



Health Development Agency

Injuries in children aged 0–14 years and inequalities

A report prepared for the Health Development Agency

Elizabeth Towner, Therese Dowswell, Gail Errington, Matthew Burkes, John Towner

Community Child Health, Department of Child Health
University of Newcastle upon Tyne

**This document is also published on the
Health Development Agency website at
www.hda.nhs.uk**

Acknowledgements

This research study has been funded by the Health Development Agency, London, and this support is gratefully acknowledged. We wish to thank Mr Antony Morgan for his comments and support.

We are also grateful to Mrs Penny Giddings for retrieving the publications cited, and Mrs Lilian Simpson and Mrs Ann Pattison for typing and preparing the report.

Copies of this publication are available to download from the HDA website (www.hda.nhs.uk).

Health Development Agency
Holborn Gate
330 High Holborn
London
WC1V 7BA

Email: communications@hda-online.org.uk

ISBN 1-84279-339-X

© Health Development Agency 2005

About the Health Development Agency

The Health Development Agency (www.hda.nhs.uk) is the national authority and information resource on what works to improve people's health and reduce health inequalities in England. It gathers evidence and produces advice for policy makers, professionals and practitioners, working alongside them to get evidence into practice.

Contents

Summary	1
A: Setting the scene	3
A1 Introduction	3
A2 Definitions	4
A3 Methods	5
A4 National data sources on injury and coverage of inequalities	6
A5 Key points	9
B: Why are inequalities associated with injury risk? Evidence from observational studies	10
B1 Introduction	10
B2 Age	12
B3 Gender	13
B4 Social and economic factors	15
B5 Culture and ethnicity	17
B6 Place	19
B7 Vulnerable groups	21
B8 Key points	23
C: Have injury intervention studies addressed inequalities?	24
C1 Introduction	24
C2 Pedestrian injuries	25
C3 Car occupant injuries: child restraints	29
C4 Bicycle injuries	31
C5 Injuries in the home	34
C6 Injuries in the leisure environment	41
C7 Mass media and training interventions	43
C8 Community-based interventions	44
C9 Key points from all the intervention studies	47
D: Discussion and recommendations	48
D1 Discussion	48
D2 Recommendations for practitioners, researchers and policy makers	51
References	53
References for Appendix Tables C2–C8	58

Summary

All children are exposed to injury as part of their everyday lives, but the burden is not evenly spread: injuries disproportionately affect some children more than others. Great variations occur in injury mortality and morbidity, which reflect a child's age, gender, socio-economic group, cultural and/or ethnic group, and where they live.

In this report we attempt to describe and seek to understand these variations. For each inequality in turn (age, gender, social and economic factors, culture and ethnicity, place) we question why it is associated with injury risk. We then examine evaluated intervention studies identified in an earlier review (Towner et al 2001; www.hda-online.org.uk/downloads/pdfs/prevent_injuries.pdf) and ask whether injury prevention studies have addressed these inequalities. The information is presented in tabular and narrative form for different injury types.

Key points identified in our description of inequalities are:

- There are great variations in injury mortality and morbidity, reflecting children's age, gender, socio-economic group, cultural or ethnic group, and location
- These variations suggest there is considerable scope for improvement and intervention
- A number of reports and policy initiatives are relevant to this report: the *Independent inquiry into inequalities in health* (Acheson, 1998); *Saving lives: our healthier nation* (Secretary of State for Health, 1999); the report of the Accidental Injury Task Force (Department of Health, 2002b); and the Economic and Social Research Council (ESRC) Health Variations Programme
- Children as a group are particularly vulnerable to injury: they have little say in how environments are planned, and in recent years child poverty has increased
- National injury data systems provide good information on age and gender and some information on social and economic factors, and on place

- National injury data systems do not routinely provide information on ethnic groups or on vulnerable groups such as children in homeless families or disabled children.

Key points identified in relation to the causes of inequalities are:

- The factors associated with injury inequalities are multi-faceted and inter-related; the causal pathways linking these factors to injury events remain uncertain
- Three tiers of factors need to be considered to clarify the inter-relationships: (1) proximate tier, immediate conditions that result in exposure to hazard; (2) intermediate tier, eg childcare practices; (3) ultimate tier, the wider social, economic, political and cultural processes
- These tiers fit into the concept of structure and agency; the interplay of structure and agency is worked out in specific geographic locations
- More direct causes of injury include exposure to hazards, the ability of parents, carers and communities to protect children, and children's ability to manage hazards
- Greater knowledge about disparities between groups and factors leading to increased risk is important in designing interventions.

Key points relating to whether intervention studies have addressed inequalities are:

- Few intervention studies explicitly address inequalities – and still fewer attempt to set out the problem in relation to that factor, take it into account in the design of the intervention, and report on whether there has been any differential impact in relation to that factor
- Age: many interventions target specific age groups of children, but there are few examples of results comparing the impact of an intervention on different age groups
- Gender: despite the great differences in injury rates in boys and girls, few interventions have targeted this factor

- Social and economic factors: interventions have increasingly been targeted at deprived individuals or groups – the main strategy adopted in interventions is the provision of safety equipment
- Culture/ethnicity: cultural differences are rarely addressed (a few interventions have involved the target group in the design of the intervention), and few studies compare interventions in different ethnic groups
- Place: when communities have been matched in controlled interventions, broad demographic variables have been used and little attention has been paid to the context.

We discuss how definitions need to be improved and how descriptive and analytical studies and intervention studies could be improved to address inequalities. We also consider the role of targeted and universal approaches to injury prevention.

Recommendations are made that are of relevance to practitioners, researchers and policy makers.

A: Setting the scene

A1 Introduction

Unintentional injury is the main cause of death in childhood in the UK, and a major cause of ill health and disability. All children are exposed to hazards as part of their everyday lives as they play, travel around, work, and even (at times) when they are asleep. The burden of injury is not evenly spread – injuries disproportionately affect some children more than others. Great variations occur in injury mortality and morbidity which reflect a child's age, gender, socio-economic group, ethnic group, and where they live.

In this report we attempt to describe and seek to understand these variations. Injuries are preventable, and the great variations in injury mortality and morbidity between, for example, different socio-economic groups suggest that there is considerable scope for improvement and intervention.

Sections A (variations in injury risk) and B (factors associated with risk) both relate to the UK context, while section C (evaluated interventions) is drawn from the international literature. For information on patterns of child injuries and inequalities in other countries a special edition of the journal *Injury Control and Safety Promotion* (2001), on social inequalities in injury risks, is a useful source, particularly for articles related to childhood injuries and inequalities in Sweden and Germany.

What policy initiatives are relevant to childhood injury and inequalities?

The *Independent inquiry into inequalities in health* (Acheson, 1998) reviewed and summarised inequalities in health in England and identified priority areas for future policy development. These areas included poverty, income tax and benefits; education; employment; housing and environment; mobility, transport and pollution; and nutrition. Areas were also identified by life-course stage,

and one important group identified was mothers, children and families. There was also a focus on ethnic and gender inequalities. The *Independent inquiry into inequalities in health* was an important influence in the development of the health strategy for England.

Saving lives: our healthier nation (Secretary of State for Health, 1999) includes accidents as one of four priority areas. The target set for 2010 was:

'to reduce the death rate from accidents by at least a fifth and to reduce the rate of serious injury from accidents by at least a tenth – saving 12,000 lives'

Children were one of the groups highlighted. The national strategy aimed to improve the health of everyone, but in particular aimed to improve the health of the worst-off in society. The report acknowledged the importance of social, economic and environmental factors in poor health.

Our Healthier Nation also announced that a Task Force on Accidental Injury would be set up. This was convened in November 2000 and its terms of reference were:

'To advise the Chief Medical Officer on the most important priorities for action to meet the national target, to develop an implementation plan and to develop and publicise a more unified approach to accident prevention across Government and the NHS'

The Task Force identified immediate priority areas using three criteria: they are a substantial burden of injury; they represent areas where marked social disadvantages are apparent; and some evidence-based interventions are available. For children aged 0–15 years the priority areas were pedestrian injuries; fires and thermal injuries; and play and recreation (eg cycling and swimming) (Department of Health, 2002a).

Also relevant to this review is the work of the Health Variations Programme. This was established by the ESRC in

1996 to focus on the causes of health inequalities in Britain. Publications stemming from this review have been used throughout the report.

Why is inequality in childhood particularly important?

In the last two decades of the twentieth century Britain became richer and healthier, but inequalities in income and health widened markedly. The benefits of increasing prosperity were not equally shared, and there was a sharp rise in the proportion of children living in households below the poverty line (below 50% of average income after housing costs). An increase in child poverty has profound implications for health inequalities in both current and future generations (Graham, 1999).

Children as a group are particularly vulnerable to injury because they live in a world in which they have little power or control. They live in environments constructed by and for adults, and seldom have any input into how places, even places such as playgrounds, are designed.

This report

This report is divided into four sections. In this section we set out the definitions (A2) and methods employed in the review (A3), and examine national sources of injury data for their coverage of inequalities (A4).

Section B uses evidence from observational studies to investigate the causes of injury. For each inequality in turn (age, gender, social and economic factors, culture/ethnicity, and place) we question why it is associated with injury risk.

Section C uses evidence from evaluated intervention studies and asks whether injury intervention studies have addressed inequalities. The information is presented in tabular and narrative form for different injury types, eg pedestrian injuries (C2), car occupant injuries (C3) etc.

At the end of each section A–C, the key points are summarised. In Section D these key points are used as the basis for discussion. Recommendations are made that are of relevance to practitioners, researchers and policy makers.

A2 Definitions

In this report we examine childhood injuries and inequalities. This is the focus of both *Saving lives: our healthier nation* (Secretary of State for Health, 1999) and the Accidental Injury Task Force (Department of Health, 2002a,b).

Unintentional injury can be defined as 'injury occurring as a result of an unplanned and unexpected event which occurs at a specific time from an external cause'. The Office for National Statistics (ONS) uses definitions based on the International Classification of Diseases, ICD-9 (www.cdc.gov/nchs/about/otheract/icd9/abticd9.htm) and ICD-10 (www.who.int/whosis/icd10/). The types of injury included are:

- Transport – rail, road, air, water
- Poisoning
- Falls
- Fire, flames and smoke
- Natural and environmental factors
- Submersion, suffocation and foreign bodies
- Other accidents.

The inequalities we examine are age, gender, social and economic factors, cultural and ethnic groups, and place. Many of these factors are, however, inter-related and this needs to be borne in mind throughout the report. Below, we define how we have used these terms.

- Age: we concentrate in particular on the 0–14 age group but on occasions data are given for 0–15 year olds. Where possible, subgroups of 0–4, 5–9 and 10–14 years are used.
- Gender: we use the term 'gender' throughout the report.
- Social and economic factors: in section A4 on national data sources, social class has been derived from the classification of children's parental occupation. Wider definitions of social and economic factors are discussed in section B4.
- Culture/ethnicity: in section A4 on national data sources, definitions of ethnic groups as used in labour force surveys are used for the UK (Scott et al 2001). In section B5 we discuss wider definitions of 'cultural group' and 'ethnic group'.
- Place: can be considered as a portion of geographic space such as a ward, enumeration district etc, and this definition is mainly used in section A4. In section B6 a broader definition is discussed – 'space' relating to physical attributes and a site or area to which people attach certain meanings.

Sections A4 and B focus on conditions in the UK. Some statistics are collected and reported for the whole of the UK, eg fire statistics; road traffic accidents are reported for Great Britain (England, Wales and Scotland); and mortality data for England and Wales. Section C on intervention studies describes the international literature but is limited to studies published in English.

A3 Methods

The aim of this report is to address the issue that unintentional injuries disproportionately affect some children more than others, and to consider the scope for improvement and intervention.

The objectives are to:

- Describe inequalities related to age, gender, social and economic factors, culture and ethnicity and place, using national data sources relating to unintentional injury
- Seek to understand why inequalities are associated with injury risk
- Examine whether, and to what extent, intervention studies have taken inequalities into account in the selection of injury target groups or settings, explicitly in the ways interventions have been designed or results and outcomes have been reported.

These three objectives are examined in sections A4, B and C. The methods used in these three sections are described below.

Description of inequalities and childhood injury in national data sources (section A4)

The primary source for this section is the report of the Measuring and Monitoring Injury Group to the Accidental Injury Task Force (Department of Health, 2002b). In the course of preparing this review we collected information from different national data sources (eg ONS), but the Task Force Report succinctly summarises these data and we have consequently used this as the main source. For each of the inequalities in the review – age, gender, social and economic factors, cultural and ethnic group and place – we provide illustrations of the varying patterns in relation to unintentional injury. This is not a comprehensive review, but is intended to show what information can be gleaned from the different national data sources.

Explanation of why inequalities are associated with injury risk (section B)

In this section we use a framework described by Thomson et al (2001) in a review examining ethnicity and injury. This suggests that the direct causes of injury are exposure to hazards, parents, carers and communities' ability to protect children, and children's capacity to manage hazards. We apply this framework to the five inequality areas. The literature for this section is primarily drawn from large cohort studies and case–control studies examining the characteristics

of injured children. Relevant cohort and case–control studies were identified by searching electronic databases (eg MEDLINE, Web of Science) and by hand-searching relevant journals (eg *Injury Prevention*). Studies are included which were carried out in the UK context. Additional literature on injury risk was identified from the same sources and is included where it sheds further light on the causes of injuries related to inequalities. In view of the varied and potentially large volume of literature in this area, the search and reviewing strategies adopted for this section were not systematic, instead illustrative examples of the literature have been provided. The search strategies used mean that many of the studies included were drawn from the medical/epidemiological literature which is predominantly quantitative in nature. This section does not explicitly identify qualitative studies or examine the contribution they can make to understanding inequalities in childhood injury. This would be a valuable future area of work to extend the scope of the review.

Examination of whether, and to what extent, evaluated intervention studies have taken inequalities into account (section C)

Section C uses as its source a systematic review of the literature which attempted to answer the question 'How effective are health promotion interventions in preventing unintentional injuries in childhood and young adolescents?' (Towner et al 2001). It includes studies published between 1975 and 2000 and builds on two earlier reviews published in 1993 and 1996. This review has been updated with studies published in 2001.

In the 2001 systematic review, relevant literature was identified by a variety of means. Computerised databases including MEDLINE, BIDS (and more recently the Web of Science), Excerpta Medica, and more specialised sources such as the Transport and Road Laboratory databases were searched. A full list of databases searched and search terms used is available on request. This electronic search was supplemented by hand-searching a number of relevant journals such as *Accident Analysis and Prevention* and *Injury Prevention* along with the reference lists of relevant published articles and books. In addition, relevant informants (researchers and specialists in the area of child injury prevention) were consulted. The criteria for inclusion of studies were that they should:

- Be written in English and published between 1975 and 2000
- Relate to the prevention of unintentional injuries (solely or in part)

- Have a target population including children under 15 and report results for this group
- Describe either a primary intervention measure to prevent accidents occurring or a secondary measure to prevent or reduce the severity of injuries
- Have been evaluated using some measure of outcome or impact, eg changes in injury mortality or morbidity, changes in observed or reported behaviour, environmental change or hazard removal, or changes in knowledge or attitudes.

Violence prevention studies were excluded except where they were combined with unintentional injury studies.

All studies were read and reviewed independently by two reviewers. Where statistical advice or other specialised knowledge was required a third reviewer was consulted. A standardised data extraction form was devised and used to record details from each study (available on request). Details recorded included the date and place of the study, the injury target group, and the aim, content and setting of the intervention. Where interventions had been targeted at socially or economically disadvantaged groups this was noted. In addition, details about the evaluation were recorded. This included a brief description of the methods used (study design, sample size, data collection methods, outcome and impact measures), and a note was made of strengths and weaknesses of the evaluation. The process of assessing the quality of the evidence of the various studies was informed by the NHS Centre for Reviews and Dissemination guidelines on carrying out systematic literature reviews (Arblaster et al 1995). The reviewers reached a consensus decision on the quality of the evidence. Each study was graded on a five-point scale ranging from weak to good (weak, reasonable/weak, reasonable, reasonable/good, good).

Key results were recorded and a consensus decision made about the effectiveness of the intervention. Where results were reported for subgroups in the sample (eg for children attending schools in higher- or lower-income areas), these were recorded.

