parents should check the laces of jolly jumpers regularly

Table 8:1 SUMMARY OF LITERATURE - BABY BOUNCERS

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
Ozanne-Smith J, Heffernan CJ. (1990, March) Child injuries associated with nursery furniture. *Monash University Accident Research Centre, Report No.12.*	Australia	Retrospective review of emergency department cases	n=32 infants < 3 years old with bouncinette-related injuries	National Injury Surveillance and Prevention Program (NISPP) data	❑ Emergency department presentations	❑ 15.6% admitted to hospital ❑ 94% of injuries occurred during the first year of life ❑ Falls from a height (e.g. benches, tables, freezer, washing machine, bed) accounted for at least 38% of the injury events

9. CHANGE TABLES

9.1 KEY ISSUES

9.1.1 Scope of the problem

Although injury surveillance data suggests that injuries associated with change tables are not uncommon, there appears to be no in-depth research into this issue. Data from the Netherlands (de Graaf, 1987) suggests that that the most vulnerable age for change table-related injury is between 6 and 18 months of age, with 72 percent of recorded injuries occurring at this age. This is to be expected since babies start to move by themselves at about six months of age which makes it possible for them to roll off a change table. By 18 months, most children are standing by themselves and many are out of nappies and so can be dressed while standing on the floor. Australian data suggests a slightly different age-range with most injuries (87 percent) occurring to children under 12 months of age (Ozanne-Smith & Heffernan, 1990).

9.1.2 Causes of injury

Injury surveillance data indicates that almost all change table injuries are falls (de Graaf, 1987 : 94%; Ozanne-Smith & Heffernan, 1990 : 91%), which result from babies rolling off the table while briefly left alone (Nancarrow, 1996). Caregivers often turn away to access nappies etc, resulting in a brief shift of attention from the infant. Babies may also wriggle out of the restraining strap attached to the change table (ACC, 1994).

9.1.3 Type and severity of injury

The severity of the injuries sustained relates to the height of the falls. The percentage of hospitalisations recorded in injury surveillance data varies with the Dutch data recording 34 percent (de Graaf, 1987) and Australian data only 11.7 percent (Ozanne-Smith & Heffernan, 1990). The most injured part of the body is the head (over 50 percent of injuries) with about half of these being concussion (de Graaf, 1987).

A report examining death data from the Australian Bureau of Statistics and the Victorian Consultative Council on Obstetric and Paediatric Mortality and Morbidity revealed one change table-related death in the 1985 to 1988 period (Ozanne-Smith et al, 1991). The infant was strangled in the frame of the changing table.

9.2 DESIGN ISSUES

Designs of change tables need to address the primary problem of falls. In particular, they should be equipped with restraining devices, with adequate locking mechanisms. It is estimated that the correct use of safety harnesses could prevent up to 80% of the injuries associated with change tables (Watson & Ozanne-Smith, 1993). Point of sale inspections (Ozanne-Smith & Heffernan, 1990) have revealed that several models of change tables do not have restraining devices fitted.

The side edges of change tables should also be raised to prevent the child from rolling sideways off the change table (Ozanne-Smith & Heffernan, 1990). The changing table should have three barriers if the width of it is greater than the length. If the length is greater than the width, then the table should have two barriers which cover the full length of the table (prEN 12221-1:1995).

The changing surface should also be part of the structure of the change table, and should consist of strong, easily cleanable material that is firmly attached to the frame of the table.

The type of changing pad should also be considered. Point of sale inspections also revealed that some change tables may have loose vinyl covered changing pads which can readily slip off the surface of the changing table (Ozanne-Smith & Heffernan, 1990).

The stability of the change table, the strength of the locking mechanisms, and the presence of sharp edges, small parts, or entrapment hazards need to be considered in the design of change tables (prEN 12221-1:1995).

9.3 INTERVENTIONS

No studies were identified which evaluated the efficacy of interventions relating to change table injuries. The interventions and design changes recommended in the current literature are outlined in Section 9.6.

9.4 STANDARDS

There are no Australian standards for change tables.

French: NF S54-005:1987. Child care articles. Changing tables. Minimum safety requirements and tests.

CEN:

prEN 12221-1:1995. Changing units for domestic use-Part 1: Safety requirements.

prEN 12221-2:1995. Changing units for domestic use-Part 2: Test methods.

These standards addresses the strength (e.g. of folding mechanisms), stability, dimensions, entrapment hazards, materials and surfaces of change tables. They address the fall hazards by specifying that "barriers shall be provided as an integral part of the changing unit or by means of an additional item, e.g. changing pad, that can be affixed to the changing unit." No mention of safety harnesses is made.

9.5 RECALLS

A search of the CPSC website did not reveal any US recalls of changing tables.

9.6 SUMMARY OF RECOMMENDATIONS FROM THE LITERATURE

9.6.1 Design

- The table should have safety straps (and adequate locking mechanisms) to help keep the child in place, and prevent falls (Kidsafe, 1992; CPSC #4200).
- The table should have drawers or shelves that are easily accessible (for nappies, creams etc) without leaving the child unattended (CPSC #4200).
- The changing surface should be made of strong material which can easily be cleaned, it should be firmly attached to the frame (Kidsafe, 1992).
- Changing pads should be well fitted.
- The sides should be raised to prevent the child rolling from the table (Kidsafe, 1992; Ozanne-Smith & Heffernan, 1990). The changing table should have three barriers if its width is greater than its length. If the length is greater than the width, then the table should have two barriers which cover the full length of the table (prEN 12221-1:1995).

- The change table must be stable so that it doesn't collapse during use (Kidsafe, 1992).
- There must be no gaps or spaces near the changing surface which could entrap a child's head or limbs (Kidsafe, 1992).
- Change table designs need to relate to the weight and dimensions of the child (prEN 12221-1:1995).

9.6.2 Education

- Parents and caregivers should be educated regarding the dangers of using change tables, particularly the risk of infants rolling and falling from the table.

9.6.3 Instructions and warning labels

- A warning label on the change table, concerning the risk of leaving the baby unattended, may alert parents to this hazard

9.6.4 Safety checklists

- Parents should consider the key design issues highlighted above when deciding whether or not to purchase a change table.
- The change table must be appropriate for the child's weight. Some change tables are for children up to 9kg in body weight (corresponding approximately to 12 months of age), while others are for children weighing up to 15kg (corresponding approximately to 36 months of age) (prEN 12221-1:1995).

9.6.5 Safe Practice

(from ACC, 1994; Kidsafe, 1992; Ozanne-Smith & Heffernan, 1990).

- Do not leave the baby alone on a change table.
- The restraining strap should be used to prevent falls from the table.
- All necessary items (wet cloths, pins, clothing etc.)should be placed within reach, so that the child will not be left unattended, even briefly, during changing.
- Do not hang bags or cloths from a change table, they can make it unstable.
- If the unit includes a bath, the changing surface should be lifted away completely so that it does not fall on the baby when being bathed.

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Table 9:1 SUMMARY OF LITERATURE - CHANGE TABLES

Publication	Country	Study Type	Subjects	Setting/Data source	Measures	Results
de Graaf, AP (1987, October). Children's products : Accidents, hazards and minimal safety requirements. *Consumer Safety Institute, Amsterdam, Report No. 31.*	The Netherlands	Review of injury data from HASS, NEISS & PORS.	n=32 children, < 14 years old with change table-related injuries.	Dutch Home & Leisure Accident Surveillance System (PORS)	❑ Emergency department presentations	❑ 94% of injuries associated with change tables resulted from falls ❑ 72% of injuries occurred in infants aged between 6 & 18 months (45% in the first 12 months) ❑ 34% were admitted to hospital.
Ozanne-Smith J, Heffernan CJ. (1990, March) Child injuries associated with nursery furniture. *Monash University Accident Research Centre, Report No. 12.*	Australia	Retrospective review of emergency department cases	n=94 infants < 3 years old with change table-related injuries	National Injury Surveillance and Prevention Program (NISPP) data	❑ Emergency department presentations	❑ 91% of injuries associated with change tables resulted from falls ❑ 87% of the injuries occurred during the first year of life ❑ There was an absence of restraining devices in several models of change tables inspected at the point of sale. Some change tables were also observed to have a loose vinyl covered changing pad which could readily slip off the surface of the changing table ❑ 11.7% were admitted to hospital (including deaths)

10. BUNK BEDS

10.1 KEY ISSUES

This section focuses on injuries associated with the use of bunk beds. For the purposes of this report a bunk bed is defined as:

1. a set of components assembled as beds, one stacked over the other; or
2. any bed (other than a hospital bed) in which the upper surface of any mattress base is at least 800mm above the floor surface (this includes a tall one-level bed as well as the upper bed of conventional double-decker bunk).