Details from the data extraction forms were used to devise summary tables for each study. Studies where the evidence was rated as weak were excluded at this stage.

The 2001 systematic review has been supplemented by studies published in 2001, using the methods outlined above. This new database of 164 studies was then re-analysed to see whether inequalities (age, gender, social and economic

groups, culture/ethnicity and place) have played any part in the selection of injury target groups and settings, the design of the interventions, and the results and outcomes reported.

Our research team extracted this additional information from the original articles and amended the entries in the tables. The additional findings were discussed by the team and formed the basis for analysis of the tables, as presented in section C. The tables themselves are available online at www.hda.nhs.uk/evidence, along with a full list of the studies included.

A4 National data sources on injury and coverage of inequalities

There are six national data systems in the UK, or parts of the UK, that are relevant to this review:

- Mortality statistics – ONS
- Road traffic accidents – STATS19 data
- Hospital admissions data – Hospital Episode Statistics
- A&E attendance statistics – Home and Leisure Accident Surveillance Systems (HASS/LASS)
- Fire statistics
- Self-reported injury – Health Survey for England.

Detailed information on the first five of these systems is available in Appendix 2 of the *Measuring and monitoring injury* report to the Accidental Injury Task Force (Department of Health, 2002b). The types of data collected by the different data systems are summarised below.

Mortality statistics – ONS

The ONS compiles mortality statistics on unintentional injuries based on details collected when deaths are certified and registered. Deaths have been coded using the International Classification of Disease coding, ICD-9 for the period 1979–2000 and ICD-10 since 2001. In England and Wales, for each major type of injury information is available on age, gender, and cause and place of occurrence of the injury event.

Road traffic accidents – STATS19 data

In Great Britain information on mortality and morbidity resulting from road traffic accidents, involving vehicles on public highways, is collected by the police and collated by the Department for Transport.

Information on three levels of severity is available: fatal, serious and slight. Data are collected on the location and circumstances of the accident, the vehicle involved and the resulting injuries incurred.

Hospital admissions data – Hospital Episode Statistics

The Department of Health collects data on hospital admissions. Diagnosis and external cause are coded using the International Classification of Disease coding, and ICD-10 codes have been in use since 1995. Data are collected on personal, medical and administrative variables.

A&E attendance statistics – Home and Leisure Accident Surveillance Systems (HASS/LASS)

The Department for Trade and Industry collects information about home and leisure accidents in the HASS and LASS databases. Data are collected from 18 A&E departments in the UK, representing about 5% of all UK attendances for home and leisure accidents. Data are collected directly from patients through an interview and supplemented by information derived from medical records. Information is available on the immediate circumstances of the accident, accident mechanism, location, activity at the time, type of injury and body part injured, products involved, outcome of the initial A&E visit and duration of in-patient stay.

Fire statistics

The Office of the Deputy Prime Minister collates and analyses fire statistics, including injuries from fires, which are collected by local fire brigades. Records of deaths are checked against certification from the ONS.

Self-reported injuries – Health Survey for England

In the Health Survey for England self-reported data on ‘major’ and ‘minor’ accidents were collected for children aged 2–15 years for the years 1995–97. ‘Major’ accidents

were considered to be those where a hospital was visited or a doctor consulted, while ‘minor’ accidents were those causing pain or discomfort for more than 24 hours (Purdon, 1997).

These systems are uncoordinated at present and it is possible for one injured person to generate sets of unlinked records in different systems. Some of the systems also achieve incomplete coverage (Department of Health, 2002b). For example STATS19 records omit many cyclist and pedestrian injuries, even when casualties are admitted to hospital (Department of Health, 2002b).

Two out of these six systems, the Health Survey for England and HASS/LASS data, are sample surveys intended to provide nationally representative data.

Table 1 summarises whether these national data systems can provide information on unintentional injury and age, gender, socio-economic group, ethnic group and place. All six systems provide information on the age and gender of the injured child. Five of the systems provide some information on place. The ONS mortality data and Hospital Episode Statistics data include the geographic area of residence (postcode) of the injured person. STATS19 data has the geographic area of the road accident, and since 1999 it has also started to collect the geographic area of residence (postcode) of the casualty. HASS/LASS data includes the home address postcode of the casualty, but not of the accident location if this is outside the home.

In relation to social and economic factors, ONS has done limited analysis in relation to death registration data (see below for details). STATS19 and Fire statistics do not collect information on the socio-economic status of casualties. HASS/LASS data include information on employment status. Some studies have used STATS19, Fire statistics and HASS/LASS data, and examined social and economic factors using

	Age	Gender	Social and economic factors	Ethnic group	Place
ONS	✓	✓	(✓)	x	✓
STATS19	✓	✓	(✓)	x	✓
Hospital Episode Statistics	✓	✓	(✓)	x	✓
HASS/LASS	✓	✓	(✓)	x	x
Fire statistics	✓	✓	(✓)	x	✓
Health Survey for England	✓	✓	x	x	x
() Can be derived from data.					

the residential postcode of accident victims. The Health Survey for England has some information on social class for adults 16 and over, but there is no information for children. None of the systems routinely provides information on ethnic groups of injured children.

In relation to particular vulnerable groups, eg children living in homeless families or disabled children, it is impossible to obtain a national picture in relation to childhood injury (see B7).

Using examples from these data systems we illustrate the patterns relating to age, gender, social and economic factors, ethnic group and place. This is not a comprehensive review, but is intended to give a flavour of the sources available.

Age

Patterns of injury can be identified that reflect children's age and stage of development, eg pre-school children are more likely to have an unintentional injury in the home environment. School-age children are much more likely to have injuries in the road environment.

ONS mortality data for England and Wales for the three-year period 1997–99 show that 1,071 children aged 0–14 years died of an unintentional injury (ICD9 E800-949). Forty per cent of these deaths were in children aged 0–4 years. For certain injuries such as cycle or pedestrian injuries, older children aged 5–14 years predominated, accounting for 99% of cycle deaths and 78% of pedestrian deaths. In the home environment pre-school children accounted for 66% of the deaths from suffocation and foreign bodies and 70% of the deaths from fire and flames.

STATS19 data for the three-year period 1998–2000 for Great Britain showed that 84 children were killed as pedal cyclists, 2,219 were seriously injured and 15,889 were slightly injured. There was a steep age gradient, with older children (aged 10–14 years) having the greater number of casualties and pre-school children (aged 0–4 years) having the fewest. A more pronounced age gradient occurred for deaths than for either serious or slight injuries.

HASS data for the four-year period 1996–99 for children attending A&E departments as a result of a choking incident showed that 62% of the incidents involved children aged 0–4 years, 24% children aged 5–9 years, and 15% children aged 10–14 years. The peak age for choking incidents was the second year of life, and from this age the number of cases declined with increasing age (Towner and Errington, 2002).

Gender

The pattern of injury mortality and morbidity is very different for boys and girls, with boys experiencing more injuries than

girls for most injury types. The gender differences in injury mortality have remained constant over time (Jarvis et al., 1995).

Of the 1,071 children aged 0–14 years in England and Wales who died as a result of an injury in the period 1997–99, 66% were male and 34% female. In the road environment, 74% of cyclist deaths were male, as were 63% of pedestrian deaths and 48% of passenger accidents. For drowning deaths 81% were male, for falls 71%, for suffocation and foreign bodies 64%, and for poisoning 61%. Deaths from fire and flames showed fewer gender differences, with 54% of fatalities in males.

The Health Survey for England provides evidence of the scale of injury morbidity. Self-reported data on 'major' and 'minor' accidents were collected for children aged 2–15 years for the years 1995–97. Major accident rates (where a hospital was visited or a doctor consulted) were higher in boys than girls, 31 per 100 per year, compared with 22 per 100 per year. Minor accidents (other accidents causing pain or discomfort for more than 24 hours) were reported more by boys: 216 per 100 per year, compared with 144 per 100 for girls (Purdon, 1997).

Socio-economic group

The decennial supplement of occupational mortality published by the Office of Population in Censuses and Surveys (now ONS) provides injury mortality data by occupational class for children aged 1–15 years in England and Wales for 1979, 1980, 1982 and 1983 (data for 1981 are unavailable because of an industrial dispute; OPCS, 1988). Direct comparisons with more recently published data are made difficult by changes in the reporting of class-based population data. Roberts and Power (1996) were able to overcome these limitations by obtaining anonymised records of all child deaths for 1989–92, and parents' occupational class.

In 1979–83 the injury death rate for children in social class V was 3.5 times that in social class I (Roberts and Power, 1996). For 1989–92 the injury death rate was five times that of children in social class 1. As a result of the differential decline in injury death rates, socio-economic mortality differences increased.

Over this period, motor vehicle accident death rates declined by 30 and 39% in social classes I and II, compared with 18 and 1% in social classes IV and V. For deaths due to fire and flames, rates in social classes I and V declined by 28 and 5%, respectively (Roberts and Power, 1996). The death rates for children from social class V for fire and flames were 16 times those for children from the most affluent backgrounds and

five times those for pedestrian injury (Roberts, 1997). Death rates among the 'unoccupied' groups were even greater than for social class V, with children from these backgrounds being particularly vulnerable (Judge and Benzeval, 1993). Similar trends have been identified in Scotland using alternative methods of classifying social groups (Morrison et al 1999).

STATS19 data contain information on the postcode where road traffic accidents take place. Kendrick (1993) has analysed pedestrian accidents in children in Nottingham using locally derived deprivation scores. She found a significantly higher accident rate in deprived areas and a dose-response relationship between areas of deprivation and accident rates. Other studies have extracted data from police files to obtain postcoded home addresses of children: in an analysis of child pedestrian accidents in Manchester and Salford (Preston, 1972), and in analysing road traffic accidents in Newcastle (Walsh et al 1990). In the past few years STATS19 data have included the casualty's home address postcode – when coverage rates are higher it will be possible routinely to examine the effect of deprivation on road traffic accidents.

Ethnic groups

None of the national data sources on injury specifically collects information about the ethnic group of injured children. Raleigh and Balarajan (1995) noted that information on ethnic origin had not been previously recorded in health information systems and population-based statistics. In particular they point to the paucity of information in relation to 'child abuse, accidental injury and levels of disability and handicap'. As information is lacking about injury in different ethnic groups at national level, in the following we describe demographic patterns relating to children from minority ethnic groups, then consider some small-scale studies of childhood road accidents.

Estimates of the minority ethnic populations of Great Britain in 2000 were derived from the Labour Force Survey and relate to the population living in private households. Four million people belonged to a minority ethnic group – 7.1% of the total population. An estimated total of 1,065,000 children aged 0–14 years belonged to minority ethnic groups, 9.9% of the child population, and 90% of these children were born in the UK (Scott et al 2001).

Three studies have been conducted by Lawson and colleagues examining road accidents by ethnic origin (Lawson and Edwards, 1991). These include an examination of coroners' records for a five-year period, an analysis of all road casualties for Birmingham over 12 months, and a

questionnaire survey of seriously injured pedestrians over the same period. For the coroners' data, ethnic origin was derived from post-mortem descriptions of the body, language used in interviewing next of kin, etc. For the STATS19 data ethnicity was derived from victims' surnames (Thomson et al 2001).

Place

It is possible to examine OPCS/ONS data on child accident death rates by health district. One of the earliest studies to do this in England and Wales was conducted by Avery et al (1990) who found higher rates of injury in the North and West of England. Jarvis et al (1995) found similar variations in their analysis of child accident death rates by regional health authority for the period 1989–91. The death rate per 100,000 population was 7.2 in England and 8.1 in Wales. Regions with the highest rates were North Western (9.8) and Northern (9.5), and those with the lowest were South Western (5.4) and Oxford (5.9).

Lynam and Harland (1992), in their analysis of STATS19 data on child pedestrian casualties, found that casualty rates varied twofold in different administrative areas in the UK. Rates in major conurbations were 50% higher than the average for the UK, and the casualty rate for inner London districts was 50% higher than for the outer suburbs.

A5 Key points

- Great variations occur in injury mortality and morbidity which reflect children's age, gender, socio-economic group, cultural or ethnic group and place where they live.
- These variations suggest there is considerable scope for improvement and intervention.
- A number of reports and policy initiatives are relevant to this report: the *Independent inquiry into inequalities in health* (Acheson, 1998); *Saving lives: our healthier nation* (Secretary of State for Health, 1999); the report of the Accidental Injury Task Force (Department of Health, 2002b); and the Economic and Social Research Council (ESRC) Health Variations Programme.
- Children as a group are particularly vulnerable to injury: they have little say in how environments are planned, and in recent years child poverty has increased.
- National injury data systems provide good information on age and gender and some information on social and economic factors and place.
- National injury data systems do not routinely provide information on ethnic groups, or on vulnerable groups such as children in homeless families or disabled children.

B: Why are inequalities associated with injury risk? Evidence from observational studies

B1 Introduction

In this section we examine the pattern of injuries relating to inequalities. We draw on evidence from large cohort studies and case–control studies examining the characteristics of injured children. Evidence from other observational studies will also be considered, particularly where population denominator data have been used to enable the characteristics of injured children to be compared with those of the child population as a whole. The literature in this area is large, and we will concentrate on studies carried out in the UK. While observational studies are not able to point to the direct causes of injury, or to account for differences in injury rates in different groups, they do provide evidence of different patterns of injury and the range of factors associated with increased risk. These studies on injury will be supplemented by reference to the more general literature on risk where this sheds light on factors that might contribute to inequalities between groups. Knowledge about disparities between groups and the factors leading to increased risk is important in targeting and designing interventions to prevent injuries and to reduce inequalities in injury rates.

In the following sections different aspects of inequality are addressed – age, gender, social and economic factors, culture and ethnicity, and place – and their relationship with injury risk is examined. Separating aspects of inequality in this way allows us to examine the scale and nature of inequalities in different groups, but does little to explain why disparities arise. This is partly because, as many studies show, the factors leading to injury are multi-faceted and inter-related. Further, as Thomson et al (2001) note in relation to ethnicity and social background, such factors are not in themselves direct contributors to risk. The more direct causes of injury

are exposure to hazards; parents', carers' and communities' ability to protect children; and children's capacity to manage hazards to avoid harm.

Figure 1 sets out the structure of section B.

The inter-relationships discussed above can be considered to operate in a broader conceptual framework, as suggested by Millard (1994).

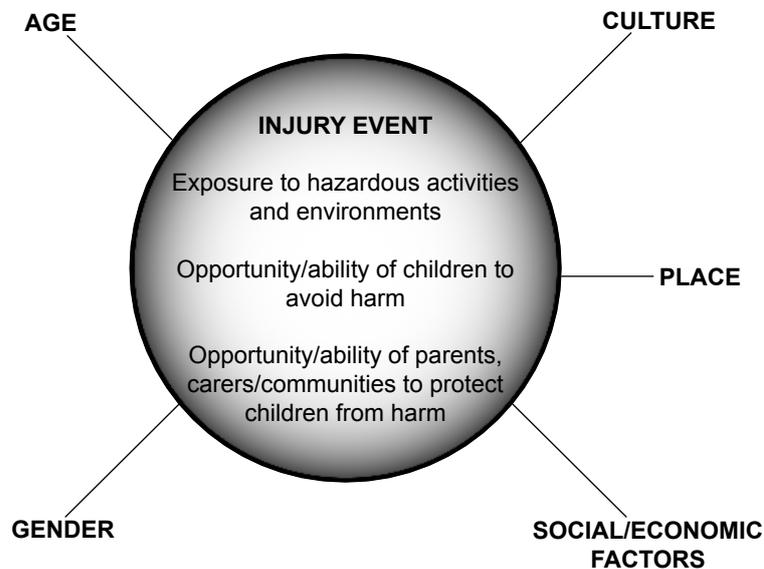
Three tiers of factors are suggested:

- Proximate tier – includes immediate conditions that result in exposure to hazard and an injury event
- Intermediate tier – includes factors such as childcare practices and other behaviour that increases exposure in the proximate tier
- Ultimate tier – embraces the wider social, economic, political and cultural processes that lead to a differential distribution of resources in society.