10.1.1 Scope of the problem

Due to the nature of Australian injury surveillance data, the overall burden of injury arising from the use of bunk beds in this country is difficult to quantify. Due to the particular design characteristics of bunk beds (primarily height) it is clear that the risk of injury associated with this type of furniture is significantly greater than for conventional beds. A recent Australian study estimates this risk to be 5 times greater for children aged between 2 to 12 years and 13 times greater for children aged 2 to 4 years (Thompson, 1995). These figures are consistent with those from other countries. Senturia et al (1993), for example, estimate that 0-4 year old males are the peak injured age group in the US with a rate of 1,399 per 100,000 of exposed children followed by 5-9 year old males at 206 per 100,000 of exposed children.

Two measures of childrens' level of exposure to bunk beds have been attempted in Australia in recent years. In 1989 a population survey of Metropolitan Adelaide families revealed that 11% of all children aged between 2 and 12 years regularly slept in the upper level of bunk (SAHC, 1990). In 1992 a survey of safety in Melbourne homes revealed that 15% of households with children aged 4 years or less had a bunk bed (ABS, 1993). In this latter study it is not clear whether these children actually used the bunk.

These figures are less than the 24% of children found to be using a bunk bed in a cross-sectional survey of 679 families in Chicago (Senturia et al, 1993). In this study the peak use age group corresponded with the 4 to 11 year age group. Of these families, 15% of the bunk bed users were aged under 5 years, 31% were aged between 5 and 9 years and 23% were aged between 10 and 14 years.

10.1.2 Causes of injury

The major causes of injury associated with bunk beds are falls and entrapment, with falls accounting for between 70% and 94% of all bunk bed-related injuries (Kim, 1995; Routley & Valuri, 1993). In a study of South Australian injury data, Thompson (1995) found that 20% of fall-related injuries directly involved ladders, 10% structural failure of the bed and more than 10% occurred while the child was sleeping. In a different study, Routley and Valuri (1993) found that two-thirds of injuries associated with bunk beds occurred as a result of playing. These figures emphasise the importance of an approach to injury prevention that focuses on both design and behaviour modification.

10.1.3 Type and severity of injury

In their study of Victorian injury surveillance data, Routley and Valuri (1993) found that the most common types of bunk bed-related injuries were arm and wrist fractures (22%), concussion (14%), bruising or lacerations to the face, scalp or mouth (15%) and clavicle fractures (2%). These types of injuries are most commonly associated with falls. Another potentially more fatal type of injury, which is described in the literature as being more common amongst younger children, is asphyxia (CPSC, 1997d). Asphyxiation is more likely to be the result of entrapment.

As with other nursery furniture-related injuries, the severity of injuries resulting from bunk beds ranges from insignificant to fatal. In a US study of emergency department presentations, Selbst et al (1990) found that 9% of bunk bed-related cases required hospital admission, with the remainder requiring treatment without admission. This means that, on average, bunk bed-related injuries are more serious than those associated with conventional beds (Hawkins, 1992).

Since 1990, 34 children have been reported to the US Consumer Product Safety Commission as having died after becoming caught in wooden bunk beds with improper openings in the top bunk structure. Thirty-one of those children were aged 3 and under. In addition, 4 children have been reported as having died after becoming caught in spaces in the top of metal bunk beds. All four children were 2 years of age or younger (CPSC, 1997d).

The following case reports illustrate the risks associated young children using bunk beds (CPSC, 1996f & 1997e):

1. *A 19 month-old male was sleeping on a bunk with a railing around the perimeter. The victim was found hanging sleeping between the mattress and the side of the bed with his feet dangling down. His face was in toward the mattress. The cause of death was asphyxia.*
2. *A 3 year-old male was placed to sleep in the top of a bunk bed. Since the bed did not have a mattress, the child slept on blankets. Apparently the child attempted to climb down to the lower bunk, but became entrapped. He was found by his parents hanging from the top bunk with his head caught in the rails and his feet dangling. The cause of death was asphyxia.*

10.2 DESIGN ISSUES

10.2.1 New bunk beds

The US Consumer Product Safety Commission (CPSC, #71) recommends that consumers look for the following features when considering purchasing a new bunk bed:

1. Guardrails on all sides which are screwed, bolted or otherwise firmly attached to the bed structure
2. Spacing between bed frame and bottom of guardrails that is no greater than 89mm
3. Guardrails that extend at least 127mm above the mattress surface to prevent a child from rolling off
4. Cross ties under the mattress foundation which can be securely attached
5. A ladder that is secured to the bed frame and will not slip when a child climbs on to it
6. A feature which permits the beds to be separated to form two single beds if children are too young to sleep safely on the upper bunk

The Australian Consumers' Association (Choice, 1992b) suggests the following checklist for consumers:

1. Bunk beds must be stable and strongly made.
2. The bunk bed should have safety guard rails on all sides. They should be high enough to prevent a child from rolling out of bed. There should also be several vertical rails to ensure the child cannot roll under the safety rail.
3. The bunk itself should be no higher than 1550mm.
4. The ladder and safety rails should be permanently fixed to the bunk.
5. The ladder should be designed to be used by children, ie. ladder rungs and handrails should be an appropriate width for children to grip.

6. To avoid accidental entrapment and strangulation, no gap should be between 75 and 230mm (to prevent head entrapment), or 30 and 50mm (to prevent limb entrapment) or 5 and 12mm (to prevent finger entrapment).
7. There should be no protrusions, projections on the bunk to catch on clothing.

10.2.2 Existing bunk beds

Thompson (1995) recommends the following modifications be made to improve the safety of an existing bunk bed in accordance with current Australian standards:

1. Provide safety guardrails (horizontal rail or rails, vertical rails or even a total infill) to all sides of the upper level, if they are not already present, to protect the occupant from falling whilst asleep
2. Gaps and spaces thus created or already existing shall conform to the following criteria:
    - openings less than 5mm are considered relatively safe
    - openings larger than 5mm and less than 12mm are considered dangerous
    - openings larger than 12mm and less than 30mm are considered relatively safe
    - openings larger than 30mm and less than 60mm are considered dangerous
    - openings larger than 60mm and less than 75mm are considered relatively safe
    - openings larger than 75mm and less than 230 mm pose a serious danger as far as entrapment of the head is concerned
    - openings larger than 230mm are considered relatively safe
3. The upper surface of the mattress shall be at least 150mm below the upper edge of the guardrail
4. In the case of a single horizontal guardrail the space between the upper surface of the mattress and the underside of the guardrail shall not be less than 230mm (in this case some vertical railing will be necessary to prevent the occupant rolling out of the bed)
5. The guardrails shall not be readily removed (use of tools necessary)
6. The access ladder shall not be readily removed (use of tools necessary)
7. Children less than 9 years of age should not occupy or gain access to an elevated bed
8. There shall be no sharp edges or projections than might snag clothing

10.3 INTERVENTIONS

Table 10:1 SUMMARY OF BUNK BED INTERVENTIONS

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 (AFRDI, 1995) • specific marking, labelling and instructions supplied at the point of sale (AFRDI, 1995) • top of matters at least 150mm below upper edge of guardrail (Thompson, 1994) • access ladder not readily removed (Thompson, 1994) • no sharp edges or protrusions where clothing could get caught while falling (Thompson, 1994) • gaps and spaces not between 5-12mm, 30-60mm or 75-230mm to prevent entrapment (including fall-related) (Thompson, 1994) • well secured guardrails required on all sides of the upper level (Thompson, 1994) ❑ Recall of defective or unsafe bunk beds (Selbst et al, 1990)	
Design changes	❑ Bunk beds complying with the Australia Standard estimated to reduce injuries by 30% (SAHC, 1990) ❑ US study found significantly more head and face injuries in the absence of side rails on the top bunk (Selbst et al, 1990)	❑ As contained in the Australia 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 (Choice, 1992b)

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 (Selbst et al, 1990; Kim, 1995) ❑ Installing a night light so that children can get in and out of bed safely at night (Selbst et al, 1990) ❑ 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 (SAHC, 1991) ❑ Not permitting children with an increased risk of falling (eg., epilepsy, seizures) to sleep in bunk beds (Selbst, 1990) ❑ Position bunk bed away from windows (Spinks et al, 1992) ❑ Distribute brochures on how to modify a poorly designed bunk bed • currently produced by SA Health Commission and SA Department of Public and Consumer Affairs (see Thompson, 1994)	
Maintenance		❑ Regular maintenance and inspection of cross wires, bolts, ladders etc (Selbst et al, 1990)	
Flooring	❑ US study found that carpet played a protective role in reducing the extent of injury (Selbst et al, 1990)		
Lobbying	❑ Education Department of SA adopted a new bunk bed safety policy for school camps where no child under the age of 9 years 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 (SAHC, 1991)	❑ 800 SA Health Commission summary papers of research and recommendations for bunk bed use were distributed to relevant safety bodies in SA (Thompson, 1995) ❑ SA television segments on the risks of elevated beds lead to interest in the production of a safer bunk bed (Thompson, 1995)	

10.4 STANDARDS

The following standard currently applies to the manufacture of bunk beds in Australia:

- AS/NZS 4220:1994 (Australian/New Zealand) Bunk beds

This standard specifies safety requirements for bunk beds in terms of material, construction, design and performance specifications. It was prepared following concern expressed by the South Australia Health Commission about the number and severity of injuries suffered by children from or otherwise injured by bunk beds and has been based on:

- International standards (BS 6998, ISO 9098-1 & 2)
- recommendations proposed by the South Australian Health Commission
- Australian standards AS 2172 (Cots for household use - safety requirements) and AS 1924 (Playground equipment for parks, schools and domestic use)

The following international standards are relevant to the manufacture of bunk beds:

- BS 6998 (British) Bunk beds
- BS EN 747-1:1993 (British) Furniture - Bunk beds for domestic use - Safety requirements
- BS EN 747-2:1993 (British) Furniture - Bunk beds for domestic use - Test methods
- 91/35488 DC:1991 (British draft)
- ISO/DIS 9098-1 Furniture - Bunk beds - Safety requirements and testing - Part 1 - Safety requirements
- ISO/DIS 9098-2 Furniture - Bunk beds - Safety requirements and testing - Part 2 - Test methods
- NEN-EN 747-1:1993 (Dutch) Furniture - Bunk beds for domestic use - Part 1 - Safety requirements
- NEN-EN 747-2: 1993 (Dutch) Furniture - Bunks beds for domestic use - Part 2 - Test methods

10.5 RECALLS

Only one bunk bed recall has occurred in Australia since 1987. This was due to a fault in the weld in the bracket supporting the side rail which could result in a collapse of the metal bunk.

The most extensive information on the recall of bunk beds comes from the US Consumer Product Safety Commission (CPSC). Since 1995, CPSC has obtained the recall of approximately half a million hazardous bunk beds (CPSC, 1997d). The reasons for these recalls include:

- the collapse of tubular metal frame bunks due to cracking or breaking of frames and welded joints
- openings on the top level of wooden and metal bunks that present a potential entrapment hazard to young children

The CPSC claims that removing recalled products from the distribution chain is usually not difficult, but getting customers to give them up can be. In an attempt to overcome this the CPSC initiated a nation wide collaborative Recall Round-Up project starting with a video news release by satellite to all US TV stations describing the hazards of four types of dangerous products, including wooden bunk beds. The Recall Round-Up also included strategies for increasing community and media awareness. The outcome of this initiative is unknown at this stage.

Table 10:2 SUMMARY OF LITERATURE - BUNK BEDS

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Kim C. (1995) Product-related injuries in children: An analysis of Childsafe NSW data. *Health Promotion Unit, NSW Health Department, North Sydney.*	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 included fractures (58%) and concussion (21%)
Standards Australia (1995) Catalogue of Australian Standards and other Products. *Standards Association of Australia: NSW*	Australia	Catalogue of standards			❑ **AS/NZS 4220 - 1994. Bunk beds.** 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.
Thompson P. (1995) Bunk beds: Classical example of a prevention strategy (Ch 15, Part 3) In J. Ozanne-Smith, & F. Williams *Injury research and prevention: A text. Monash University Accident Research Centre, Victoria.*	Australia (SA)	Prospective comparison groups	150 children aged 12 years and under treated for injuries in Adelaide	South Australian Injury Surveillance System. Population survey of metropolitan Adelaide families. ❑ Emergency department presentations ❑ Exposure information re type of bed slept in ❑ Rates of hospital treated injury associated with elevated beds and conventional beds by age group	❑ Risk of injury for children aged 2-12 years was 9.2 injuries per 1000 persons per year in a bunk bed, compared to 1.9 injuries per 1000 persons per year in a conventional bed ❑ 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 ❑ 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. ❑ Children, especially the very young should not be placed in an elevated bed. ❑ Elevated bed should not be used for any child less than 9 years of age.

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Routley V, & Valuri J. (1993) Home Injuries: Nursery Furniture *Hazard*, Vol. 14.	Australia (VIC)	Injury Surveillance Database	1533 children under 15 years of age were injured in the home in association with beds (321 of these were associated with bunk beds)	VISS (1989-92) ❑ Emergency department presentations ❑ Injuries in the home	❑ 18% of children required hospital admission for bunk bed injuries versus 11% for conventional beds ❑ Falls over one metre accounted for at least 70% of all injuries associated with bunk beds ❑ Two thirds of the injuries associated with bunk beds occurred while playing ❑ Bunk bed injuries included arm and wrist fractures (22%), concussion (14%), bruising/lacerations to the face, scalp or mouth (15%) and clavicle fractures (2%).
Senturia YD, Binns H, Christoffel KK, Tanz RR. (1993) Exposure Corrected Risk Estimates for Childhood Product-Related Injuries. *Accid. Anal. & Prev*, Vol. 25, No. 4, pp. 473-477.	US (Chicago)	Cross sectional survey	679 families - included 1,469 children aged under 20 years selected over four one month periods over 1 year.	❑ Exposure data for seven consumer products (including bunk beds) derived from questionnaires administered by staff at a children's hospital and 10 paediatric practices in the Chicago area. ❑ Families (with at least 1 child over 36 months of age) visiting either the hospital or one of the practices during one of the four sampling periods were selected for the study. ❑ Demographic information plus use and frequency of use for each family member for each product.	❑ 24 % of families with children surveyed used bunk beds. ❑ 15% of bunk bed users were aged under 5 years. ❑ 31% of bunk bed users were aged 5-9 years. ❑ 23% of bunk bed users were aged 10-14 years. ❑ Peak use age group corresponded with the 4-11 age group. ❑ Injury rates for males using population data show that injuries are highest among the 5-9 year age group (80 per 100,000 population) followed by 0-4 year olds (65 per 100,000 population). However, when this rate is corrected for exposure, 0-4 year old males become the peak injured age group at a rate of 1399 per 100,000 of exposed children followed by 5-9 year old males at 206 per 100,000 of exposed children.

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Choice. (1992b, January) A Safer Bunk Bed *Australian Consumers' Association.*	Australia	Descriptive - Guide for consumers	Review article	Injuries recorded by 3 South Australian Hospitals	❑ Bunk beds must be stable and strongly made. ❑ The bunk bed should have safety guard rails on all sides. They should be high enough to prevent a child from rolling out of bed. There should also be several vertical rails to make sure the child cannot roll under the safety rail. ❑ The bunk itself should be no higher than 1550mm. ❑ The ladder and safety rails should be permanently fixed to the bunk. ❑ The ladder should be designed to be used by children, ie. ladder rungs and handrails should be an appropriate width for children to grip. ❑ To avoid accidental entrapment and strangulation, no gap should be between 75 230mm (to prevent head entrapment), or 30 and 50mm (to prevent limb entrapment) or 5 and 12mm (to prevent finger entrapment). ❑ There should be no protrusions, projections on the bunk to catch on clothing.
Hawkins C. (1992) Children's Injuries from Bunk-beds vs Conventional beds. *Hazard*, Vol. 11, pp. 12.	Australia (VIC)	Injury Surveillance Database	❑ Children ages less than 15 years. ❑ N=949 for conventional beds ❑ N=262 for bunk beds	VISS (1989-1991) ❑ Emergency department presentations (3 hospitals)	❑ Found a higher admission rate for bunk bed injuries (18%) compared with conventional beds (11%). ❑ The nature of injuries sustained by bunk bed cases were more serious than those for conventional bed cases, ie. concussion, fractures.