This framework also falls within the overall general concept of structure and agency (Gesler and Kearns, 2002). This seeks to understand social phenomena, such as inequality, in terms of the interplay between underlying structures in society that create divisions along the lines of age, gender, class, ethnicity, etc and individual (human agency) actions and beliefs. This interplay between structure and agency is worked out in specific geographic locations or places.

In each of the following sections attention is drawn to how those factors associated with inequality at each of the tiers of causation may influence exposure and ability to deal with hazards so as to influence injury risk. Boxes 1 and 2 contain examples of major studies whose findings illustrate the inter-relatedness and complexity of factors associated with injury risk.

Figure 1 Childhood injuries and inequalities: structure of the review



Box 1 British Births Survey

This large cohort included 98% of children born in Great Britain during a week in April 1970.

More than 13,000 children were followed up when they were five years old (just over 80% of the original cohort) and information was collected from more than 10,000 parents when the children were 10 years old. At each interview parents reported any medically attended injuries and hospital admissions children had suffered over the previous five years. Data were also collected from health visitors. Information on socio-demographic and family factors (including maternal psychological distress) was collected along with information on children's development and behaviour.

Parents who were not able to speak English were excluded from interviews.

The results are summarised below.

- The study revealed age-related patterns in injury rates, eg young children under five were much more likely to suffer burns and scalds or poison ingestion; older children (aged 5–10) were more likely to suffer fractures and head injuries
- Between the ages of 0 and 5, boys suffered 30% more medically attended injuries
- Young maternal age was associated with increased injury rates
- Children living with both natural parents were less likely to suffer injuries
- Aggressive children were more likely to suffer injuries
- Social class was associated with repeated injury and hospital admission
- Frequent house moves were associated with increased risk.

(Taylor et al 1983; Wadsworth et al 1983; Bijur et al 1986, 1988a,b; Stewart-Brown et al 1986)

Box 2 A case–control study examining child pedestrian accidents

This case–control study included children aged 5–16 years injured as pedestrians in five areas in the UK between 1991 and 1994. Cases included 152 injured children; controls were 484 children attending schools in the catchment areas of hospitals treating injured children. The study included interviews with parents and children and surveys of the road environment near children’s homes. Information was collected on socio-demographic factors and parents’ attitudes.

Summary of findings

- Injured children were more likely to live on through roads
- Injured children were more likely to live in pre-war housing
- Injured children were more likely to live on roads without parking
- Injured children were less likely to be living with both natural parents
- Injured children were more likely to be from non-white backgrounds
- Children with hearing impairment were at particularly high risk.

(Christie, 1995a)

B2 Age

Most studies observing injury in childhood reveal distinct age-related patterns, not only in relation to the overall rates of injury in different age groups, but also in terms of the types of injury that children suffer at different times in their lives. For example, evidence from the British birth cohort study (Box 1) revealed that medically attended injuries sustained by children aged between birth and five years were different in scale and type from those of children aged between five and 10 years. Here, while poisoning, burns and scalds were frequent among the younger children, they were relatively rare among the older age group. Conversely, rates of fractures and severe head injury were greater among older children (Bijur et al 1988a,b). An earlier cohort study revealed that for traffic-related injuries there were higher rates of medically attended injuries in older children. Thus while rates of injury were 24 per 1,000 in boys under seven years, they were 65 per 1,000 in boys over 11 years (Pless et al 1989). Similarly, hospital- and general practice-based observational studies have revealed age-related patterns in injury (Walsh and Jarvis, 1992).

How does age affect injury risk?

While it is clear that the risk of different types of injury varies at different ages, the reasons for these differences are less obvious. As Wilson et al (1991) note:

‘The kinds of events in which a child is likely to be injured depend on the child’s abilities and on where, how, and with whom the child spends time, all of which change as a child grows and matures. Children develop at different rates, and caretakers’ decisions to grant independence are subjective, so age is only a crude correlate of developmental stage.’

Box 3 sets out a range of age-related factors that may influence injury risk.

Box 3 Age and injury risk

- Physical development (height, size of head in relation to body)
- Motor coordination (using playground equipment, falls etc)
- Perceptual development (immature search strategy in traffic)
- Cognition and intellectual development (awareness of hazards)
- Immature attitudes and behaviour (risk taking in adolescents)
- Changing nature of play and increasing independence
- Changing levels of supervision and greater freedom of activities (licence to travel independently)
- Exposure to different environments inside and outside the home
- Changing health service use.

Several studies provide information on age-related hazard exposure – where, how and with whom a child spends time. In studies where the locations of injury events are identified, it is evident that at different times during childhood children are exposed to different types of environments and activities which may give rise to increased risk. These exposures may also relate to gender. For example, in an observational study of A&E attendance the most likely location for injuries in female children of all ages (0–14) was the home. For boys, the location of injury events depended on age – pre-school boys tended to be injured at home, while older boys were more likely to be injured during a sport or leisure activity in a public place (Gorman et al 1999).

Studies that focus on particular types of injury emphasise this link between age and exposure to different activities and environments (Campbell and O’Driscoll, 1995). A study of fatal head injury in the Northern Region similarly revealed that for pedestrian injuries (which accounted for approximately half the total number of fatalities) children at different ages were likely to be injured in different locations and while undertaking different types of activities (Sharples et al 1990). The median age of children fatally injured while playing in the street was seven, for those injured on the school journey the median age was 10, and for those injured on other journeys the median age was 12.

Health service utilisation may also partly account for different patterns of injury observed in different age groups. In a study examining injury in the Northern Region, Walsh and Jarvis (1992) revealed that the rate of deaths, moderate and serious injuries all increased with age. However, the same pattern was not observed for all injuries leading to hospital admission as it seemed that younger children with less serious injuries were more likely to be admitted to hospital than older children. This study revealed some of the difficulties inherent in interpreting epidemiological studies using health service utilisation or treatment data to ascertain rates of injury. It may well be that a child’s age influences whether or not parents seek medical attention for their child, and a child’s age may also influence their medical management.

More general surveys of children’s activities also show how exposure is age-related. Towner et al (1994), in a study of injury risk in children aged 11–14, revealed that younger children on school journeys were less likely to walk, had shorter journeys, crossed fewer roads and were more likely to wear helmets while cycling than their older counterparts.

The types of injuries children experience at different stages in childhood illustrate the interaction between developmental

factors and exposure. Thus children under five are at increased risk of home injuries because they spend more time at home than older children, and are unable to manage potential hazards because of their developmental stage. For example, bathtub drownings occur almost exclusively in children under two, and occur in older children only where they have a disorder that places them at particular risk. Similarly, as injury studies demonstrate, poison ingestion and bathroom scalds occur most frequently in the youngest children. In all these examples older children would have the motor coordination and intellectual skills to avoid injury (Gallagher et al 1984; Kemp and Sibert, 1992). Agran et al (1994) have shown the vulnerability of young children to injury in parking places and driveways close to their home. In these injury events a child’s small stature and the inability of drivers to see them when reversing contributes to risk. Children’s psychological and perceptual development may also contribute to risk. Studies of children in traffic reveal that young children may not have the knowledge, skills or levels of concentration needed to manage in the road environment: skills related to perception of movement, sound, speed and distance are not well developed in children (Sandels, 1975; Klein, 1980; Ampofo-Boateng and Thompson, 1991; Christie, 1995b; Thomson et al 1996).

B3 Gender

Just as children of different ages have different patterns of injury, most studies reveal distinct patterns of injury for boys and girls. For most (but not all) types of injury the number of injuries sustained by boys is greater than for girls, and the association between males and increased risk appears to apply at all severity levels. Having said this, the gender ratio in different studies varies considerably.

Several large cohort studies identify increased risk associated with being male. Focusing on traffic injuries, the National Child Development Study identified an almost twofold increase in risk for boys, with injury rates for boys and girls being 122 and 65 per 1,000 children, respectively (Pless et al 1989). For all injury types the gender ratio identified in the British Births Survey was less pronounced, but single and recurrent medically attended injuries, and injuries leading to hospital admission, were all more common among boys (Wadsworth et al 1983). A cohort study in Nottingham focusing on young children (3–12 months) with follow-up for two years also identified being male as a factor associated with increased risk of medically attended injury in these young children (Kendrick and Marsh, 2001).

Case-control studies examining the characteristics of injured children have also identified an excess of injuries among boys. For example, in a study of children attending hospital 70% of cases (children with injuries) compared with 51% of controls (age-matched children with non-injury conditions) were boys (Ohn et al 1995). Similarly, in a case-control study focusing on children with pedestrian injuries, 65% were male compared to 47% of age-matched controls (Christie, 1995a).

Other observational studies have revealed an increased risk of death and morbidity among boys at all levels of severity (Sharples et al 1990; Sellar et al 1991; Laing and Logan, 1999).

Why is gender associated with injury risk?

Exposure to different environments and the ability of children to cope successfully with them may relate to the factors associated with inequality. Box 4 sets out factors associated with gender that may influence children's injury risk.

Information about children's activities and the location of injury events demonstrates that boys and girls may be exposed to different types of risks. A study of leisure injuries in Scotland revealed that football injuries accounted for the largest group of injuries among boys but were low for girls, whereas netball and horse riding were an important cause of injury for girls but were rare for boys (Campbell and O'Driscoll, 1995). Where boys and girls share the same leisure environment the disparity in injury rates may be reduced – a study of playground injuries revealed only a slight increase in risk for boys (Mott et al 1994).

The large cohort studies suggest other mechanisms that may help explain the increased risk of injury among boys. The findings of the National Child Development Study suggest that a child's physical coordination, intellectual development

and behaviour may contribute to their risk of pedestrian injury (Pless et al 1989). The findings were not simple to interpret, as different risk factors appeared to operate for boys and girls at different ages. This may not be surprising – both age and gender influence exposure to different hazards, and physical and intellectual development may occur at different times for boys and girls. Thus for boys aged between seven and 11 years, sensory deficit, fidgety or sensitive behaviour, and poor maths and oral ability were all significantly associated with increased injury risk. For girls of the same age, poor gross motor control was associated with increased risk, and in girls aged 12–16 years poor coordination increased risk. For both genders previous injury increased risk of subsequent injury.

The British Births Survey also identified behavioural factors associated with increased risk. In this study risk was greater among boys, and those with high aggression scores were at particular risk. As part of this study children's general behaviour was rated, and again there was a linear association between behaviour scores, injury occurrence, re-occurrence and hospital admission. Boys whose behaviour was rated as poor were at high risk of injury (Wadsworth et al 1983; Bijur et al 1986, 1988a,b).

More general studies on risk provide more information that may help explain the inequalities in injury rates between boys and girls. For example, parents' attitudes and children's risk-taking behaviour may be different for boys and girls, and may influence exposure. Towner et al (1994), in a study of travel and leisure activities among secondary school children, reported that compared to girls, boys were more likely to travel unaccompanied on their school journeys, make longer leisure journeys, and were much more likely to ride bicycles. Similarly, a study of pedestrian exposure revealed that between the ages of five and 15 years, boys had much greater exposure to the road environment than girls. This difference in exposure can account for much of the difference in casualty rates for children aged 5–9 years, with boys and girls having similar casualty rates per kilometre walked. When exposure was taken into account, girls aged between 10 and 15 were at higher risk per kilometre walked compared to boys (Ward et al 1994). There is some evidence that boys and girls of the same age may differ in their ability to manage hazards. One study has shown that boys have better motor coordination and faster reaction times compared to girls (Grossman and Rivara, 1992). Boys and girls may also differ in their attitudes towards taking risks and towards protective equipment such as cycle helmets.

Box 4 Gender and injury risk

- Different rates of physical development
- Motor coordination
- Spatial ability
- Cognition and intellectual development
- Gender differences in behaviour (eg risk taking, peer pressure)
- Different forms of play and levels of independence
- Different levels of supervision and freedom of activities
- Exposure to different environments.

B4 Social and economic factors

Social and economic influences on injury and injury risk can be considered as part of the wider structural influences on health, part of the ultimate tier suggested by Millard (1994) (page 10). Section A3 demonstrates that there is a strong association between social class and injury. Thomson et al (2001) make the critical point that it is much more difficult to determine what gives rise to this association. They note that:

‘it seems certain that low socio-economic status only correlates with accidents to the extent that it indicates the presence of other factors which more directly confer risk on members of low socio-economic status groups’ (p. 17)

Thomson et al (2001) suggest that more proximate factors have to be explained to establish clear causal pathways. Thus we must consider socio-economic factors not as a source of explanation, but as something to be explained (Gesler and Kearns, 2002). Understanding how social and economic factors influence causal pathways is complex. This complexity is compounded by the fact that a broad range of quite different, but often related, factors have been identified which have been associated with injury risk. These include economic indicators such as family income; social factors such as maternal education; factors concerning family structure and characteristics including lone parenting, maternal age, number in household and number of children under 16; accommodation-related factors such as tenure, overcrowding and housing type; and indicators encompassing a range of factors measured at either individual or neighbourhood level. Paternal occupation has frequently been used as a means of stratifying social groups, but many authors point to the weakness of this means of classification in a context where a large proportion of children are raised in households without a male breadwinner. Overall, it is not clear how these many and different factors actually increase risk, whether they have an independent effect or are markers for one or other factor(s) not measured, or whether they are incremental or interactive in the ways they influence risk.

Despite these problems with definition and interpretation, many studies at national level reveal that social and economic factors are strongly associated with injury risk. Section A3 illustrates the steep mortality gradient associated with social class at national level; other studies at regional or local level reinforce this. In a study of fatal head injuries in the Northern Region, Sharples et al (1990) noted that for pedestrian fatalities the rate of injury in the most deprived neighbourhoods (electoral wards) was 9.1 per 100,000

Box 5 Social and economic factors and injury risk

- Lack of money (ability to buy safety equipment)
- Exposure to hazardous environments inside and outside the home (facilities for safe play; smoking parents; older wiring; lack of garden; small, cramped accommodation)
- Ability of parents/carers to supervise children (single-parent families; parents’ maturity, awareness and experience; depression and family illness; large family size)
- Children’s attitudes and behaviour (risk taking)
- Access to information and services.

children compared to 0.23 per 100,000 in the most affluent areas. Eighty per cent of these injuries were sustained within 1.6 km of children’s homes. Another study in the Northern Region revealed that, while inequalities were most pronounced for fatalities, they could also be identified for non-fatal injuries. Here the relative risk of injury for the most, compared to the least, deprived groups were 2.4 for all injuries, 3.6 for severe injuries and 7.5 for deaths (Walsh and Jarvis, 1992). At the local level, Laing and Logan (1999) identified a correlation between A&E attendance and area of residence, with this factor accounting for a third of the variation in attendance rates.

How does socio-economic group influence risk?

Box 5 sets out some of those mechanisms whereby social factors may influence the proximate tier (page 10) in the path of causation by increasing children’s exposure to risk or their ability to overcome hazards.

Evidence from cohort and case-control studies demonstrate some of the associations between family background and injury risk. The British Births Survey identified a number of maternal factors associated with increased risk of sustaining medically attended injury between birth and five years. Young maternal age and maternal psychological distress were both associated with increased risk. These factors, in turn, were associated with high aggression scores in children which had an independent effect on injury rates and hospital admission (Bijur et al 1986). Further analysis suggested that the influence of maternal age on injury may have related to issues concerning supervision and maternal experience. Thus, while children of young mothers had more injuries at home, they were not at increased risk of injuries in traffic or at nursery (Taylor et al 1983). The ability of families to provide

appropriate supervision for their young children may also relate to the number of other children in the family, family structure, housing type and neighbourhood characteristics. In the same studies recurrent injury was associated with larger families and frequent moves, while increased risk of hospital admission was associated with atypical family type (ie where the child was not living with both natural parents), frequent moves, and the presence of younger siblings. Maternal awareness of hazards may also influence risk; when children were followed up at age 10, maternal education was associated with risk of hospital admission (Stewart-Brown et al 1986).