Publication	Country	Study Type	Subjects	Setting/Data Source/ Measures	Results
Selbst SM, Baker MD, Shames M. (1990) Bunk Bed Injuries *American Journal of Diseases in Children*, Vol. 144, pp. 721-723.	US	Retrospective cohort	Emergency department presentations for bunk bed and non bunk bed injuries. ❑ 68 cases ❑ 54 controls	❑ Emergency department presentations from Feb 1987 to Feb 1988. ❑ Interviews with subjects (face to face, by phone) plus a questionnaire. ❑ Demographic information plus information about the bunk bed - age/composition, presence & location of ladder & guard rails, floor surface where bed was located. ❑ Child's medical history & other bunk bed injuries.	❑ Found significant differences in age groups, a greater proportion of the injured group were less than 2 years of age when compared with the control group. Similar finding with children aged less than 6 years. ❑ Cases were more likely not to have carpeted floors under their bunk beds ($p<0.05$). ❑ Injuries mainly occurred when the child fell from the top bed (58%), fell off the ladder (11%), fell off the bottom bed (12%) or hit the sides of the bed (5%). ❑ One incident involved the bed collapsing. ❑ Children were mainly injured by hitting the floor (61%), 15% were injured by hitting part of the bed, the remaining 24% hit another object (toy, glass, table) while falling. ❑ Injuries occurred during sleep (29%), while getting in or out of bed (20%), 36% of cases were playing in bed. ❑ Of those children injured while asleep (19), 13 (68%) were under 6 years of age. ❑ Injured body parts included the head (52%), lower extremity (13%), face (12%), upper extremity (10%). ❑ The most common injuries were lacerations (40%), followed by contusions (28%), concussion (12%) and fractures (10%). One case had a skull fracture with a subdural haematoma. ❑ 9% of cases required hospital admission. 81% (55) of cases were treated and released from the ED. ❑ Recommended that children using bunk beds should be carefully supervised. ❑ Children younger than six years should not be using bunk beds. ❑ Bunk beds should not be used for play. ❑ Parents need to make sure that there are no sharp objects, pointed furniture, or ceiling fans near the beds.
Riley TL, Brannon WL. (1979) Bunk beds and the person with epilepsy. *JAMA*, Vol. 242, No. 25, pp. 2761.	US	Case Description		National Naval Medical Centre, Bethesda.	❑ Patient died from head injuries after falling from a top bunk bed during a seizure. ❑ Highlights the potential hazards of bunk beds for individuals with nocturnal seizures particularly children. ❑ Recommends warnings for those suffering from epilepsy about potential hazards with the bunk beds.

11. SUMMARY OF FINDINGS AND RECOMMENDATIONS

11.1 INTRODUCTION

This chapter summarises the project's findings and discusses a number of issues arising from the study. These include issues relating to standardisation, data issues, research and dissemination of information. Recommendations are also made for further progress in the area of nursery furniture and bunk bed safety.

Much of the information contained in this report will be widely disseminated in the national and international literature. It is expected to also inform standardisation processes, coronial investigations of nursery furniture and bunk bed-related deaths, manufacturers, importers, retailers, professionals working with families of young children and the community.

11.2 SUMMARY OF FINDINGS

11.2.1 Nursery furniture

An analysis of injury surveillance data revealed that the major nursery furniture products associated with injury in Australia are : prams, cots, high chairs, baby walkers, strollers, change tables and baby exercisers (bouncers). While injuries in the under five age-group peak at around one to two years of age, injuries associated with nursery furniture are most likely to occur in the first year of life.

It is estimated that, in Australia, at least 6,540 injuries associated with nursery furniture (and treated in hospital Emergency Departments or by general practitioners) occur annually in the under five age-group. Of these, it is estimated that at least 540 cases result in hospital admission. Over 3,500 of these cases are aged under one year and of these, at least 270 result in hospital admission.

The estimated injury rate of 508 per 100,000 population for all medically treated (Emergency Department and general practitioner treated) nursery furniture-related injuries in the under five age-group is not too dissimilar from the U.S. injury rate of 431 per 100,000 population which only applies to treatments in hospital Emergency Departments.

In terms of injury severity, cots have the highest mortality. Of the 13 nursery furniture-related deaths identified in Victoria between 1985 and 1994, 10 (over 75 percent) were associated with cots. This is consistent with U.S. figures which show that almost 70 percent of nursery furniture-related deaths, identified by the CPSC, were associated with cots. All but one of the deaths associated with cots in Victoria were due to asphyxia and involved entrapment hazards directly related to cot design or modification (6) or to the cot environment (2 accessed blind cords, 1 strangled on the elastic attached to a toy). The other death resulted from a fall from a cot, though the actual mechanism of death was again asphyxia, due to the child falling into a clothes basket and suffocating in the contents. Strollers, high chairs and change tables have also been implicated in at least one death each in Victoria since 1985.

In terms of non-fatal injury, the picture is less clear cut with the frequency of injuries associated with the different nursery products varying between States. Baby walkers, high chairs and strollers were the three nursery furniture products most frequently associated with injury nationally while prams, cots and high chairs were most prominent in Victoria. A comparison between the national (NISPP) and Victorian (VISS) data sets suggests that this difference does not reflect demographic variations between the two collections. Rather, it may suggest different patterns of usage or changes over time since the collections represent different time periods. For

example, the fall in baby walker injuries recorded by VISS over the period 1989-93 appears to coincide with a strong intervention program in Victoria to discourage the use of baby walkers. The proportion of baby walker injuries recorded in the new VEMD collection in 1996 (ranked sixth compared to fourth in VISS) suggests that such injuries are still declining in relation to injuries associated with other nursery furniture products.

A comparison of hospital admission rates in the Victorian collection for the different products suggest that baby exercisers or bouncers are associated with the most severe non-fatal injuries with almost one in three injuries resulting in hospital admission. This is due to the fact that falls from bouncers are usually from a height when care-givers place the bouncer on an elevated surface such as a bench-top. These are followed by high chairs and strollers both of which have admission rates equal to, or higher than, the overall admission rate for children under 5 years of age.

Falls were the most common cause of non-fatal injury in every product category (65 percent overall) ranging from 43 percent in the case of baby bouncers to 77.5 percent in the case of change tables. Injuries to the head and face were most prevalent in all product categories accounting for 63.5 percent overall (and up to 82 percent for stroller-related injuries). Injuries to the upper extremities were next at 15.3 percent of injuries recorded (and up to 22.3 percent for cots). Bruising, inflammation and/or swelling was the most common type of injury (31.3 percent), followed by lacerations (16.1 percent), concussion (11.2 percent) and fractures (8.3 percent).

For at least four of the nursery furniture products (cots, prams, strollers and high chairs) a small percentage of product failure was indicated as causal. For this group of products about 6 percent of cases could be clearly identified as product failure (collapse, malfunction or entrapment hazard). High chairs had the greatest percentage of identified product failure (8 percent) due mainly to the tray falling off allowing the baby to fall out. Seven percent of cot injuries were attributed to failure on the part of the product, mainly entrapment hazards. The main problem identified for prams and strollers was collapse of the product resulting in it folding up on the child. Almost half of identified malfunctions in prams involved the restraint breaking or coming undone.

11.2.2 Bunk beds

Injury surveillance data (VISS) shows that eighty-six percent of bunk bed-related injuries in children under fifteen years of age occur in children under ten years. While bunk bed injuries peak in the 5-9 year age-group, they still account for similar numbers of injuries as individual nursery furniture products in the 0-4 year age-group.

It is estimated that, in Australia, there are at least 3,850 injuries annually, in the under fifteen age-group, associated with bunk beds, that are treated by hospital Emergency Departments or by general practitioners. Of these, it is estimated that about 390 cases result in hospital admission. Almost half of all bunk bed injury cases occur (1900) in the 5-9 year age-group and, of these, at least 180 result in hospital admission.

No deaths associated with bunk beds have been identified in the Victorian data. However, the U.S. Consumer Product Safety Commission has identified 38 cases, since 1990, in which children (mainly aged under 3 years) have died of asphyxia due to entrapment in the bunk structure. Based on NEISS data, it was estimated that there were at least 17 bunk bed-related deaths in the U.S. in 1995.

The main cause of non-fatal injury associated with bunk beds is a fall from the top bunk (80 percent of cases). The most common activity associated with a fall is playing (32 percent of falls). Over half of these falls occur in the under five age-group (55 percent), with about 40 percent in the 5-9 age-group and only 4 percent in the 10-14 year age-group. Jumping from bunks (7 percent of all injury) as a cause of injury also decreases with age. After playing, sleeping is the next most common activity associated with falls. The pattern is somewhat different in this instance with the majority of injuries (64 percent) occurring in the 5-9 year age-group, 19 percent in the 10-14 year age-group and the remainder (17 percent) in the under fives. One would expect that the lower involvement of under fives is due to the fact that they are less likely to sleep in a bunk bed. However, the high proportion of 5-9 year olds falling from bunks while sleeping suggests that children of this age may not be ready to sleep in a top bunk.

Because only 5 percent of narratives specified the presence or absence of a safety rail, little can be inferred about the usefulness of these in preventing falls. In at least 10 cases (1.6 percent), the injury can be directly attributed to a failure of the product or its design. Nine of these cases involved a collapse of part of the bunk (7 safety rails, one ladder and one base) resulting in a fall. The other case involved entrapment of the child's arm in part of the bunk.

Of the five-year age-groups, the admission rate is highest for 10-14 year olds at 22 percent which is substantially higher than the overall admission rate for the age-group. While the admission rate for under fives is similar to the overall admission rate for the age-group, the admission rate for one-year olds is particularly high at 27.5 percent.