The association between young maternal age and increased risk of admission to hospital was also identified in the cohort study carried out by Kendrick and colleagues in Nottingham (Kendrick and Marsh, 2001). For traffic-related injuries, various family factors were associated with increased risk in the National Child Development Study (Pless et al 1989). In this study, girls in families described by teachers as 'having problems' were at increased risk of injury, along with boys who were not living with their own mothers or were in local authority care. Again factors were inter-related: boys whose behaviour was described as fidgety and who were in local authority care were at 1.8 times the risk of injury compared to boys without these characteristics. The many factors associated with risk identified in that study led the authors to conclude that there was a lack of strong predictors and serious difficulties in adjusting individual behavioural risk factors (Pless et al 1989). The links between behaviour, social factors and injury were also recognised as being complex in the British Birth Study cohort, where Bijur et al (1998a) note:

'Thus, whereas the observed consistent nature of injury occurrence may be due, in part, to the characteristics of the child, it is also likely to be explained by a complex interaction between the child and his physical and social environment.' (p. 711)

When children were followed up at age 10 as part of this study, it was revealed that the area in which children lived and the play facilities available to them were associated with risk. Thus children living in poor urban and rural areas were at increased risk, along with children who had no access to unshared gardens or yards. This study also highlighted the different factors associated with single and recurrent injuries and those leading to hospital admission, again illustrating the complex way in which factors increase risk (Stewart-Brown et al 1986).

Case-control studies also identify risk factors that may partly explain why children from deprived backgrounds are more

vulnerable to injury. Christie (1995a) examined social and environmental factors associated with risk of pedestrian injury. This study involved in-depth interviews and a survey of the road environment around children's homes. Features of the environment associated with increased risk included living in pre-war housing, on a road with through traffic and/or without on-street parking. This finding suggests that injured children lived in different types of traffic environment than uninjured children. Christie concluded that many of the factors associated with increased risk were highly correlated with socio-economic group.

The environment in the home may also influence risk factors, eg overcrowding may have an effect on supervision and on the physical environment in the home. Alwash and McCarthy (1988) noted that children from overcrowded homes were at almost three times the risk of injury compared to children from uncrowded homes. Sharing facilities with other families was also associated with increased risk.

A study of injuries among older children in Scotland suggests ways in which social and environmental factors inter-relate so that more deprived children may have greater exposure to risk and may be less equipped to deal with it (Williams et al 1991). In this study, overall, medically attended injury rates were not associated with the father's occupational group or family affluence scores, but specific injury types were associated with social group. Lower occupational group was associated with injuries occurring in the road environment, while affluent children were more likely to be injured in school. Bicycling and pedestrian injuries (together with assault injuries) were associated with lower social groups, whereas sports and car passenger injuries were more prevalent among the more affluent. The use of safety equipment also related to social factors, with those from the higher occupational groups being more likely to wear cycle helmets and protective sports equipment. Other behaviours also appeared to be associated with social background, with those from more deprived backgrounds reporting increased risk taking.

Other more general studies illustrate how exposure and safety behaviours may relate to social factors. Towner et al (1994) reported that children from deprived backgrounds were less likely to travel in cars and more likely to walk, compared with their more affluent counterparts. DiGiuseppi et al (1998) showed (not surprisingly) that primary school children without access to a car may be more exposed to risk as pedestrians, but that the majority of child pedestrians in this age group were accompanied on their journey to school. Kendrick and Marsh (1998) revealed that use of baby walkers

in the home was associated with social group, but that this association was not strong. This study also showed that use of baby walkers was associated with other unsafe practices (eg absence of stair gates or fire guards) which are likely to compound the risk associated with baby-walker use.

Studies investigating parents' attitudes and injury risk indicate that attitudes may vary in different social groups. In a qualitative study involving interviews with parents of injured children residing in affluent and deprived areas, Sparks et al (1994) revealed that parents living in different environments perceived risk and responsibility in different ways. Affluent parents perceived that the low rates of injury in their area were due to the quality of parenting and adequate supervision, while parents living in deprived areas perceived that the high injury rates in their area related to the poor quality environment in which they lived. Affluent parents regarded it as their own responsibility to keep their children safe, whereas parents living in deprived surroundings thought the council had a responsibility to keep children safe, particularly for accidents outside the home. Parents in both groups said they taught their children about safety.

One reason for increased injury rates in children from more deprived backgrounds may be that parents are unaware of hazards, as they do not have access to injury prevention advice or other health promotion interventions. There is some evidence to support this and we will return to this issue in the section on interventions (page 24). Kendrick and Marsh (2000) revealed that more deprived families were less likely to receive health promotion interventions, but that this depended to some extent on the nature of the intervention. While families living in rented accommodation were less likely to take up an offer of first aid training, they were more likely than other groups to take up low-cost safety equipment. In an earlier study by Kendrick et al (1995), deprived families were less likely overall to take up a range of child health services where safety advice was imparted, but there was no evidence that children who had not attended these appointments were any more likely to be injured.

While there is a great deal of evidence linking social factors and injury risks, the mechanisms whereby children from more deprived backgrounds are injured remain elusive. Injury risk is likely to be mediated by a broad and inter-related set of factors. These factors may operate differentially at different ages, for different types of injury, and in relation to gender and cultural group. There is evidence that children from more deprived backgrounds may have individual characteristics that increase risk by reducing their ability to deal with hazards. Many of these factors are not easily addressed,

although educational interventions may modify some risks. It is also evident that children in these groups face more hazardous environments and are exposed to hazards more frequently than their more affluent counterparts (see section B6, page 19). Hence initiatives at community level, modifying the environmental hazards in children's neighbourhoods or reducing the number of exposures to hazards, may be effective in reducing inequalities.

In addition to trying to establish the links between broad social and economic factors and the more proximate causes of injury, a further challenge relates to the fact that the various factors may not operate to the same degree for different injury severity levels. For deaths and, to some extent, severe injuries there is a recognised association with socio-economic factors, but there is a less pronounced association between minor injury and social and economic factors. This may be an artefact of how data are collected –while case ascertainment for fatalities is relatively simple, the threshold at which parents of children with a minor injury seek medical attention, or at which medical staff decide to admit a child to hospital, may be influenced by social factors. A third complexity is that the association between social factors and injury does not appear to apply equally to all types of injury. Thus while burns and pedestrian injury are more frequent among some social groups, this relationship is not apparent for other injury types. There is also controversy about whether adolescents are less susceptible to the risks associated with deprived social backgrounds.

B5 Culture and ethnicity

The links between culture and injury, like those between social group and injury, are complex.

Culture is difficult to define. It can be taken to refer to the values, rules and beliefs of social groups as they reflect their view of the world. Culture can also be considered to operate at different spatial scales, from the international to the national, regional and local scales, and to include the relationship between minority cultures and the culture of the majority in a location. Ethnicity refers to groups of people who share a relatively homogeneous culture through kinship and/or particular situations.

As with socio-economic factors, culture should not be seen as a source of explanation for inequalities, but as a contributory factor that needs to be explained. In the same vein, Thomson et al (2001), as with their consideration of socio-economic processes, stress the need to search for proximate factors of culture that increase exposure to injury

risk. The role of culture and ethnicity in the area of injury has been little explored although its importance has often been acknowledged. Berger and Mohan (1996) state:

‘Although little research has been done on the subject, socio-cultural factors play a major role in shaping the frequency and nature of injury events, and the intensity and success of efforts to reduce injuries.’

However, out of a book of 278 pages they devote only 1.25 pages to this topic. What work has been done tends to view culture/ethnicity as a facet of a minority group in society, rather than how major cultures in society may vary between countries. Thus we only have occasional glimpses into what may be national cultural variables. Hillman et al (1990) note differences between German and English children in terms of exposure to risk which stem from variations in culture. These include the greater supervision of children on streets in Germany by all adults, not just parents; the observation and guidance of children if their behaviour falls below the standard expected; and the German law which forbids children to use the street for play. Observations of pedestrians in Denmark and Germany similarly show a great difference from the UK in pedestrian crossing behaviour, the former groups rarely crossing when the red man is shown. In Nigeria the usual pattern of boys having more pedestrian accidents than girls is reversed, because the cultural practice is to keep boys at home and to send girls out on errands. Boys in Nigeria, on the other hand, have more domestic accidents (Berger and Mohan, 1996). We are not clear how cultural variations and attitudes to what constitutes an ‘accident’ may have a bearing on exposure.

In trying to tease out the proximate factors for injury among minority ethnic groups in Britain, Thomson et al (2001) concluded that, despite the overlap between socio-economic structural factors such as poverty/housing and ethnicity, it is possible to identify specific ethnic factors that influence exposure – these are supervision, socialisation, and opportunities to learn.

In most studies that examine injury and culture, ‘culture’ has been defined narrowly and tends to relate to differences in injury rates between majority compared to minority racial or ethnic groups. Even with this more limited view of culture, definitions have varied across studies so that comparing and interpreting findings is not simple. In some studies all ‘non-whites’ are grouped, implying that the many subgroups in the ‘non-white’ category can somehow be regarded as similar to each other but different from the ‘white’ group. It is known that in the UK different cultural groups tend to be localised and findings cannot easily be transferred

to other settings. Some groups are from long-established communities where children and their parents were born in the UK; other groups have arrived more recently. In many studies it is difficult to disentangle the influence of deprivation on injury risk from that associated with cultural group. Yet, as noted above, to understand whether cultural background is associated with risk we must understand how culture influences exposure to risk and ability to cope with risk independently of, or in addition to, any influence exerted by social and economic factors.

There is some evidence that children from minority groups in Britain have different injury experiences from the majority group. However, findings relating to the scale and types of injury suffered by children in different cultural groups are mixed and, as with other aspects of inequality, the influence of culture may be mediated by age, gender, social and other factors.

In a study examining the links between ethnicity and injury, Alwash and McCarthy (1988) used census data to calculate injury rates for Caribbean, Asian, British and other children attending a London hospital. Here, the ethnic group was related to the father’s country of birth, or mother’s where the parents were not living together. Rates and types of injury suffered by children from different ethnic groups were similar. Other factors, including distance from hospital, social class and housing-related factors, were more important predictors of hospital attendance.

Other studies have pointed to increased risk for children from minority ethnic backgrounds, but in many cases there has been no adjustment for social factors so it is difficult to know whether ethnicity exerts any independent effect or is simply a marker for more general deprivation. For example, an analysis of national mortality data revealed that compared to injury death rates overall, the death rate for Pakistani children was 2.55 times that of all children (Balarajan, 1995). It is not clear why these differences occurred.

In a case-control study where ethnicity was ascertained by children’s names, there was no increased risk of A&E attendance for injury among those children defined as being from minority ethnic groups (Ohn et al 1995). Here more than two thirds of all children, in both case and control groups, were from deprived backgrounds.

For road injuries there may be more evidence of an association between ethnic group and injury risk. In a case-control study of pedestrian injuries, Christie (1995a) noted that cases were more likely to be from non-white families. Further analysis revealed that non-white parents tended to

have lower scores on a measure examining risk perception compared to white parents.

Other studies have indicated that young children of Asian descent had an increased risk of injury on the road, but that among children aged 10 years and over there was no increased risk (Lawson and Edwards, 1991).

Why is culture/ethnicity associated with injury risk?

It needs to be emphasised again that few studies examine culture in the wider sense as a possible influence on injury, but focus rather on minority ethnic groups. The possible reasons for increased risk of injury among children from different cultural or ethnic groups are set out in Box 6.

As suggested in other sections of this report, it is likely that the way that culture influences risk is by influencing exposure and the ability of children to deal with hazards. As Thomson et al (2001) note, however, separating the influence of culture from that of social deprivation is complex, and if social factors are taken into account many of the differences between cultural groups disappear. Having said this, exposure, attitudes and behaviour may relate to cultural group, and these may increase risk for some children. The study by Christie (1995a) suggests that parents from non-white groups may not perceive risk in the same way as white parents. This may, in turn, influence attitudes towards exposing their children to the road environment and the level of supervision they feel is appropriate. Similarly, Hapgood et al (2000) revealed that ethnicity was negatively associated with safety practices (eg use of safety equipment), but that this factor explained only a small part of the variation between groups as, overall, unsafe practices were common among all groups. Thomson et al (2001) suggest that recent immigrants may be unfamiliar with the road environment and that parents may have difficulty in acting as role models and teaching their children appropriate road safety

Box 6 Culture/ethnicity and injury risk

- Exposure to different environments inside and outside the home (food preparation practices, different activities)
- Access to information and services
- Barriers relating to language
- Ability of parents/carers to supervise children (attitudes to childcare, lack of familiarity with traffic conditions for first-generation immigrant families).

behaviour. Many of these theories to explain increased risk among different cultural groups, although plausible, remain untested.

One possible explanation for differences between groups is access to services which may influence levels of awareness. There is some evidence that parents from minority ethnic groups are less likely to attend child health surveillance appointments at which safety advice is offered (Kendrick and Marsh, 2000). The reasons explaining this variation are complex, and outside the scope of this review.

B6 Place

'Place' has been described above as where the interplay between structural factors in society and human agency is worked out. The notion of place requires some elaboration – here we consider three of its attributes which are relevant to this study:

- Place as a portion of geographic space
- Physical/environmental attributes of places
- Place as an area to which people attach certain meanings and actions.

Place can, at one level, be considered simply as a portion of geographic space. Often it is conceived as an official geographic entity, eg enumeration districts, wards, boroughs, counties or health authority regions (Gesler and Kearns, 2002). In epidemiological studies the use of statistics gathered at some areal scale generally accords to this idea of place (section A3). Important patterns of risk and injury can be discussed in this way.

Places can also be seen as possessing certain physical and environmental attributes such as topography, land use, the layout of roads and buildings etc. These features may influence exposure to injury by affecting the speed and volume of traffic, visibility, and the ratio of pedestrians to traffic. Exposure to risk may reflect a number of these attributes coming together in certain places, eg a lack of garden play space and busy roads. The physical environment of a place can be one of the proximate factors in injury risk, closely linked to social and economic factors (see section B1, page 10).

However, 'place' in the geographic literature is taken to mean more than a portion of space or a physically different area (Shaw et al 1988; Curtis and Rees-Jones, 1998; Gesler and Kearns, 2002). Places can be sites or areas to which people attach certain meanings, giving them a 'sense of place' or belonging, such as a neighbourhood (Spencer and Blades, 1993). Equally, it could be an area from which

people feel alienated. Godkin (1980) showed that it was beneficial for alcoholics to have a feeling of 'rootedness' in places where they lived, or went for help, in their treatment. Alternatively 'placelessness', a lack of belonging to an area, may contribute to unhealthy behaviour. In addition, Matthews (1995) points to the important inter-relationships between culture (section B5) and environment in influencing children's behaviour in particular places. Places, in this sense, are created by the intersections of local and wider factors where individual agency and society's structures are acted out. And these intersections also have the dimension of historical time, creating layers of varying experience for people in different areas. Thus Phillimore and Morris (1991) compared two towns with similar levels of social deprivation but different premature mortality rates. They concluded that closer examination of the social and economic histories of places was needed as part of the explanation for these health variations. Epidemiological studies that simply try to 'control' certain social and economic factors when comparing different places will not take account of this notion of place.

Ultimately these concepts of place feed into the debate over whether health variations are because of people or places – compositional or contextual factors. The former view sees area health patterns as the aggregate effect of personal factors, whereas the latter stresses the context in which a person lives. Health is thus not only a product of individual characteristics but is influenced by where a person lives (Macintyre et al 1993). So far, few studies have developed these ideas of place in relation to injury.

How does place affect injury risk?

The three conceptions of place discussed above can be traced in a number of works related to injury and inequality. By far the largest corpus of material relates to the use of space as an areal unit for statistics in describing the varying patterns of injury at national, regional and local scale. They help us answer the question of where injury inequalities can be found in the UK and make broad correlations with structural factors such as social and economic spatial variations (section A3).

Differences in injury rates associated with children's houses and the road environment near children's homes have been explored already in section A3, relating to social and economic factors, as these broad themes are inevitably inter-connected. As Christie (1995a,b) and others have noted, characteristics of the environments in which children live relate closely to economic and social indicators. Where children spend their time influences not only exposure to

hazard, but also the ability of children to avoid harm and the ability of parents and others to protect children. Children may be more at risk in cramped living accommodation, especially where this problem is compounded by overcrowding. In section B7 (page 21) we consider the home as a place where limited and cramped accommodation, with crowded kitchens and little space for children to play, can expose children to more physical hazards. Parents may have more difficulty providing adequate supervision in housing that lacks safe play areas visible from the house, and where children use the street environment for play. King et al (1987) found higher child accident casualties in streets of Victorian terraced houses with little or no gardens, few garages and much on-street parking, compared with post-war housing estates. The way in which many physical and environmental factors can come into play in particular places is emphasised by Whitelegg's (1987) description of a road traffic accident as being:

'a function of the land use system, residential patterns, population densities, street geometry, location of workplace, shopping precinct, health centre or other traffic generators.'