The most common non-fatal injuries associated with bunk beds are fractures (33 percent), three-quarters of which are upper extremity fractures. Bruising (21 percent) is the next most prevalent type of injury followed by lacerations (17 percent) and concussion (10 percent). These types of injury are most commonly associated with falls. Fractures and concussion result in the greatest number of hospitalisations (fractures accounting for 48 percent of admissions and concussion 20 percent). Injuries to the upper extremities are most common (38 percent) followed by injuries to the face (27 percent) and the head (13.5 percent).

11.3 STANDARDISATION ISSUES

11.3.1 Mandatory versus voluntary standards

The United States is probably the best example internationally where a combined approach of mandatory and voluntary standards works effectively. A number of publications describe the activities of the US Consumer Product Safety Commission (CPSC) (Australian Consumers' Council, 1993; CPSC, 1994b; CPSC, 1996g). The CPSC is a Federal Government agency charged with product safety responsibility covered by five Acts. These are:

Consumer Product Safety Act (which also established the Commission)

Poisons Packaging Act

Federal Hazardous Substances Act

Flammable Fabrics Act

Refrigerator Safety Act

Notable exceptions to the CPSC's jurisdiction are drugs and medications (although packaging of these products is included), alcohol tobacco and firearms, registered motor vehicles, work, water sport and recreation-related, and animals (Ozanne-Smith, 1997).

Mandatory standards are developed over a lengthy period due to the weight of evidence required. Evidence is required that the regulation is in the public interest, including regulatory impact

statements on: industry, including small business; the environment; estimates of benefits and costs; effects on competition and competetive advantage; effects on international trade; and effects on consumers (US Federal Register, 1993). They are generally developed where compliance cannot be achieved with voluntary standards "CPSC regulates only if necessary when negotiated voluntary standards and the marketplace prove to be ineffective" (CPSC, 1996g).

Standardisation is sought by United States' manufacturers, importers and retailers, since, in a strongly litigious society, meeting standards bench-marks quality and protects against litigation. The current international trend to performance standards allows freedom for manufacturers to choose methods of meeting the standards. The development of horizontal standards which can be applied across aspects of many products will also streamline the standardisation and compliance processes.

It seems, however, that a considerable amount of enforcement of "voluntary" standards occurs by means of rigorous customs activities, product recalls, industry co-operation, public education by means of the media (video releases from the Chairman of the Consumer Product Safety Commission), information hot-lines, internet information and litigation. Compliance is further assured by voluntary standards being developed through a national consensus process, ensuring openness and allowing participation of all interested parties (CPSC, 1994b).

The threat of mandation, if voluntary compliance does not occur, seems also to be an important contributor to compliance with voluntary standards. The CPSC supports the development of selected voluntary standards by providing technical support.

Of importance to Australia is the issue of "non-tariff barriers to trade", in the context of World Trade Organisation agreements. It has been clearly demonstrated in the United States that product design changes demanded for safety purposes will be met by overseas manufacturers with little shift in the distribution of trade. This is documented, for example, in the regulatory impact statements on competition and international trade and competitive advantage developed for child resistant cigarette lighters (US Federal Register, 1993).

No doubt, this willingness by oversees manufacturers and importers to conform relates to the size of the US market. It implies, however, that Australia and New Zealand can, at least, "piggy-back" on the US standardisation process. Thus, for example, the current US standard (ASTM, 1996) could be adopted for baby walkers to fill the current Australian void. It is understood that there are no Australian manufacturers of baby walkers; thus any impact of such an Australian/New Zealand standard would be likely to be on the same manufacturers who serve the US market and who already meet the US standard.

Communications by MUARC with the Australian nursery furniture industry indicate a strong interest in mandation of standards. While the industry sees this as a means to protect the responsible manufacturers and traders, they also expect that there would be some gain in market share since they believe cheap non-conforming imports would diminish or cease. US experience, at least for child resistant cigarette lighters, indicated that the oversees manufacturers quickly adapted to the new regulations (CPSC personal communication). The relevant regulatory impact statements predicted for those products, that no significant differential impact on domestic versus foreign producers would occur, though some temporary competitive advantage may be gained (US Federal Register, 1993). There was deemed to be no significant barrier to mandation.

The US Customs Service plays a major role in intercepting and detaining shipments of imported products that do not meet US safety standards for either re-conditioning or export out of the US (e.g. 400 shipments in 1994) (CPSC, 1996g). Customs Service activities at ports of entry are targetted at products believed to violate safety standards, including, for example, fireworks, and household chemicals and medications requiring child resistant packaging.

Potential enhanced links with the Australian Customs Service should be investigated.

11.3.2 Safety Directives

The European Product Safety Directive and the US Consumer Product Safety Act provide a legislative base for product safety which appears to be more effective than the Trades Practices and other relevant Acts in Australia.

11.3.3 International Standardization Organization Safety Guides (Guide 50 and 51)

A number of standards and guides address safety aspects in a general sense eg. the European standard on safety of machines EN 292 (internationally endorsed as ISO/TR 12100). ISO/IEC Guide 51: 1990 "Guidelines for the inclusion of safety aspects in standards" is currently under review. Another development is the European "A standardizer's`guide to child safety" with reference to child care products (CEN/TC 252/WG 'Child care products- General and common safety specifications').

ISO/IEC Guide 50: 1987 "Child safety and standards - General guidelines" is currently also under review by an ISO/IEC Joint Technical Advisory Group, on which Australia is represented. This review formally commenced in October 1996. The 1987 Guide 50 stated that "The safety of children should always be considered when drafting a standard for a product intended for use or likely to be used by children or with which they are likely to come into contact....".

The revision will address the potential interaction of children with all products with which they are likely to come into contact. Specifically, it will focus on issues of children's vulnerability due to size, other physical characteristics and stage of development. Importantly, it will recognise that children use products in ways not originally contemplated by designers, manufacturers and parents.

11.3.4 Expanded definition of product safety

The standardisation process has moved forward considerably to expand its focus to issues beyond product failure. The current Australian/New Zealand cot standard addresses the issue of the safety of the cot environs. Furthermore, both ISO and US standards consider foreseeable use (as well as intended use) of products by children as within scope of their standards (ISO Guide 50, revision in preparation; ASTM infant walker standard, 1996).

11.3.5 Data and research driven standards

The US CPSC undertakes or commissions research to underpin the standardisation process. Data and research findings are clearly stated in the introduction to infant equipment standards such as the performance specifications for infant walkers. This is not generally the case for Australian/New Zealand Standards.

Similarly, ISO Guide 51 Guidelines for the inclusion of safety aspects in standards (1990) states:

"Work on a project starts with the identification of all the safety aspects to be covered. At this stage, it is essential to search for accident data and to study research reports."

11.3.6 Standards review process

US standards, such as the American Society for Testing and Materials (ASTM) Standard Consumer Safety Performance Specifications for Infant Walkers (1996) indicate clear processes for review:

"This consumer safety performance specification is written within the current state-of-the-art of walker technology. It is intended to be updated whenever substantive information becomes available that necessitates additional requirements or justifies the revision of existing requirements. It shall be reviewed and, if necessary, modified at least once every five years."

11.4 PRODUCT SPECIFIC ISSUES

11.4.1 Lack of standards

Currently, despite substantial injuries related to baby walkers, high chairs and change tables, no Australian/New Zealand standards exist for these products.

It is strongly recommended that standards should be developed for these products. Standards should be based on the best available international standards or draft standards see Table 11.1. This will ensure efficiency and low cost for the standardisation process.

baby walkers: the US ASTM 1996 standard is clearly the best available standard world wide, principally because it addresses the major hazard of steps with a stringent performance standard

high chairs: the major issues of stability, adequate restraint (shoulder harness or equivalent), and entrapment hazards are probably best addressed by the US ASTM standard. Clearly, the current Australian practice of lap and crotch straps on many high chairs would be insufficient to meet the performance requirements of the ASTM standard.

change tables: the draft CEN change table standard includes some criteria which should be considered for an Australian/New Zealand standard including barriers, attention to entrapments, stability, folding and locking mechanism. Additional components should include a safety harness, and the inclusion in the design of accessible storage for baby change equipment: napkins, baby powder etc. (so that the infant does not need to be left unattended).

11.4.2 Mandation

As in the United States, mandation of standards should occur in Australia where voluntary standards and the marketplace are ineffective in achieving compliance. Where substantial injury rates occur for specific child products, this suggests that there is inadequate compliance with standards, that standards are inadequate, or that the product itself may be inappropriate for use by young children.

There is currently sufficient evidence, at least in the case of household cots and portable cots to mandate standards. Both of these items are involved in deaths (at a rate of about 9 times that for other nursery furniture) and studies by the Australian Consumers' Association have repeatedly shown lack of compliance in the marketplace.

Because of the high rate of bunk bed injuries, monitoring is required to determine the extent to which bunk beds meet the Australian/New Zealand standard, with a view to mandation if satisfactory compliance is not achieved.