The third concept of place, as a site or area to which people attach certain meanings and actions, has been little researched so far in the field of injury and inequality. A few studies have attempted to tease out some of the implications of place and identity. A recent study by Grundy et al (2002) examines the ways in which schoolchildren identified 'safe' and 'dangerous' places in their neighbourhoods as settings for their leisure time. Their personal and group experiences and perceptions, parental rules, the behaviour of others, and the physical environment combined to produce a kaleidoscope of places which differed in many ways from the 'official' view of hazardous places. The study revealed through qualitative work how children experience exposure to risk in their everyday lives, and how human agency combines with social and economic structures often determined by others.

Sparks et al (1994) have some interesting findings relating to place and injury. Parents in an affluent area saw exposure to risk as their responsibility, and the nature of the environment or place around them was not in itself seen as critical. Parents in a poor area defined exposure to risk very much in the terms of their surrounding environment, and responsibility for making that place safe was seen as the responsibility of the authorities rather than the inhabitant. Implicitly, this study raises issues about attachment to place and 'sense of place' and injury risk.

Box 7 Place and injury risk

- Different places lead to differing exposures to injury risk through their varying physical environment, eg road layout, housing density.
- People's relationship to the place they live in can vary, eg lack of identity with a community or strong community spirit.

The work of Roberts et al (1995) also explored how human agency works out in particular places. Rather than viewing injury and inequality from an official injury statistics point of view, the authors considered the overall lives of children and adults in their environments in the Corkerhill area of Glasgow, and how these compromised their safety. They were interested to find out how human life 'works' in an area in its wider social and environmental context. However, although place plays a considerable part in this study, a number of the ideas of place discussed above are not explicitly explored.

Finally, the definition of place as an area to which people relate is closely linked with an emerging concept in the field of health promotion – social capital (Hawe and Shiell, 2000). Social capital can be defined as:

'the resources within a community that create family and social organisation ... These resources, which arise out of activities such as civic engagement, social support or participation, benefit individuals, but are developed in relationship to and with others, for example within groups or communities.' (Swann and Morgan, 2002)

The concept of social capital allows us to focus on social context to explore the importance of place in people's daily lives and the relevance of those places for their social relationships (Morrow, 2002).

The possible reasons for increased risk of injury among children from different places are given in Box 7.

B7 Vulnerable groups

This report adopts a framework for considering inequalities in injury which is encompassed by the broad concept of structure and agency in society, together with a three-tier ordering of factors related to exposure to injury ranging from proximate to underlying. These processes are acted out in particular places. In this framework we can envisage inequalities generally ranging along a continuum from those least exposed to those who are most exposed to injury risk.

However the idea of a continuum is probably too simple – there will be groups in society who are in extreme positions of vulnerability, those who are marginal to, or excluded from, the mainstream of social life. Here the interplay between the socio-economic structures of society and certain attributes of human agency will 'ratchet up' all the general problems of inequality to produce groups who may be exposed to much higher levels of injury risk. In these groups risk factors may be additive and cumulative over time. In this section we consider two examples of vulnerable groups: homeless families, and families with disabled children.

Homeless families

Homeless families are likely to represent some of the most materially and socially deprived families in the country. Homelessness can be viewed as people sleeping rough on the streets, but this is only the most visible form of homelessness. The charity Shelter advocates the use of a broader definition which encompasses:

'those living in temporary accommodation, those living in poor or overcrowded conditions and people forced to sleep on friends' floors because they have no home of their own.' (Stone, 1997)

Widdowfield (1999) examines the difficulties involved in trying to measure homelessness and the limitations of official homelessness statistics, and believes that homelessness counts are getting further from reality. Official homelessness figures simply record the number of households accepted as homeless by local authorities under the provision of the 1985 and the 1996 Housing Acts. Shelter estimates that about 65% of households accepted as homeless by local authorities are families with children (Shelter, 2002). For the year 2000–01 this represented about 65,670 households with dependent children, and over 100,000 children lived in these households (Shelter, 2002).

In a study in central London, Lissauer et al (1993) reviewed 70 children admitted to hospital who were living in temporary accommodation, and found a significantly higher rate of admissions for accidental injury for the former compared with permanently housed children. Richman et al (1991) examined the use of hospital services by children in B&B accommodation, but found no difference in A&E attendance for unintentional injury for children from B&B accommodation and other children. There was, however, an interesting difference in the type of injury experienced: children from B&B accommodation had more burn and scald injuries, while other children had more bruises, soft tissue injuries and fractures. How can factors associated

with homelessness increase injury risk in children? The physical conditions of temporary accommodation – cramped cooking and laundry facilities, limited indoor spaces to play and absence of safe outdoor places to play – can expose children to more physical hazards. In Lissauer et al's (1993) study in central London of hospital admissions of children in temporary and permanent accommodation, 70% of mothers from temporary accommodation complained about lack of space, compared with 54% of permanently housed families; 68% said there was nowhere safe where their children could play, compared with 14% of controls. An independent assessment of children's play facilities by the interviewer in this study found that only 2% of the children in temporary accommodation had satisfactory play facilities, compared with 96% of the children in permanent accommodation. The following quotes from mothers of homeless families serve to illustrate the conditions that homelessness imposes:

'There's only one cooker between about 130 people ... and if you do start cooking and go back to your room then your dinner either gets burnt or stolen.'

'My daughter has been scalded and other children have had electric shocks. In your own home you can be careful, have gates across doorways, etc, but in a hotel you've got to put up with other people being careless.'

(Spencer, 1993).

These examples also illustrate how multiple occupation can reduce the power of parents to protect their children, eg in the use of safety equipment. Stress can be caused by poor living conditions, insecurity and enforced mobility. Homeless families can often be placed in accommodation far from the area they know. In London, one in seven households accepted as homeless were in temporary accommodation outside their local authority area. Informal support networks of friends and family can be severely disrupted by distance. Barry et al (1991) have shown that families living in B&B accommodation often suffer from isolation, boredom and loneliness.

In the study by Lissauer et al (1993) many of the homeless families were recent immigrants, including refugees from various countries and 'many of the homeless families were further disadvantaged by their inability to speak fluent English'. Maternal depression was significantly increased among the homeless families. Homeless mothers had experienced a median of three significant life events in the previous year compared with mothers in the control group who had experienced a median of one significant life event. All but one of the homeless mothers had moved in the previous year, compared with a quarter of the controls.

Families with disabled children

Disabled children and their families can be exposed to additional burdens associated with poverty, and have fewer resources than other families. Specific types of disability, such as those relating to hearing, seeing or communication, may expose children to specific risks.

Botting and Crawley (1995) note that there are no routine national data on disability in childhood that can be used to monitor trends on conditions such as cerebral palsy, deafness or blindness. A major survey of disability in childhood carried out by OPCS in 1985–86 estimated that 3% of children aged 0–15 years in Great Britain had a disability (Bone and Meltzer, 1986). For each age group, boys had a higher level of disability than girls, and prevalence was higher in school-age groups than in younger children. Disabilities included those related to behaviour, communication, locomotion, continence, intellectual functioning, personal care, hearing, consciousness, dexterity, reaching and stretching, seeing, disfigurement and eating, drinking and digestion. Behavioural disability was most commonly identified in 2% of children, but a given disability seldom occurred in isolation. In relation to hearing loss, eight per 1,000 children in Great Britain aged 5–9 years and six per 1,000 aged 10–15 years had some level of hearing loss, with two per 1,000 aged 5–9 and one per 1,000 aged 10–15 years having severe hearing loss. Two per 1,000 children under 16 years had some seeing disability, including children who could not see enough to recognise someone they knew across the road.

Gordon and Heslop (1999) point out that:

'None of the specifically designed poverty surveys in Britain have had a sufficiently large sample size to provide direct evidence of the levels of poverty experienced by households with disabled children. However, all the indirect evidence available indicates that as a group these households are among the "poorest of the poor".'

The presence of a disabled child in a family may not only limit the earning power of parents but can also alter their patterns of expenditure. For example for families with a disabled child, a car is often a necessity rather than a luxury.

In their case-control study of child pedestrian accidents (Box 2), Christie (1995a) reported that hearing impairment among accident victims was noticeably high compared to control children. Of the nine accidents involving children reporting hearing difficulties, three were described as having slight hearing difficulties, three were deaf in one ear, one was hard of hearing, one suffered from 'glue ear', and one was

profoundly deaf. Although the numbers were small in that study, they support previous findings indicating that accident risk for child pedestrians was higher for those with hearing difficulties (Scottish Development Department, 1989).

The Department for Transport, Local Government and the Regions commissioned a review of the road safety of children with special needs (DTLR, 2002). The review identifies the characteristics and lifestyles of children with special needs that may affect their ability to be safe pedestrians.

B8 Key points

- The factors associated with injury inequalities are multi-faceted and inter-related. The causal pathways linking these factors to injury events remain uncertain.
- The three tiers clarify these inter-relationships:
(1) proximate tier, immediate conditions that result in exposure to hazard; (2) intermediate tier, eg childcare practices; (3) ultimate tier, the wider social, economic, political and cultural processes.
- These tiers fit into the concept of structure and agency. The interplay of structure and agency is worked out in specific geographic locations.
- More direct causes of injury include exposure to hazards; the ability of parents, carers and communities to protect children; and children's abilities to manage hazards.
- Greater knowledge about disparities between groups and factors leading to increased risk is important in designing interventions.

C: Have injury intervention studies addressed inequalities?

C1 Introduction

The findings of studies of risk described in section B have implications for those involved in preventing injury and attempting to reduce inequalities in injury rates. However there are some difficulties in responding appropriately to differences in risk. First, many risk factors are not easy to change (eg a child's gender and age). Second, single risk factors alone often do not account for much variation in injury risk. Rather, it appears that combinations of factors and possible interactions between them influence risk.

Further, it is not differences in age, gender, social and cultural background that lead to injury events, but the influence of these factors on exposure and ability to deal with hazards. How, then, can those involved in health promotion use information on inequalities to reduce risk among the most vulnerable groups? Box 8 sets out some examples of how health promotion interventions can

be designed and targeted in a way that may reduce risk among the most vulnerable.

In this section we examine a broad range of health promotion interventions to reduce injury. Apart from broad targeting in terms of children's ages (and this does not always reflect injury risk), relatively few interventions are designed and targeted in a way that takes account of injury inequalities. Some studies may increase risk in some groups by denying them the intervention, eg in many research studies those unable to speak and/or read English are excluded.

In sections C2–C8 we analyse the information related to inequalities that is reported in the 164 intervention studies reviewed. The full tables are online at www.hda.nhs.uk/evidence.

Box 8 Examples of interventions to address inequalities

- **Age:** it is known that children's developmental stage influences their ability to deal with hazards. Child road safety education must build on what is known about children's age-related attitudes, perceptions, knowledge and skills.
- **Gender:** boys are at increased risk of most types of injury. Promotion of safety equipment (eg cycle helmets) must build on what is known about boys' attitudes to helmet wearing.
- **Social and economic factors:** families living in multi-occupancy dwellings or in low-income neighbourhoods may be particularly vulnerable to injury from house fires. Fire safety campaigns could target high-risk areas. Smoke alarms must be fitted and working: campaigns to promote smoke alarms could include the provision of free devices, installation and maintenance. Parents need to be aware of the vulnerability of young children to injury from smoke and fire.
- **Culture/ethnicity:** educational materials must be available in a range of languages to reflect local diversity. The target group should be involved in the development of the intervention, or consulted about its contents.
- **Place:** families in rural areas may have different needs from those in urban areas. Community-based interventions need to take account of whether people in that community feel a sense of communality, or a sense of belonging to that place. Transport is important, particularly in relation to people's access to facilities.

C2 Pedestrian injuries

C2(i) Transport policy and traffic calming

INTRODUCTION

Seven studies were identified and reviewed relating to transport policy and traffic calming. Of these seven, only one was related to the evaluation of transport policy – this study was conducted in the UK. Two studies relating to traffic calming were conducted in the UK, two in Denmark and two in the Netherlands.

These interventions took place in the road environment and generally used road traffic accident data as their outcome measures. Other outcome measures employed by some studies included costs, observed speed reduction, traffic volume and residents' opinions.

INEQUALITIES ADDRESSED

Age

Injury target groups and settings

Most studies targeted the general population; three either targeted children or presented a detailed breakdown of data with regard to age. The other studies did not present any breakdown with respect to age, but as children (along with older people) are the most vulnerable road users it was felt that reported outcomes for interventions targeting the general population would be particularly applicable to children. It was therefore decided to include these studies here.

Intervention design

In the road transport policy intervention, Boxall (1988) measured differences in road traffic accidents following the introduction of school crossing patrols. The other studies describe the impact of introducing packages of engineering measures on recorded injuries in the road environment. These measures included the introduction of cycling tracks, speed reduction measures (20 mph zones, speed humps etc) and traffic redistribution schemes.

Key results

Where considered, the results of the studies generally report favourable results for the reduction of child casualties. Boxall (1988) suggests that the presence of school crossing patrols can reduce the number of injuries to children. Webster and Mackie (1996) report that the introduction of traffic-calming measures specifically designed to lower speeds reduced child pedestrian injuries by 70%, showing child pedestrians to be the greatest beneficiaries of these engineering measures. Ward and colleagues report that child cyclists as well as

pedestrians can benefit from engineering measures aimed at increasing road safety (Ward et al 1989a–c).

Gender

All the studies reviewed targeted both genders. None of the studies considered the possible differential impact of the interventions on children of different genders, or reported injury rates separately for males and females.

Social and economic groups

As the studies generally involved area-wide interventions, it is likely that social and economic factors were at work in the interventions. However, none of the studies specifically considered these factors in either the design or execution of the work.

Culture/ethnicity

Similarly, no specific targeting of cultural groups or reporting of results in relation to cultural groups was reported in the studies. It could be noted though that the engineering measures appeared to be broadly successful in reducing casualty rates whether they were implemented in the UK, the Netherlands or Denmark.

Place

Place can be an important factor in accident involvement. All seven of the studies involved manipulating the environment in some way, whether by providing school crossing patrols or through more engineering-related measures. Traffic-calming measures were typically undertaken in urban settings (Webster and Mackie, 1996). We are not aware of direct comparisons between the effectiveness of the interventions in rural and urban settings. Where the location of the intervention had been chosen on the basis of the perceived need for accident reduction, observed speeds dropped and accident rates were considerably reduced (Webster and Mackie, 1996). Where reported, local residents' reactions to traffic-calming schemes were favourable.

Summary

- Six studies focused on interventions relating to traffic-calming measures. One study evaluated transport policy.
- **Age:** interventions were targeted either at the general population, or specifically at children. Where considered, the results of the studies generally report reductions in child casualties.
- **Gender:** all the studies targeted both males and females. None of the studies reported injury rates separately for males and females.

- **Social and economic factors:** none of the studies specifically considered these factors in either design or execution.
- **Culture/ethnicity:** no specific targeting of cultural groups, or reporting of results in relation to cultural groups, was noted in the studies.
- **Place:** all seven of the studies involved modifying the environment. We are not aware of comparisons between rural and urban settings. Where the location of the intervention was chosen on the basis of accident risk, observed speeds decreased and accident rates were considerably reduced.

C2(ii) Pedestrian and traffic education

INTRODUCTION

Twenty-three studies were identified that dealt with pedestrian and traffic education. These studies were concerned with either pedestrian skills training (11 studies), traffic clubs (five) or other forms of traffic education (seven).

Ten studies were conducted in the UK, five in the USA, three in Australia, two in Canada, and one each in the Netherlands, Japan and Sweden.

The studies focusing on pedestrian skills training were generally school-based. Six were experimental programmes involving small numbers of children. The other five were operational programmes targeting a wider range of pedestrian skills and were incorporated in the school curriculum and/or other community action. In terms of methodology, three of these studies employed a simulated road in training and testing children, one used videotaped performance feedback, and seven used some form of training that took place in the road environment, often supplemented or compared with performance following training using table-top models. Methods of intervention included individual training (Ampofo-Boateng et al 1993), group training (Thomson et al 1992), class training (Antaki et al 1986) and mass media approaches (Preusser and Blomberg, 1984).

The majority of studies relating to traffic clubs were home-based (although one was school-based). All studies assessed the effectiveness of the traffic clubs by using some measure of knowledge or behaviour. These measures were always self-reported. Two studies also took measures of parental knowledge and attitudes. One study also took measures of mortality and morbidity to assess the impact of the intervention.

All seven of the other traffic education papers involved interventions that were school-based. Two of the studies also included mass media campaigns, one of which was aimed at the general population, not just children. Two of the interventions were combined with engineering measures, and one study used a traffic simulation game to teach children the rules of appropriate safe traffic behaviour.

INEQUALITIES ADDRESSED

Age

Injury target groups and settings

Only one of the 23 studies targeted the general population, and this study also included some school training. All others targeted children of various ages. Seven studies targeted five year olds (including one school-based traffic club study). The other four traffic club studies generally targeted the under-fives, although one intervention did follow children up to the age of seven. Of the remaining studies, six targeted children under 10 years old, three studies targeted children under 13, and two studies targeted children under 18.

Intervention design

When designing the interventions, a large proportion of the studies paid specific attention to ensuring the materials used, and the design as a whole, were appropriate to the age group targeted. For example, Tucker (1992) reports a traffic club intervention that mailed a series of five books to parents of targeted children. The contents of the books were synchronised with the target age at each mailing. In a number of school-based studies training was integrated into the curriculum for children of varying ages (Rivara et al 1991; Harland and Tucker, 1994). In these studies safety training was delivered using age-appropriate methods and materials, ranging from colouring-in tasks to class discussions and workbooks. Cross et al (2000) developed materials designed to be read aloud in class to assist less-able students.

The use of simulated roads instead of real roadside training was often seen as a way to train young children to cross the road safely, without their lack of ability causing them increased risk in the process. Those studies that did involve roadside training were well supervised and used trained individuals to reduce risks to children arising from their lack of knowledge and poor performance on crossing tasks (Thomson and Whelan, 1997).

As well as developing interventions that considered the abilities of the target age group, a number of studies also took into account the differing needs of children at different

ages. For example, Preusser and Blomberg (1984) reported epidemiological data suggesting that 71% of mid-block dart-and-dash accidents involved children under nine. In their intervention they specifically targeted this age group and accident type, using a film featuring a cartoon character. In a later study, Preusser and Lund (1988) targeted 9–12 year olds. Recognising that older children were more independent and interacted with the road environment in a different way, and were often involved in more complex road traffic situations, they developed a new safety film aimed at the needs and attitudes of older children.

Key results

In general, the interventions reported had a positive effect on children's road safety behaviour. One study reported that following the intervention the five year old recipients were performing at the level of 11 year olds (Ampofo-Boateng et al 1993). Antaki (1986) reported an unsuccessful intervention, but noted that children improve during their first year at school. In a study looking at pre-school membership of a traffic club for children aged 2.5–5 years, Downing (1981) reported that membership was highest when children were four years old. It is possible that marked increases in ability at five years may lead parents to move away from traffic club membership.

Although most studies were targeted at particular age groups, relatively few compared results for children of different ages. Rivara et al (1991) reported improved performance across all age groups taking part in the intervention. Preusser and Blomberg (1984) reported accident reductions of 21% in children under 15 years, and 31% in children aged 4–6 years. Similarly, Tziotis (1994) reported that benefits were larger for primary school-aged children. A study by Wright et al (1995) found that benefits in terms of increased knowledge were present in only younger children, with no increases observed for older children. This is a worrying finding as studies focusing on older children suggest that older children were more likely to exhibit risky behaviour (Burke et al 1996). Preusser and Lund (1988) showed post-intervention increases in knowledge and reductions in accident involvement in children aged 9–12 years, but on balance the studies suggest that older children and young people are harder to reach.

Gender

INJURY TARGET GROUPS AND SETTINGS

Boys are more likely than girls to be involved in road traffic accidents (Burke et al 1996). This effect also interacts with age – peak accident involvement for boys occurs between

7–8 years, and for girls occurs around 12 years (Tucker, 1992). Accidents for young boys are particularly high during the afternoon, in the post-school 3–5 pm period (Tziotis, 1994).

Intervention design

Despite the increased risk for boys, no studies directly address this gender difference in their interventions. This can be seen as a failure to target the most vulnerable road users, and warrants further research.

Key results

West et al (1993) found that young boys were more likely than their female counterparts to run into the road, less likely to stop when told by a parent, and less likely to hold a parent's hand. They were more likely to cross roads on their own and, possibly as a result of this, were more likely to have knowledge of roadside objects. These results may go some way to explaining boys' increased level of accident involvement. It is possible that different age peaks noted in male and female accident involvement may be due to differences in the level of independence at different ages. In studies that compared impacts in relation to gender, it was found that intervention programmes were effective in improving safety performance in both boys and girls (Thomson et al 1992; Burke et al 1996; Thomson and Whelan, 1997).

Social and economic groups

Injury target groups and settings

Thomson and Whelan (1997) specifically targeted children attending local schools which served a poor housing estate with high levels of pedestrian injury. Rivara et al (1991) studied a school in which 40% of students were recipients of free school meals. Some studies reported wide socio-economic spread among their target populations (Downing, 1981; Harland and Tucker, 1994). But the majority of studies did not take socio-economic status into consideration.

It was suggested that traffic club members may have a better socio-economic situation than non-members (Gregersen and Nolen, 1994), but Downing (1981) ensured that representatives of all social groups were included in a UK-based study of traffic clubs. Similarly, West et al (1993) included measures of social factors in their assessment of knowledge, behaviour and attitudes following participation in a traffic club. Cross et al (2000) compared the impact of interventions on a school of mainly middle-to-high socio-economic status with that of a mainly lower status school.

Intervention design

It was not clear that traffic club materials are designed

to take into account the socio-economic background of participants. However, the provision of free materials may help overcome the barriers of cost.

Key results

Children in more disadvantaged social groups were more likely to cycle unsupervised, play in the street unsupervised and cross roads by themselves (West et al 1993). They were also less likely to recognise roadside objects or to know safe places to play. It is encouraging to note, then, that the programme implemented by Thomson and Whelan (1997) proved effective in reducing 'very unsafe' crossing behaviour in their targeted high-risk setting. Cross et al (2000) reported increased safer behaviour in both high and low socio-economic intervention groups.

Downing (1981) found that membership of traffic clubs was indeed lower in lower socio-economic groups, and that mothers in these groups were less likely to have understood the material and less likely to have acted on it. In terms of recruiting membership, parents in lower social groups were more likely to have heard of the programme following television advertising. Press and radio advertising had little impact on reaching them.

Culture/ethnicity

Few studies considered cultural factors in their interventions. Rivara et al (1991) reported an intervention in an ethnically diverse school. Parental involvement was specifically encouraged through the shared completion of parent-child activity workbooks. This approach was found to improve safe crossing performance in younger children. Thomson and Whelan (1997) involved parents by training volunteers to act as trainers for the children involved in the intervention, with notable success. Cross et al (2000) also involved the wider community by enlisting community participation in determining road safety priorities to be addressed in the intervention.

Place

Injury target groups and settings

Place can have a large impact on road injuries. Factors such as traffic volume, local speed restrictions and engineering measures all play a part in accident figures. The majority of studies were carried out in an urban setting, although two interventions were in rural, urban and suburban settings (Harland and Tucker, 1994; Wright et al 1995). A number of studies compared different geographic regions, although this was generally done to compare an intervention region with a similar non-intervention region acting as a control,

rather than to address differences between regions (Tucker, 1992, West et al 1993). At a more local level, seven studies employed some training in the local road environment. Thomson and Whelan (1997) specifically chose to perform roadside training in the local environment to provide a familiar backdrop for the trained children.

Intervention design

Two studies were specifically designed to be implemented in regions with high levels of pedestrian injury (Tziotis, 1994; Thomson and Whelan, 1997). In the Tziotis study municipalities were selected for the intervention on this basis. In an attempt to compare knowledge and attitudes across three regions of a single city, Downing (1981) measured these factors in three regions of London: inner London, outer north London and outer south London.

Key results

Few reported results were related to place. No differences were observed in performance between rural, urban and suburban settings. Both studies targeted at regions of high accident incidence showed benefits for at least some of the target groups.

SUMMARY

- Twenty-three studies focused on pedestrian and traffic education, including pedestrian skills training (11 studies), traffic clubs (five) and other forms of traffic education (seven).
- **Age:** studies targeted different age groups. Traffic clubs generally targeted pre-school children. Studies comparing the performance of different age groups suggest that some interventions were more successful at reaching younger rather than older children.
- **Gender:** boys were more likely than girls to engage in risky behaviour. Where gender was considered, interventions were effective in improving performance in both boys and girls.
- **Social and economic factors:** few studies addressed socio-economic factors, but those studies that did so proved to be effective interventions.
- **Culture/ethnicity:** few studies considered cultural or ethnic factors. Three focused on community approaches to training/education.
- **Place:** few studies related to place. No differences were observed in performance between rural, urban and suburban settings. Two studies targeted regions of high accident incidence. Both showed benefits for at least some of the target groups.

C3 Car occupant injuries: child restraints

INTRODUCTION

Thirty-nine studies relating to use of child restraints were identified and reviewed. These studies cover child restraint loan schemes (nine studies), educational campaigns designed to increase the use of child restraints and seatbelts (16 studies), legislation requiring the use of restraints (nine) and enforcement of this legislation (five). The majority of the studies (33) were conducted in the USA. Of the remaining six, two were conducted in Sweden and one each in Australia, New Zealand and the UK.

In relation to child restraint loan schemes and education, 11 studies were hospital-based, seven were based at the primary healthcare level, and seven were school-based. Studies examining restraint legislation generally looked at effects of state-wide legislation (seven studies), although two studies examined the impact of legislation on groups of states. In the examination of enforcement of restraint legislation, four studies were community-based and one was school-based.

A number of methodologies were employed to measure the impact of interventions. Twenty-two studies used observation of restraint use, six used reported use, four used a combination of observation and report, and six used injury outcome measures.

INEQUALITIES ADDRESSED

Age

Injury target groups and settings

Three studies targeted the general population; the remaining studies targeted specific age groups. Most frequently targeted were infants under one year old, with 11 studies examining interventions aimed at this age group. Two studies targeted children under two years old, six targeted children aged 0–3, two targeted children aged 0–4, two targeted children aged 0–5, and one targeted children aged 0–10. The remaining studies targeted a range of different ages, generally from 3–5 to between seven and 19. In most cases the targeted age group was dictated by the setting of the study, eg hospital-based studies were more likely to target infants under one, whereas school-based studies were more likely to target children over three.

Intervention design

Intervention design and implementation were generally specific to the age of the child. Interventions relating to newborn infants generally involved provision of pre- or post-natal educational materials to parents (particularly mothers).

Nine of these interventions included provision of free child seats. Studies targeting older children generally employed school-based educational materials aimed at children and adults. Two of these studies employed reward schemes for correct use of child restraints.

In the nine studies examining the impact of state-wide legislation, seven compared morbidity rates before and after legislation, one compared observed seatbelt wearing rates before and after legislation, and one compared reported wearing rates between states with different laws. In the five studies of legislation enforcement, educational and publicity campaigns of a mass media or community-based nature were employed before or concurrently with the intervention.

Key results

Results relating to correct restraint use were moderated by child age. A number of studies concluded that restraint use was more prevalent among younger children (particularly the 0–3 age range) than older children (Miller and Pless, 1977; Streff et al 1992). This effect was mitigated if the adult driver was wearing a seatbelt (Russell et al 1994).

Scherz (1976) suggested that the decision to obtain a car seat was frequently taken when the infant was 7–8 months old, which is of some concern as Reisinger et al (1981) note that children are particularly vulnerable to injury at 0–3 months. Scherz (1976) goes on to state that most infants who are secured in safety restraints at eight weeks continued to be transported safely at 9–12 months, suggesting that interventions aimed at early infancy can provide later benefits.

Legislation requiring seatbelt use was shown to have a significant positive effect on the number of children observed wearing restraints, and a significant reduction in the number of children killed or seriously injured as passengers in motor vehicle accidents. In states where legislation targeted only very young children (typically 0–3 years old) a small but significant ‘spillover’ effect was seen in the increased rates of seatbelt wearing for older children (Wagenaar and Webster, 1986; Agran et al 1987). Following the introduction of legislation aimed at all children under 16, Margolis et al (1996) report an immediate increase in wearing rates for young children, but a more gradual change for older children (and adults).

Both legislation and enforcement studies noted greater increases for child restraint use if accompanied by educational methods rather than by coercion alone (Bowman et al 1987).

Gender

All studies targeted both boys and girls, and only one considered gender differences in its outcomes. Morrow (1989) reported that boys started with higher rates of seatbelt wearing than girls but, unlike girls, did not significantly increase wearing rates following an educational intervention. With regard to adults, a number of studies were targeted specifically at mothers. Wagenaar and Webster (1986) reported that the impact of a seatbelt law did not vary by the gender of the adult driver.

Social and economic groups

Injury target groups and settings

Relatively few studies specifically considered social and economic status. Where this was considered, a few studies commented only that the target group was predominantly well educated and relatively affluent (Greenberg and Coleman, 1982; Sowers-Hoag et al 1987). However a few studies did specifically target low-income areas (Liberato et al 1989; Hazinski et al 1995; Hanfling et al 2000) while others obtained socio-economic information (Miller and Pless, 1977; Reisinger and Williams, 1978).

Intervention design

Few studies were specifically designed with socio-economic status in mind. Social group was typically measured by parental education, number of children, marital status and free school meal provision. It could be argued that provision of free child restraints was an economic intervention, however only two studies where free seats had been provided included the collection of information on social group (Reisinger and Williams, 1978; Colletti, 1986).

Key results

The implementation of free or loaned child seat schemes for newborn infants or very young children appears to be effective in increasing the likelihood of children being restrained, at least in the short term. Use of provided restraints was more likely if mothers were older, had fewer children, were married and were not receiving medical assistance. In terms of the effectiveness of educating people on the use of restraints, Miller and Pless (1977) report no difference in restraint use between social groups, while other studies suggest that those of a higher social group are more likely to use restraints (Goodson et al 1985; Hazinski et al 1995). Hazinski and colleagues report that with good implementation of education programmes, increased restraint usage among more disadvantaged social groups can be achieved. No clear-cut picture emerges following studies

of legislation and enforcement, with restraint use variously reported as being unrelated to social group (Wagenaar and Webster, 1986) or related to some aspects of social group (Russell et al 1994). Hanfling et al (2000) suggest that higher social group is related to safer behaviour, but that interventions are effective across all levels of socio-economic status.

Culture/ethnicity

Injury target groups and settings

Again, relatively few studies specifically considered cultural factors. One (Reisinger and Williams, 1978) specifically excluded non-English-speaking participants from the intervention.

Intervention design

Hanfling et al (2000) attempted to promote a community-based approach to increased seatbelt wearing by involving community and church leaders and local political figures in the educational intervention. Geddis and Pettengell (1982) specifically tried to change the cultural perception of the special nature of the newborn's ride home from maternity hospitals which suggested that the mother should carry the infant, rather than using a restraint.

Key results

Of the studies that noted participants' ethnicity, most did not perform any comparisons of different ethnic groups. Hanfling et al (2000) did examine the impact of ethnicity on restraint use and found no differences between ethnic groups. Hanfling et al (2000) also found that good results could be obtained by tailoring an integrated intervention to the community's needs.

Place

Location was rarely specifically targeted, and was mainly noted only in relation to other factors such as social group. Location was associated with the catchment area of the intervention base, rather than the content or targeting of the intervention. Hazinski et al (1995) did compare rural and urban settings, and suggested that behavioural change was observed only in the urban setting.