There may also be a case for the mandation of the standard for prams and strollers, currently under review, given the high injury rates and some deaths associated with product design faults (particularly with regard to asphyxiation and inadequate restraint of children).

Table 11:1 SUMMARY OF STANDARDS RELATING TO NURSERY FURNITURE AND BUNK BEDS

Prams and strollers	**High chairs**	**Cots**	**Baby walkers**	**Bouncinettes**	**Change tables**	**Bunk beds**
AS 3747-1989 (Australian)	90/35653 DC: 1990 (British draft)	AS/NZS 2172:1995.	16 CFR 1500.86 (a)4	Nil	NF S54-005:1987	91/35488 DC:1991 (British draft)
AS/NZS 2088:1993 (Australian/New Zealand)	90/35654 DC: 1990 (British draft)	AS 2195 - 1978	ASTM 977-89		prEN 12221-1:1995	AS/NZS 4220:1994 (Australian/New Zealand)
ASTM F833-95a (US)	ASTM F1235-89 (US)	AS 2196 – 1978	BS 4648		prEN 12221-2:1995	BS EN 747-1:1993 (British)
BS 7409:1996 (British)	ASTM F404-89 (US)	AS/NZS 4385:1996				BS EN 747-2:1993 (British)
DIN 66068-1:1989 (German)	BS 3785:1964 (British)	ASTM F 1169-88				ISO/DIS 9098-1
DIN 66068-2:1989 (German)	BS 5799-1986 (British)	ASTM F66-96				ISO/DIS 9098-2
pr EN 1888 (Preliminary European)	BS 7495: 1991 (British)	BS EN 716-1: 1996				NEN-EN 747-1:1993 (Dutch)
	DD ENV 1178-1: 1995 (European)	BS EN 716-2: 1996				NEN-EN 747-2: 1993 (Dutch)
	DD ENV 1178-2:1995 (European)	BS 7423: 1991				
	DENORM EN 1887:1995 (Austrian)	ISO/DIS 7175-1:1992				
	DENORM ENV 1178 Teil 1: 1995 (Austrian)	ISO/DIS 7175-2:1992				
	DENORM ENV 1178 Teil 2: 1995 (Austrian)					
	DIN V ENV 1178-1: 1995 (German)					
	DIN V ENV 1178-2: 1995 (German)					
	ISO 9221-1:1992					
	ISO 9221-2: 1992					
	prEN 1887:1992 (European draft)					
	SN ENV 1178-1:1995 (Swiss)					
	SN ENV 1178-2:1995 (Swiss)					

11.5 DATA ISSUES

11.5.1 Hospital emergency department injury surveillance

Current Australian data systems are generally poor at identifying the involvement in injury of nursery furniture, bunk beds and most other consumer products. National estimates have been made on the basis of Victorian Injury Surveillance data and the now aging dataset collected by the National Injury Surveillance Unit until 1994.

Currently no trend data is available over time for nursery furniture or bunk bed-related injuries. The only available evidence of changing trends in Australia comes from a comparison of proportions of nursery furniture injuries associated with the range of products over time. While this provides useful information on the apparent success of interventions to prevent baby walker injuries in Victoria, rate data would provide stronger evidence.

The problems are several. There is currently no national injury surveillance system. Most states do not have injury surveillance systems from which they are able to supply useful data. The level 1 National Minimum Data Set for Injury Surveillance does not necessarily identify products, since capture of this information is dependent on case narratives and it is not specifically coded. Collecting information on the degree of involvement of products in injury causation is also problematic in injury surveillance data, since there are several possible levels of involvement and these are not always specified.

The National Injury Surveillance Unit is currently undertaking a feasibility study for the Commonwealth Department of Health and Family Services on options for the establishment of a national injury surveillance system.

It is recommended that an option is chosen and supported which collects product-related injury data in sufficient detail and sufficient numbers to allow useful in-depth analyses and reliable trend data over time. It should also contain sufficient cases, by state, to allow comparisons to identify best practice and effective interventions. There is potential for state support for options involving adequate numbers of cases to be collected at the state level to meet state as well as national needs. Level 2 data collections have already commenced in Queensland and are about to commence in Victoria.

11.5.2 Hospital admission data

Few products can be identified using the International Classification of Diseases 9th or 10th revision coding systems for mechanism of injury. It is recommended that linkage of emergency department injury surveillance and hospital admission datasets be undertaken to provide reasonably comprehensive information on moderate and severe injury cases (admissions).

11.5.3 National Coronial Information System

While the Australian Bureau of Statistics collects national death data, the information collated is derived from death certificates and does not include information at the level required to identify consumer product involvement. There is also no national coronial data system as yet. Currently, Victoria is the only State with a computerised data system which allows searching for cases across various fields (eg cause, product, age, location, etc.). Most other States still maintain a paper-based system, through which information is only accessible if the identity of indiviual cases is already known. The national system, under development, requires funding support before further progress can be made.

11.6 RESEARCH AND EVALUATION

11.6.1 Introduction

A number of potential research studies have been identified from which projects could be selected to be undertaken as a second stage to the current project. The proposed studies would address associations between product types and injury and relevant risk factors.

Comprehensive data analyses have been undertaken for the products addressed by this report. While further international comparisons would be possible, no further data analysis is recommended at this stage. Where sufficient evidence has been documented in this report on which to base recommendations for prevention, these recommendations are to be found later in this chapter.

11.6.2 Research and evaluation studies

Exposure studies are particularly important to monitor the number of particular types of products in the homes of families with young children and their usage patterns. Such studies provide denominator data to determine the injury rates by products actually in use, rather than the much less specific population figures, which must otherwise be used. This information can be used to monitor injury rates over time and to evaluate the effectiveness of interventions. An Australian Bureau of Statistics Household Safety Survey undertaken in Melbourne in 1992 collected baseline data on some items of nursery furniture and bunk beds in households with young children.

It is recommended that further household surveys be undertaken to collect additional information with regard to nursery furniture, bunk beds and possibly other products of interest. This could include information relevant to potential points of intervention, including the age of products in use, whether purchased new or second-hand, passed down from friends or family, whether restraints are the harness type, whether they are used regularly, what the barriers to use are, etc. Surveys should be piloted in one state, possibly Victoria since the new information could be compared with previous baseline data. Such surveys should include rural as well as urban populations.

Since the cost of such a study, to obtain a representative random sample of households would be approximately $100,000 per state, it is recommended that the surveys should be undertaken collaboratively with other sectors or state departments interested in further exposure issues such as sport and recreation, fire protection, drugs and medications, etc.

The timeline for such a study would be approximately 12 months.

Other useful survey studies would include retail outlet observations of compliance of nursery furniture and bunk beds with Australian or overseas standards (where there are no Australian standards). Such studies would need to include appropriate cross-sections of retail outlets and should be undertaken in more than one state. Each such study could be undertaken for approximately $20,000 and would take approximately 3 months.

Similar studies should be undertaken to investigate second hand marketing, including: newspaper and trading post advertisements; opportunity shops; fairs; trash and treasure markets, etc. Compliance with standards, modifications to design, maintenance and general condition should be assessed. These studies would take approximately 6-9 months to complete, and would cost approximately $40,000-$50,000.

Additional in depth studies are required to conduct detailed tests of nursery furniture performance against test procedures detailed in relevant standards for current models in the market place. Costing and timelines for such studies should be sought from the Australian Consumers' Council.

Relative risk studies are an important method for comparing risks between products. These studies are dependent on exposure data such as that determined from the household survey

described above. Because of the high rate of injuries to young children sleeping in both cots and beds, it is recommended that a relative risk study be undertaken for cots versus beds by age.

This study would take approximately two years to complete (including the exposure study component) at an additional cost of approximately $150,000. Similar methods could be used to address other relative risk questions.

Follow-up case studies should be undertaken to determine whether child injuries associated with nursery furniture involved a range of factors which should be further investigated. Information to be collected might include availability and use of restraints, age of equipment, method of purchase, modifications and the exact circumstances of injury. Such studies would be expected to generate research questions for further investigation. A study of this type would cost approximately $50,000 and would take approximately 18 months to complete, in order to collect a sufficient sample to draw meaningful conclusions.

In depth investigations should be undertaken as coronial inquiries for all deaths involving nursery furniture. The average cost for such an investigation would be approximately $3,000 and the time required would be approximately one month.

Interventions should be evaluated. For example, the effectiveness of the letter sent to retailers by the former Minister for Consumer Affairs, regarding withdrawing baby walkers from sale could be investigated. The development of a simple questionnaire and a telephone survey to determine the impact of that intervention and how well it is holding could be conducted quite quickly for approximately $12,000.

The effects of the introduction of new standards, and mandation of existing standards should be evaluated against injury data. These studies would require estimates to be made of the rate at which the complying products would be taken up. Cost estimates and timelines for these studies would need to be undertaken with regard to the particular issue under evaluation.