SUMMARY

- Thirty-nine studies focused on the use of child restraints, including restraint loan schemes (nine studies), educational campaigns (16), legislation (nine) and enforcement (five).
- **Age:** target age group varied, with the majority targeting 0–1 year olds. Restraint use decreased in older children relative to younger children. Legislation increased restraint use.

- **Gender:** all the studies targeted both males and females. One study reported higher initial levels of restraint use for males, although this did not increase following intervention.
- **Social and economic factors:** few studies targeted social and economic factors. Free or loaned child seat schemes were effective in increasing the likelihood of children being restrained. Some evidence suggests that restraint use is higher among higher social groups, but that lower social groups can be effectively targeted.
- **Culture/ethnicity:** few studies considered cultural or ethnic factors. Those that did found no difference in restraint use.
- **Place:** few studies considered place. One study suggested that behavioural change following intervention took place in urban, but not rural settings.

C4 Bicycle injuries

INTRODUCTION

Twenty-eight studies relating to bicycle safety, helmet promotion and bicycle helmet legislation are reported. These studies relate to bicycle training (three studies), educational programmes designed to increase the use of bicycle helmets (19) and the impact of legislation requiring the use of helmets (6).

The majority of the studies (14) were conducted in the USA. Of the remaining studies, six were conducted in Canada, two in each of the UK, Australia and New Zealand, and one in the Netherlands and Sweden.

In relation to helmet promotion and cycle training, 17 studies were school-based (with one relating to a pre-school enrichment programme), two were hospital-based, one involved a primary healthcare setting, and two were mass media campaigns aimed at communities. The six studies examining bicycle helmet legislation looked at effects of the introduction of state-wide legislation.

Most of the interventions included an educational component. Three of the legislation interventions specifically examined the interaction between legislation and education and how this had an impact on helmet-wearing rates. Several of the interventions included the provision of free or discounted bicycle helmets.

The interventions were evaluated by a range of study designs, including seven randomised controlled trials, 13 controlled trails without randomisation, and seven time-series observation studies. Twenty studies included the collection of

data on observed helmet use; the remaining studies collected self-reported measures of helmet wearing, hospital records and helmet sales.

INEQUALITIES ADDRESSED

Age

Injury target groups and settings

A number of different age groups were targeted in the studies. Four targeted children of primary school age or younger, four targeted children aged 5–12 years, and five targeted children aged between nine and 12/13 years. In terms of legislation, four studies detailed legislation requiring all children under 16 to wear a bicycle helmet, and two described legislation requiring helmet use by all riders of any age (including adults). The concentration of studies targeting school-age children was in response to epidemiological evidence suggesting that these children were the most at risk of bicycle-related injuries. The majority of the studies were school-based, so differences in specifically targeted ages were often due to the intake of the particular school.

Intervention design

Most of the studies reported making use of age-appropriate materials in the education of children with regard to helmet use. Also, a number of studies attempted to address the attitudes and concerns of children specific to their age. The principal area addressed in this way was peer pressure and the social acceptability of bicycle helmet wearing, an important factor in helmet use.

Key results

A frequently reported finding was that older children were far less likely to own or wear helmets than younger children (Kim et al 1997; Ni et al 1997). Older children were also less likely to believe that a helmet could be effective in preventing head injury (Logan et al 1998). Moore and Adair (1990) note that older children are more susceptible to peer pressure, and it may require legislation as well as education to get this age group to increase their rate of helmet wearing. Following legislation and a decade of education in the Australian state of Victoria, an increase in teenage helmet-wearing rates was observed – however this may have been due to a 46% decrease in the number of teenage cyclists seen following the introduction of the law, suggesting that a good number of young people would rather not cycle than wear a helmet. Peer pressure is an important barrier to the use of bicycle helmets, particularly among older children, and this should be taken into consideration when designing interventions.

Gender

Injury target groups and settings

Boys aged 10–14 years are at a higher risk than girls of death as a result of a cycling injury. While a number of studies report helmet-wearing rates differentiated by gender, few studies have been carried out to address this inequality of injury.

Intervention design

Only one study specifically addressed gender in its design. Wood and Milne (1988) particularly targeted negative attitudes to bicycle helmet use among older boys in their educational intervention. Many other studies reported helmet use by gender, but did not tailor the intervention specifically to target either boys or girls.

Key results

Reported gender differences in helmet-wearing rates vary in the different studies. Some studies report no difference in helmet-wearing rates between boys and girls (Logan et al 1998). One study reported that helmet use was more likely in boys, but presented no evidence to substantiate this claim (Puczynski and Marshall, 1992). Several studies reported that post-intervention, girls were more likely to wear helmets than boys (Kim et al 1997). Two studies (Parkin et al 1993, 1995) presented an interesting finding in relation to gender differences and social group: in observation studies carried out in high-income areas there was no difference in helmet-wearing rates between boys and girls, but when observations were carried out in low-income areas boys were significantly less likely than girls to wear a helmet.

In a study relating to cycle training, Savill et al (1996) found that boys scored significantly higher than girls in tests of cycling knowledge. However, this increased knowledge appears to be insufficient to prevent injury. It is possible that increased knowledge is due to increased cycling exposure for boys relative to girls.

Social and economic groups

Injury target groups and settings

A number of studies targeted groups with some form of social or economic disadvantage. Most of the studies targeted areas or schools with disadvantage based on average family income. Farley et al (1996) defined a municipality as poor if more than 20% of families were below the poverty threshold. Other measures of social disadvantage taken were parental education (Logan et al 1998), lunch assistance (Puczynski and Marshall, 1992), number of lone parents (Parkin et al 1995) and percentage of owned dwellings (Parkin et al 1995). A number of studies

compared the impact of interventions in low- and higher-income areas (Farley et al 1996).

Not all studies worked with disadvantaged social groups; some were carried out in middle-class communities (Cushman et al 1991a; Macknin and Medendorp, 1994). Dannenberg et al (1993) reported a study comparing helmet-wearing rates in middle-class communities with those observed in upper-middle-class communities.

Intervention design

As well as addressing inequality of social group by targeting schools or areas of low income and using them as bases of education, or regions in which to base observational studies, many studies also specifically addressed the barrier of helmet cost. The issue of cost was flagged as being an important potential barrier to helmet use by low-income parents (Towner and Marvel, 1992). To address this, helmets were given away free of charge, or discount coupons were provided to reduce the cost of purchase (Mock et al 1995).

It is possible that the provision of free helmets may in some way reduce their perceived worth, and may possibly lead to less use. An interesting variation on the give-away schemes was described by Kim et al (1997) who suggested that, while cost may be a barrier to low-income groups, placing a small cost on the helmet may lead to greater value being placed on it and therefore greater use. This was described as 'co-paying' and generally involved a large subsidy to bring the cost of the helmet down to US\$3–5. In this study no eligible child was refused a helmet, and those who could not afford to co-pay were given helmets free of charge.

Key results

Trying to understand the role of social group in bicycle helmet use is a complex task. The evidence from the studies reviewed does not present a clear overall picture. Several studies reported that helmet use was associated with higher socio-economic group (Towner and Marvel, 1992), however two reported that this was not the case and that helmet use was not related to social economic group (Pendergrast et al 1992). Interestingly, Ni et al (1997) reported that helmet use was correlated with household income before, but not after, the intervention.

In terms of effectiveness of the interventions described, again there are equivocal results. Logan et al (1998) found that helmet use could be increased through intervention in a low-income setting, unlike Parkin et al (1993) who reported no increases in helmet use in low-income areas. In a later study Parkin et al (1995) noted that in low-income areas, post-

intervention helmet ownership increased but helmet wearing did not. Farley et al (1996) reported a programme that was three times more effective in average/rich neighbourhoods compared with poor ones.

These results suggest that although the cost of a helmet is a real barrier to low-income families in lower social groups, it is not the only factor at play in determining levels of helmet use.

Culture/ethnicity

Injury target groups and settings

The study of Abularrage et al (1997) specifically addressed issues of culture and ethnicity. The study attempted to develop a helmet-promotion programme that was appropriate and implementable in a multi-racial community. The study was carried out in a county of New York State, selected because it was the most racially diverse county in the USA. Similarly, Hendrickson and Becker (1998) used schools' level of minority representation as a central criterion for inclusion in their intervention. Britt et al (1998) describe a study in which 18% of children taking part had a primary language other than English. A few other studies, which targeted low-income areas rather than focusing on ethnicity, noted that in their target communities there were high levels of minority students (Puczynski and Marshall, 1992) or non-English speakers (Parkin et al 1995).

Intervention design

The main design facet employed was the use of multi-lingual materials translated into a language appropriate to the target community. For example, Cushman et al (1991a) report a Canadian study using educational materials in both English and French; Logan et al (1998) report a US-based study in which parental questionnaires were translated into Spanish and Vietnamese. Perhaps the most surprising study is that of Abularrage et al (1997) which used only English language materials – while many other studies also employed English-only materials, it seems particularly strange that a study deliberately targeting a community so ethnically diverse should do so. They report that multi-lingual materials were not available at the time of the study.

Key results

Where results are presented broken down by cultural/ethnic group, differences are generally found. However, few studies report their findings in this way. DiGuiseppi et al (1989) and Dannenberg et al (1993) report that whites are more likely to be observed wearing bicycle helmets than cyclists of other ethnic groups. Similarly, Hendrickson and Becker (1998) found some relationship between ethnicity and helmet use. Again, Abularrage et al (1997) reported

that, overall, white children were more likely to be observed wearing bicycle helmets, however they also present an interesting finding relating to the differential impact of the intervention. Following the intervention increased helmet-wearing rates were observed in black and in white children, but no increases were observed in Hispanic or Asian children. Whether this is due to the use of English language materials only, or to other cultural factors, is not clear.

In terms of 'culture of safety' it is worth noting that a number of studies reported that children were more likely to wear bicycle helmets if cycling with other helmeted children, and particularly likely to be wearing them if accompanied by an adult wearing a helmet. Hendrickson and Becker (1998) noted that a factor that significantly increased helmet-wearing rates in children was a mother's encouragement to do so. Finally, mention should be made of the introduction of helmet legislation in Victoria, Australia which was introduced in the context of promotion of a culture of safety. The legislation was introduced following a decade spent creating a favourable climate through educational measures, parliamentary statements and related safety laws.

Place

Injury target groups and settings

Place was rarely the target of the intervention studies. Hendrickson and Becker (1998) reported a study in which they specifically targeted a rural setting because access to trauma services was restricted, and because of this injury prevention was particularly important. A study by Logan et al (1998) also had a rural setting. The majority of other studies specified urban or suburban locations, or compared these with rural settings (Britt et al 1998).

Intervention design

Savill et al (1996) describe a study that ran training courses over a variety of different areas to include a wide geographic spread. A number of other studies used location as a basis for comparisons of intervention effectiveness. This included educational studies that used similar, non-intervention areas as controls, and legislation studies comparing the observed helmet rates or injury outcomes in areas where legislation had been enacted with those in areas without legislation. This latter study type was sometimes used to compare the impact of legislation alone with regions where legislation had been accompanied with educational measures (Macknin and Medendorp, 1994).

Key results

The study by van Schagen and Brookhuis (1994) found that children's behaviour related to the road conditions they were

in. DiGuseppi et al (1989) reported that helmet-wearing rates were higher in parks than on streets. Two studies noted that the geographic differences were moderated by social and economic factors. Parkin et al (1995) found that in high-income areas helmet use increased in schoolyards relative to recreational sites, but that this was not the case in low-income areas. Farley et al (1996) reported an intervention that was effective in raising helmet-wearing rates in all areas of average-rich municipalities, but effective only on local streets (a higher-risk environment) in low-income areas.

Wood and Milne (1988) suggested that helmet-wearing rates were lower in rural environments, and Ekman et al (1997) reported greatest post-intervention decreases in head injuries in rural locations, suggesting that rural environments are worthy of targeting.

In terms of legislation, Macknin and Medendorp (1994) reported that legislation alone leads to higher observed helmet-wearing rates relative to areas without legislation. However, greater impact still was attained in areas that combined legislation with a programme of education.

SUMMARY

- Twenty-eight studies focused on interventions relating to training (three studies), educational programmes (19) and legislation (6).
- **Age:** a number of different age groups were targeted. Older children were less likely to wear bicycle helmets and were less likely to have a positive attitude towards them.
- **Gender:** several studies reported that girls were more likely to wear helmets, although a number of studies found no gender difference. Two studies suggested that gender differences may be moderated by social and economic factors.
- **Social and economic factors:** a number of studies addressed helmet cost. Results suggest that while cost is a barrier to low-income families, other factors are also involved.
- **Culture/ethnicity:** where results are reported in relation to ethnicity, minority children are less likely to wear bicycle helmets. Other cultural factors that effect helmet use include mother's encouragement and peer helmet use.
- **Place:** children's behaviour and likelihood of helmet use varies depending on the environment.

C5 Injuries in the home

C5(i) Prevention of falls and general injuries in the home

INTRODUCTION

In this section we examine 18 studies focusing on interventions to prevent a range of injuries in the home, including falls, suffocation, scalds and bath-tub drowning. In addition to this literature on general injuries there is a relatively large number of studies focusing specifically on the prevention of burns and scalds and poisonings. These studies are considered in sections C5(ii) and C5(iii), respectively.

Of the 18 studies evaluating interventions to prevent general home injuries, six were carried out in the UK, 10 in the USA and one each in Canada and Australia.

Most of the interventions included parent counselling on home safety, and 11 involved home visits with individual advice on hazards. Several interventions included the provision and/or fitting of home safety devices such as electric socket covers. While most of the interventions targeted a range of injuries, the intervention described by Spiegel and Lindaman (1977) focused specifically on falls from windows.

The interventions were evaluated by a range of study designs. Twelve studies included random allocation to intervention and control groups, however in some studies randomisation was at group rather than individual level. Seven of the studies included the collection of injury outcome data, the remainder evaluated the impact of interventions by using data on observed home hazards, tests of parents' knowledge, or questionnaires eliciting information on attitudes and behaviour.

INEQUALITIES ADDRESSED

Age

Injury target groups and settings

Three of these studies targeted children of all ages, in the remainder specific age groups were selected. Children under five years of age were specifically targeted in 13 studies. This concentration on the youngest age group reflects the epidemiological evidence which shows that pre-school children are most at risk of injuries in the home.

In a study focusing on suffocation, which targeted all children under 15 years, the relative age-related risk of different types of suffocation and entrapment injuries was

set out (Kraus, 1985). Thus for fridge entrapments, children were at greatest risk between the ages of two and seven years. For suffocation from plastic bags children under two were recognised as being at high risk, while babies aged 6–8 months were at high risk of cot suffocation.

The selection of target age groups related not only to relative risk, but also to the settings in which the interventions were delivered. Several interventions were delivered in well child clinics or as part of routine child surveillance appointments (Kelly et al 1987; Kendrick et al 1999). Here the target age groups would reflect the ages of the clinic population, eg babies and children under two years.

Intervention design

The design of interventions in these studies frequently related to the age of the children targeted, although this may not have been made explicit. In several studies, free devices were provided which reflected the vulnerability of children under five to specific types of injuries, eg the provision of cupboard locks, poison stickers and an emetic for the prevention and treatment of poisoning. In the intervention described by Kendrick et al (1999), where advice was offered at specific child surveillance appointments, advice was designed to reflect the child's developmental stage.

Most of these interventions targeted parents rather than children, and offered counselling and advice which frequently formed a part of existing service provision. The intervention described by Johnston et al (2000) involved parents of children enrolled on Head Start programmes, while another study involved health visitor counselling and the loan of home safety equipment (Thompson et al 1998). Home visits to offer safety advice occurred as part of several of these interventions. For parents of children under five years, advice on child health, surveillance and home visits are a routine part of a child's healthcare, and therefore these approaches may have been more acceptable to these families than they would have been for parents of older children.

Key results

None of these studies reported results specifically relating to the ages of children included. Results of the studies suggest that counselling parents of pre-school children and home assessments can achieve some positive results.

Gender

All these studies targeted both genders, and there were no studies where outcomes for boys and girls were reported separately. Relatively few of the studies collected information on injury outcomes and where outcomes were collected, eg

parent knowledge and/or behaviour or hazard removal, the gender of the child may not have been perceived as relevant. Some authors recognised that boys and girls had different levels of risk for some types of injury, but this was not taken into account in the way the interventions were designed or in the measurement of outcomes.