11.7 DISSEMINATION OF INFORMATION

The targetted dissemination of research findings plays an important role in the implementation of findings from data analyses and research and in raising community awareness about safety issues. It is intended to publish this report in formats accessible to government, industry and other professionals working in different areas by producing journal articles on each of the major products and featuring nursery furniture as a major issue in Victorian Injury Surveillance System publications.

It appears that a strong intervention program based on injury research data can be effective in reducing injury. The campaign, in Victoria, to discourage the use of baby walkers, used injury surveillance data to inform public and professional education, and appears to have contributed to a reduction in baby walker-related injury in that State.

Point of sale information about the correct use of products and the hazards associated with them is an important source of information for parents and care-givers. Advice provided should be underpinned by sound research. Brochures, such as those produced by Kidsafe (*Kidsafe furniture : A safety guide, 1992*), provide a good example of the type of information that should be provided in this context.

Community service TV advertisements may be effective in alerting parents and care givers to nursery furniture risks and preventive measures. An informed market place would be expected to put pressure on manufacturers and retailers to provide safe products. It may be appropriate, for example, to target baby walkers at the time of implementing an Australian/New Zealand standard.

Evidence from road safety of the success of the Transport Accident Commission's advertising campaign, in conjunction with speed and alcohol interventions and enforcement, in reducing road trauma has been documented (Cameron et al, 1993).

11.8 RECOMMENDATIONS

11.8.1 General

1. Action should be taken by the Federal Bureau of Consumer Affairs and other responsible authorities to reduce deaths and injuries related to nursery furniture and bunk beds.
2. A general product safety directive should be adopted and enforced in Australia/New Zealand.
3. Safety guidelines for standardisation such as ISO/IEC Guides 50 and 51 should be actively promoted in Australia/New Zealand.
4. Where necessary to inform and monitor policy and action on product safety, research and evaluation studies should be commissioned.
5. Resources should be allocated, where required to meet the recommendations which follow.

11.8.2 Standardisation

6. Standards should be developed for baby walkers, high chairs and change tables. No Australian/New Zealand standards exist. These standards should be based on the best available international standards or draft standards.
7. Children's furniture safety standards should be reviewed and, if necessary, modified at least once every five years, to ensure that new requirements or revision of existing requirements occurs as new substantive information becomes available.
8. Compliance with voluntary nursery furniture and bunk bed standards should be actively improved by measures such as: seeking industry co-operation, public education by means of media and hot-lines and a policy of mandation if necessary.
9. As in the United States, mandation of standards should occur in Australia where voluntary standards and the marketplace are ineffective in achieving compliance and evidence warrants it.
10. There is currently sufficient evidence, at least in the case of household cots and portable cots to mandate standards. Both of these items are involved in deaths (at a rate of about 9 times that for other nursery furniture) and studies by the Australian Consumers' Association have repeatedly shown lack of compliance in the marketplace.
11. To avoid unacceptable "non-tariff" barriers to trade, Australia/New Zealand should focus initially on improving its safety requirements for nursery furniture in-line with other major importers of nursery equipment, particularly the United States

11.8.3 Injury data collection

12. Hospital based injury surveillance should be implemented nationally to collect product-related injury data in sufficient detail and sufficient numbers to provide useful in-depth analyses and reliable secular trend data. It should contain sufficient cases by state to allow comparisons to identify best practice and effective interventions. There is potential for state support for options which would involve adequate numbers of cases to be collected to meet state needs.

13. Linkage of emergency department injury surveillance and hospital admission datasets should be undertaken to provide reasonably comprehensive information on moderate and severe injury cases (admissions).

14. The national coroners data and information system, currently under development, should identify products and their involvement in deaths.

11.8.4 Research and evaluation

15. Household surveys should be undertaken to collect additional information with regard to nursery furniture, bunk beds and possibly other products of interest. It is recommended that the surveys be undertaken collaboratively with other sectors or state departments interested in further exposure issues.

16. Retail outlet observations of compliance of nursery furniture and bunk beds with Australian or overseas standards (where there are no Australian standards) should be conducted.

17. Studies should be undertaken to investigate second hand marketing. Compliance with standards, modifications to design, maintenance and general condition should be assessed.

18. In depth studies are required to conduct detailed tests of nursery furniture performance against test procedures, detailed in relevant standards, for current models in the market place.

19. A relative risk study should be undertaken for cots versus beds by age to determine the safest sleeping environment for children of different ages.

20. Follow-up case studies should be undertaken to determine whether child injuries associated with nursery furniture involve a range of factors which should be further investigated.

21. In depth investigations should be undertaken as coronial inquiries for all deaths involving nursery furniture.

22. Interventions should be evaluated:

    - The effectiveness of the letter sent to retailers by the former Minister for Consumer Affairs, regarding withdrawing baby walkers from sale could be investigated.
    - The effects of the introduction of new standards, and mandation of existing standards should be evaluated against injury data.

11.8.5 Dissemination of information

23. The findings of this report should be published in formats accessible to government, industry and other relevant professionals as journal articles on each of the major products and in Victorian Injury Surveillance System publications.

24. Point of sale information about the correct use of products and the associated hazards should be provided for parents and care-givers.

25. Community service TV advertisements should be produced to alert parents and care givers to nursery furniture risks at the time of implementing preventive measures such as mandatory standards or new voluntary standards.

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13. APPENDIX 1: AUSTRALIAN AND STATE DATA

AUSTRALIAN DATA

PRODUCT SUMMARY REPORT

NURSERY FURNITURE & CONSUMABLES

(Ranked by total number of cases recorded in the 0-4 yrs. age-group)

Product Code	Description	SAMPLE															TOTAL		
		0yr			1yr			2yr			3 yr			4yr			0 - 4 yrs		
		male	female	total	male	female	total	male	female	total	male	female	total	male	female	total	male	female	total
1508	Baby walkers or jumpers	405	280	685	31	27	58	7	4	11	4	3	7		1	1	447	315	**762**
1555	High chairs	125	130	255	158	144	302	52	35	87	13	10	23	6	7	13	354	326	**680**
1522	Baby strollers	138	131	269	131	113	245	48	35	83	15	15	30	8	4	12	340	298	**639**
1505	Baby carriages and prams	197	156	353	97	85	182	39	27	66	10	7	17	3	5	8	346	280	**626**
1543/ 1545	Cots & cots, not specified	70	66	136	146	128	274	62	34	96	14	12	26	14	11	25	306	251	**557**
1502	Baby changing tables	176	197	373	25	30	55	16	7	23		4	4		2	2	217	240	**457**
1520	Baby exercisers	98	82	180	4	3	7	3	1	4		2	2	2		2	107	88	**195**
1519	Car seats (for infants or children)	23	24	48	18	9	27	21	17	38	8	17	25	3	8	11	73	75	**149**
1509	Baby bottles or nipples	13	24	37	35	21	56	15	8	23	1	1	2		2	2	64	56	**120**
1518	Youth chairs	5	6	11	23	19	42	11	9	20	15	10	25	2	6	8	56	50	**106**
1554	Safety pins	17	13	30	14	13	27	7	11	18	1	4	5		3	3	39	44	**83**
1537	Bassinets or cradles	37	35	72		2	2	3	1	4							40	38	**78**
1521	Baby Capsule	41	28	69	1		1		1	1	1		1	1		1	44	29	**73**
1549	Other baby carriers	19	17	37	1	1	2								1	1	20	19	**40**
1513	Playpens	9	6	15	7	5	12	4	3	7	1	1	2		1	1	21	16	**37**
1528	Nappy buckets	4	3	7	10	8	18	3	4	7	1		1				18	15	**33**
1506	Baby gates or barriers	6	1	7	5	8	13	3		3	1	1	2	3	2	5	18	12	**30**
1556	Attachable high chairs (inc. booster seats)	9	8	17	6	4	10	1	1	2							16	13	**29**
1535	Potty chairs or training seats	1	1	2	4	10	14	3	5	8	2		2				10	16	**26**
1527	Baby carriers or slings (backpacks)	9	10	19	4	1	5		1	1							13	12	**25**
1536	Cot extender rails or youth bed rails	3	1	4	4	4	8	2	1	3	3	2	5	4	1	5	16	9	**25**
1525	Pacifiers or teething rings	8	3	11	5	3	8		1	1		1	1				13	8	**21**
1548	Baby carriers, not specified	8	6	14	2		2	1	3	4					1	1	11	10	**21**
1529	Portable cots		4	4	4	4	8	2	1	3	1	2	3				7	11	**18**
1553	Portable baby swings (for home use)	6	2	8	3		3	1	2	3				1		1	11	4	**15**
1531	Baby carriers (bicycle-mounted)	1		1	2	2	4		2	2		2	2	2	2	4	5	8	**13**
1544	Baby baths or bathinettes	5	3	8	1	1	2	1		1	1		1				8	4	**12**
1551	Nappy fasteners (excl. safety pins)	3	1	4	4	2	6										7	3	**10**
1517	Baby rattles	3	4	7		2	2										3	6	**9**
1512	Nappies	2	1	3	1	2	3	1		1					1	1	4	4	**8**
1511	Sterilisers (home use)	4		4	2		2		1	1							6	1	**7**
1534	Car beds for infants	2	3	5	1		1										3	3	**6**
1524	Dummies, pacifiers or teething rings		2	2	1	1	2	1		1							2	3	**5**
1510	Bottle warmers	1	2	3					1	1							1	3	**4**
1542	Baby mattresses or pads	1	1	2		1	1		1	1							1	3	**4**
1539	Shoelace fasteners (for infants)		1	1				1		1					1	1	1	2	**3**
1515	Baby scales		1	1		1	1										0	2	**2**
1526	Cot mobiles or crib gyms				1		1								1	1	1	1	**2**
1533	Night-lights													1		1	1	0	**1**
TOTAL		**1,449**	**1,253**	**2,704**	**751**	**654**	**1,406**	**308**	**217**	**525**	**92**	**94**	**186**	**50**	**60**	**110**	**2,650**	**2,278**	**4,931**

NOTE : 3 cases of unknown sex (age 0, 1519;age 0, 1549; age 1, 1522).

Source : National Injury Surveillance & Prevention Project (NISPP), NATIONAL INJURY SURVEILLANCE UNIT (NISU)

VICTORIAN DATA

PRODUCT SUMMARY REPORT

SELECTED NURSERY FURNITURE PRODUCTS

(Ranked by total number of cases recorded in the 0-4 yrs. age-group)

Age	Gender	Disposition	PRODUCT							
			Prams	Cots	High chairs	Baby walkers	Strollers	Change tables	Bouncers	TOTAL
0	**Male**	Presented	63	32	42	77	26	28	26	294
		Admitted	16	10	6	16	6	5	15	74
		Died or d.o.a.	0	0	0	0	1	0	0	1
		Total	**79**	**42**	**48**	**93**	**32**	**33**	**41**	**368**
	Female	Presented	68	39	34	72	23	35	26	297
		Admitted	10	5	3	9	5	8	8	48
		Total	**78**	**44**	**37**	**81**	**28**	**43**	**34**	**345**
	Total	Presented	131	71	76	149	49	63	52	591
		Admitted	26	15	9	25	11	13	23	122
		Died or d.o.a.	0	0	0	0	1	0	0	1
		Total	**157**	**86**	**85**	**174**	**61**	**76**	**75**	**714**
1	**Male**	Presented	42	45	34	13	29	9	0	172
		Admitted	9	10	8	1	6	2	1	37
		Total	**51**	**55**	**42**	**14**	**35**	**11**	**1**	**209**
	Female	Presented	33	43	22	12	28	9	1	148
		Admitted	3	8	19	0	9	1	1	41
		Total	**36**	**51**	**41**	**12**	**37**	**10**	**2**	**189**
	Total	Presented	75	88	56	25	57	18	1	320
		Admitted	12	18	27	1	15	3	2	78
		Total	**87**	**106**	**83**	**26**	**72**	**21**	**3**	**398**
2	**Male**	Presented	9	23	15	2	18	6	2	75
		Admitted	5	5	5	0	2	3	0	20
		Total	**14**	**28**	**20**	**2**	**20**	**9**	**2**	**95**
	Female	Presented	10	10	12	0	8	3	0	43
		Admitted	1	4	1	0	3	0	0	9
		Total	**11**	**14**	**13**	**0**	**11**	**3**	**0**	**52**
	Total	Presented	19	33	27	2	26	9	2	118
		Admitted	6	9	6	0	5	3	0	29
		Total	**25**	**42**	**33**	**2**	**31**	**12**	**2**	**147**
3	**Male**	Presented	5	7	3	2	3	0	1	21
		Admitted	0	0	0	0	2	0	0	2
		Total	**5**	**7**	**3**	**2**	**5**	**0**	**1**	**23**
	Female	Presented	3	3	2	0	4	2	0	14
		Admitted	0	0	1	1	0	0	2	4
		Total	**3**	**3**	**3**	**1**	**4**	**2**	**2**	**18**
	Total	Presented	8	10	5	2	7	2	1	35
		Admitted	0	0	1	1	2	0	2	6
		Total	**8**	**10**	**6**	**3**	**9**	**2**	**3**	**41**
4	**Male**	Presented	4	4	1	0	1	0	0	10
		Admitted	0	1	2	0	0	0	0	3
		Total	**4**	**5**	**3**	**0**	**1**	**0**	**0**	**13**
	Female	Presented	4	3	1	0	1	0	0	9
		Admitted	0	0	1	0	0	0	0	1
		Total	**4**	**3**	**2**	**0**	**1**	**0**	**0**	**10**
	Total	Presented	8	7	2	0	2	0	0	19
		Admitted	0	1	3	0	0	0	0	4
		Total	**8**	**8**	**5**	**0**	**2**	**0**	**0**	**23**
0-4	**Male**	Presented	123	111	95	94	77	43	29	572
		Admitted	30	26	21	17	16	10	16	136
		Total	**153**	**137**	**116**	**111**	**93**	**53**	**45**	**708**
	Female	Presented	118	98	71	84	64	49	27	511
		Admitted	14	17	25	10	17	9	11	103
		Total	**132**	**115**	**96**	**94**	**81**	**58**	**38**	**614**
	Total	Presented	241	209	166	178	141	92	56	1083
		Admitted	44	43	46	27	33	19	27	239
		Died or d.o.a	0	0	0	0	1	0	0	1
		Total	**285**	**252**	**212**	**205**	**175**	**111**	**83**	**1323**

Source : Victorian Injury Surveillance System (VISS), 1986-94.

SOUTH AUSTRALIAN DATA

PRODUCT SUMMARY REPORT

SELECTED NURSERY FURNITURE PRODUCTS

(Ranked by total number of cases recorded in the 0-4 yrs. age-group)

	SAMPLE															TOTAL		
Description	**0yr**			**1yr**			**2yr**			**3 yr**			**4yr**				**0 - 4 yrs**	
	male	**female**	**total**	**male**	**female**	**total**	**male**	**female**	**total**	**male**	**female**	**total**	**male**	**female**	**total**	**male**	**female**	**total**
Prams	23	20	43	12	7	19	3	3	6	1	1	2		1	1	39	32	**71**
Strollers	8	10	18	16	14	30	2	2	4	1	4	5	1	1	2	28	31	**59**
High chairs	10	13	23	13	11	24	5	2	7	1		1		2	2	29	28	**57**
Change tables	16	18	34	5	10	15	4	1	5							25	29	**54**
Baby walkers	14	11	25	9	5	14	2		2							25	16	**41**
Baby exerciser	16	10	26		2	2										16	12	**28**
Cots		1	1	4	3	7	2	1	3							6	5	**11**
TOTAL	**87**	**83**	**170**	**59**	**52**	**111**	**18**	**9**	**27**	**3**	**5**	**8**	**1**	**4**	**5**	**168**	**153**	**321**

Source : Epidemiology Branch, Public & Environmental Health Division, South Australian Health Commission, 1994-mid 1997.

QUEENSLAND DATA

PRODUCT SUMMARY REPORT

SELECTED NURSERY FURNITURE PRODUCTS

(Ranked by total number of cases recorded in the 0-4 yrs. age-group)

	SAMPLE															TOTAL		
Description	**0yr**			**1yr**			**2yr**			**3 yr**			**4yr**			**0 - 4 yrs**		
	male	**female**	**total**	**male**	**female**	**total**	**male**	**female**	**total**	**male**	**female**	**total**	**male**	**female**	**total**	**male**	**female**	**total**
Baby walkers	24	9	33	2	2	4										26	11	**37**
Change tables	14	13	27	1	1	2		1	1							15	15	**30**
High chairs	4	1	5	10	9	19	3		3		1	1				17	11	**28**
Prams/strollers/pushers	7	7	14	1	5	6	1	1	2	1	2	3				10	15	**25**
Cots	3	1	4	7		7	2		2	1		1				13	1	**14**
Rockers	3		3													3	0	**3**
Jolly jumpers	1		1													1	0	**1**
Portable cots					1	1										0	1	**1**
Bouncers	1		1													1	0	**1**
TOTAL	**57**	**31**	**88**	**21**	**18**	**39**	**6**	**2**	**8**	**2**	**3**	**5**	**0**	**0**	**0**	**86**	**54**	**140**

Source : Queensland Injury Surveillance & Prevention Project (QUISP), July '94-Dec.'96.