Social and economic groups

Injury target groups and settings

A relatively large proportion of the studies reviewed (14 out of 18) targeted groups with some type of social or economic disadvantage. The way these groups were defined and selected varied across studies. However, most targeted groups or neighbourhoods with disadvantage, rather than selecting individuals. For example, one of the UK studies (Colver et al 1982) described a home safety campaign aimed at families living in a deprived area of Newcastle. Relative deprivation was defined by a number of factors including the numbers in the area unemployed and receiving benefits. In another UK study the target area was described as having a large proportion of local authority housing. In a US study involving counselling at home visits, teenaged, unmarried mothers were targeted (Olds et al 1994).

In contrast, in an early study by Dershewitz and colleagues the target group was described as well educated and affluent (Dershewitz, 1979; Dershewitz and Williamson, 1977).

Intervention design

A relatively large proportion of the interventions evaluated (9 out of 18) included the provision or offer of free safety equipment. In several studies the equipment included low-cost items such as electric socket covers or cupboard locks. Smoke alarms were offered as part of some interventions. In the study described by Spiegel and Lindaman (1977) 16,000 window guards were distributed free to 4,200 families. In three of the UK studies involving the provision of free or low-cost equipment the intervention was tailored to the circumstances of the families involved. For example, in the studies by Clamp and Kendrick (1998) and Kendrick et al (1999) low-cost safety equipment was made available to those in the intervention group receiving means-tested state benefits. Similarly, the study by Thompson et al (1998) involved the free loan of equipment to families on low incomes. Two studies which did not target low-income families also provided free devices (Dershewitz and Williamson, 1977; King et al 1999).

While the provision of free or low-cost equipment may address economic barriers to their purchase, it does raise a number of issues. It is possible that providing free devices

may undermine the way they are perceived by parents. Parents may be less motivated to use them than if they had bought them themselves (even at a subsidised cost). Further, it is not known whether several of the devices offered (eg electric socket covers and cupboard locks) are effective in reducing injuries. It is possible that providing such devices may increase risk if parents believe they offer protection and reduce their level of supervision.

In two studies that included advice on home safety (Colver et al 1982; Campbell et al 2001) there was specific emphasis on recommending changes that families could achieve at no or low cost. In the study by Colver there was also advice to families on their entitlement to state benefits to allow them to purchase safety equipment. In a study targeting teenaged mothers advice was given on employment opportunities (Olds et al 1994). A study from Ireland used lay workers from the community to visit homes, enabling trust to be established and relationships built up (Mullan and Smithson, 2000).

Key results

Understanding the results of these studies in relation to health inequalities is not simple. The results of the studies were mixed, however many reported some success in reducing the number of hazards in children's homes and in increasing families' awareness of safety issues and first aid. Given that many of the studies were targeted at families living in deprived areas, it is possible that health inequalities can be addressed by targeting interventions at such groups. As Colver put it:

'Even severely disadvantaged families will respond to health education if the education is appropriate'.
(Colver et al 1982)

Having said this, only one of the studies examined the impact of the intervention in different social groups. Clamp and Kendrick (1998) examined the effectiveness of the intervention in families either receiving or not receiving state benefits, and found that the intervention was equally if not more effective in families in receipt of benefits. In the remaining studies it is not clear whether the interventions were more or less effective in different social groups. Gallagher et al (1985) reported that the intervention was more effective where families had to make no, or only minor, behavioural changes (eg where devices were fitted) when an intervention was targeted at a neighbourhood of poor housing. However, a similar finding was reported by Dershewitz (1979) in relation to an affluent, well educated target group. Mullan and Smithson (2000) found that the

home-visiting programme appeared more successful in more stable communities, where fewer tensions existed among residents.

Culture/ethnicity

Injury target groups and settings

Relatively little attention was paid in these studies to cultural issues. One intervention was specifically targeted at Hispanic migrant families (Campbell et al 2001). The participants in another study were described as predominantly of black origin (74%) (Kelly et al 1987). In the study of window falls (Spiegel and Lindaman, 1977) it was noted that fall victims were frequently non-white. In a small number of other studies the ethnic breakdown of the samples was described but there was no explicit attempt to target any particular cultural groups.

Intervention design

Little attention was paid to issues concerning language and culture in most of these studies. In the study targeted at Hispanic young people the programme was delivered by bilingual, bicultural students. In the remaining studies language barriers were not specifically mentioned. In five studies there was a general recognition that, for health promotion interventions to be acceptable to participants, they had to be delivered sensitively by trusted workers (Colver et al 1982; Gallagher et al 1985; Olds et al 1994; Johnston et al 2000; Mullan and Smithson, 2000).

Key results

Little reference was made to culture or ethnicity in the results of these studies. None of the studies compared penetration and impact of the interventions in different cultural groups. In the study targeted at Hispanic young people it was noted that 79% of the follow-up questionnaires had been completed in Spanish, and the authors concluded that the programme had resulted in improved confidence and first-aid skills among participants.

Place

Injury target groups and settings

In a sense, all the studies reviewed related to place in that the focus was on the environment in the home and many of the studies aimed to reduce environmental hazards. At the macro-level there was reference to place in that interventions were targeted at particular neighbourhoods, and this frequently related to the relative deprivation of families living in these areas. All but two of the studies were carried out in urban areas – often in built up inner-city locations. The study

by Olds et al (1994) was carried out in a semi-rural area, and those by Paul et al (1994) and Mullan and Smithson (2000) included both urban and rural areas.

Intervention design

Many of the studies included the provision of devices and equipment or home safety checks aiming to improve the environment in the home. In the study by Spiegel and Lindaman (1977) the intervention aimed to prevent window falls, and occupants of high-rise tenement buildings had window guards fitted to improve safety. The study by Gallagher et al (1985) alluded to the difficulties some families face in altering their environment to reduce risk. They gave as an example the inability of tenants in rented properties to change hot-water temperatures to reduce the risks of hot-water scalds. In one study the aim of the intervention was to increase the availability of safety equipment in local retail outlets (Paul et al 1994). However in the majority of these studies little attention was paid to broader environmental issues.

Key results

The results of many of these studies suggest that interventions can achieve behavioural changes resulting in environmental changes in the home that may reduce injury risk. No studies compared families living in different types of accommodation or in different types of neighbourhood. Mullan and Smithson (2000) found that the programme was more successful in rural than in urban settings. It was not clear whether differences in the built environment made it easier or more difficult for families to improve safety in the home.

In a study that attempted to improve access to safety equipment, there was no reduction in the number of hazards recorded after the intervention period (Paul et al 1994).

C5(ii) Prevention of burns and scalds

Nineteen studies specifically focused on the prevention of burns and scalds, and three of these evaluated the impact of regulations regarding smoke alarms or product design. Most of the studies (14) were carried out in the USA. Seven focused on all age groups (including adults), the remainder specifically targeted children.

The studies were carried out in a variety of settings: four in childcare centres and six in schools, the remainder targeting general population or neighbourhood groups. Eleven of the studies included an educational component. The duration of these educational sessions ranged from brief, one-off counselling sessions to intensive, structured, school-based

campaigns with activities spread over several weeks. In several studies free devices were provided. Free smoke alarms were distributed in four major campaigns. One study included provision of a free thermostatic device that controlled bath hot-water temperatures (Fallat and Rengers, 1993).

The interventions were evaluated using a variety of approaches. Seven of the studies were randomised trials. Injury outcome data were collected in four studies. In the remaining studies outcome data included hazard identification (eg observed presence of operational smoke alarms). Data on knowledge and awareness were collected in seven studies.

INEQUALITIES ADDRESSED

Age

Injury target groups and settings

These studies targeted a range of age groups. The three studies evaluating regulations had a population focus, but may have had relevance to children in a specific age group. For example, the product regulations examined by Sorensen (1976) applied in particular to injuries in young children under five.

The studies included several school-based campaigns which all focused on children over five years, although the target age group varied. Three studies aiming to prevent scald injuries targeted very young children (under three), the group most at risk of this type of injury (Fallat and Rengers, 1993; Waller et al 1993; King et al 1999). In a study in a childcare centre, children aged 3–5 years underwent an intensive programme on burn and scald prevention which involved 30 hours of classroom-based activities over 18 weeks. An intervention involving nurse counselling at well baby clinics was aimed at parents of babies aged 6–12 months.

Intervention design

Few studies explicitly referred to how the age of the target group had influenced the design of the intervention. Eckelt et al (1985) mentioned that materials had been designed to reflect the existing level of knowledge and the attention span of the target audience. Similarly, in a programme targeting very young children, materials and exercises had been designed to take account of the abilities of children at this age (McConnell et al 1996). A community-based study involved school-based activities for children aged 5–8 years and young people 15–17 years (McLoughlin et al 1982). Here teachers, students, parents and psychologists were all involved in designing materials to ensure that they were appropriate for the age groups concerned.

Key results

Few studies examined the impact of the various interventions with children of different ages. Harré and Coveney (2000) revealed that while the effectiveness of their programme was most pronounced with older children (who showed greater increases in their knowledge scores), the programme also had an effect on younger children. These authors concluded that even children aged 7–8 years have the ability to encourage changes in the home to increase safety. McConnell et al (1996), in a study of young children (aged 3–5 years), revealed that while pre-test scores were higher in older children the impact of the programme was more pronounced in younger children. In the school-based campaigns described by McLoughlin et al (1979, 1982) children aged both 5–8 and 15–17 years increased their knowledge scores. Here the campaign seemed equally effective for different age groups.

The results of the study by McLoughlin et al (1985) examining the impact of legislation requiring the installation of smoke alarms revealed that the presence of a child under the age of 10 had no impact on whether or not families had a working smoke alarm in their homes.

No other studies compared results of interventions for children in different age groups. Under these circumstances it is not known whether the positive results reported following some interventions would be achieved with children of different ages.

Gender

There was little information on the gender of participants in these studies, or on whether gender had any influence on the outcome of campaigns. Harré and Coveney (2000) revealed that a school-based education programme was equally effective with boys and girls.

Fallat and Rengers (1993) noted that while the gender of children did not influence the results of a campaign involving the fitting of a tap thermostat, their fathers were likely to object to the devices and remove them.

Social and economic factors

Target groups and settings

Two of these studies evaluated the impact of interventions with more affluent groups (McLoughlin et al 1985; Waller et al 1993). Several of the remaining studies specifically targeted more deprived groups or attempted to include a range of social groups. Three studies including schools or childcare centres attempted to select schools/centres serving both higher- and lower-income populations (Eckelt et al

1985; McConnell et al 1996; Harré and Coveney, 2000).

Two of the smoke alarm give-away campaigns specifically focused on more deprived communities (Mallonee et al 1996; DiGuseppi et al 1999).

Intervention design

Four studies provided smoke alarms free as part of burn-prevention campaigns. In one UK study more than 20,000 alarms were distributed free to families in London (DiGuseppi et al 1999). Eighty per cent of those receiving alarms were living in rented accommodation. In the study described by Thomas et al (1984) families were provided with discount coupons for smoke alarms to overcome some of the economic barriers to their purchase. Free devices were also provided as part of scald-prevention campaigns (eg thermometers to check bath-water temperatures or thermostats for bath taps). In a study involving the fitting of bath-tap devices to control temperature the devices were inefficient and unpopular – bath taps became clogged up and devices were removed.

Smoke alarms are associated with reductions in burn injuries; the effectiveness of some other devices (eg tap thermostats) is not known.

Key results

Relatively few studies examined results in different social groups. In those campaigns targeted at low-income groups campaigns achieved some success, eg families provided with smoke alarms tended to use them. The study of a smoke alarm give-away campaign where more than 10,000 devices were distributed revealed that 45% of alarms were still functioning at follow-up four years after the initial campaign (Mallonee et al 1996). A study examining legislation requiring smoke alarms revealed that the presence of operational devices was positively related to income and property values (McLoughlin et al 1985). Waller et al (1993) reported similar findings with regard to hot-water temperatures, with more affluent homes having safer water temperatures.

One study compared the effects of a school-based campaign in private and state schools and revealed modest increases in knowledge in both schools, with slightly greater gains among private school students (Eckelt et al 1985).

Culture/ethnicity

Target groups and settings

Relatively few studies targeted specific cultural groups or provided any information on the cultural background of participants. There were some exceptions. First, in a campaign to reduce scald injuries in Australia, Vietnamese,

Arabic and Chinese families were specifically targeted (King et al 1999). In a New Zealand study a scald-prevention campaign was targeted at what was described as an ethnically diverse population, which included people from European, Maori, Pacific Island and Asian backgrounds (Waller and Marshall, 1993; Waller et al 1993). A smoke alarm give-away campaign in London was similarly targeted at a multi-cultural population (DiGuseppi et al 1999).

Intervention design

Those studies targeting culturally diverse groups attempted to design the intervention to take account of this diversity. For example, in the Australian study including a range of ethnic groups materials were developed after initial consultation with local community groups. Materials were prepared in a variety of languages and the communication channels used related to the cultural practices of different ethnic groups (King et al 1999).

Several interventions were delivered in a way so as to be acceptable to the target group and to avoid any stigma associated with being selected for intervention. For example, in the study examining the effect of smoke alarm regulations, free devices were provided to non-compliant households (McLoughlin et al 1985). Smoke alarm give-away programmes utilised local community workers, members of tenants' groups or other trusted local people (rather than health professionals) to distribute alarms (Mallonee et al 1996; DiGuseppi et al 1999).

Key results

There was little information regarding the impact of programmes in different cultural groups. Shults et al (1998) reported that while a smoke alarm give-away campaign included an area with a variety of cultural groups, non-English-speaking families were excluded from the evaluation.

Harré and Coveney (2000) reported that a scald-prevention campaign was effective in all cultural groups targeted.

One study employed bilingual interviewers to collect outcome data and made separate analyses of results for different cultural groups (King et al 1999). Here it was revealed that different groups had different baseline levels of knowledge. Examination of the penetration of the programme revealed that Vietnamese and Arabic groups were more likely to have seen campaign information in newspapers rather than via other media (eg posters or television). Vietnamese families were more likely than others to be aware of the campaign, and this group had the greatest increases in knowledge after the campaign.

None of the other studies provided any separate breakdown of results for different cultural groups; therefore it is not known whether programmes would be equally as effective with people with different cultural backgrounds and practices.

Place

The built environment is likely to have an important bearing on burn and scald injuries, although this was not made explicit in most of the studies reviewed. Regulations relating to the environment in the home, eg requiring the installation of smoke alarms, are difficult to enforce. The study of regulations by McLoughlin et al (1985) revealed how regulations were limited (eg applied to new housing only) to increase compliance.

The ability of individuals to change their homes to prevent burns and scalds may also be limited by the built environment. For example, hot-water systems relying on fire back boilers may be difficult to control. While tap thermostats may offer a means of controlling temperatures at specific points in the home, devices must be easy to use and efficient, otherwise they will be removed.

None of the studies reported results for different locations (eg urban versus rural) or for families living in different types of accommodation. Without this knowledge it is difficult to appreciate the importance of the built environment in encouraging or inhibiting safe behaviour.

C5(iii) Prevention of poisoning

INTRODUCTION

In this section we examine eight studies focusing on the prevention of poisoning. Six of these studies examined educational approaches (aimed at children, parents or health professionals) to increase knowledge and awareness of poisoning hazards. Five of those six were carried out in the USA and one in South Africa. Two studies focused on the impact of poison packaging regulations on injury, one carried out in the UK (Sibert et al 1985) and one in the USA (Rodgers, 1996).

The packaging regulations were applied at population level. The educational studies were carried out in a range of settings. One intervention was delivered in schools (Liller et al 1998), one in childcare centres (Krenzelok and Garber, 1981), and the remainder via healthcare settings. The interventions ranged from an intensive programme with lessons on poisoning spread over many weeks, to a single lecture on hazards. The school and child-centre studies

aimed to raise awareness among children, those based in healthcare settings were aimed at parents. One intervention was designed to increase knowledge of poison prevention among healthcare staff (Eaton-Jones et al 2000). Another intervention focused on the hazards associated with storage of paraffin for heaters, and involved education on the safe storage of paraffin and the distribution of child-resistant containers (Krug et al 1994).

Two studies involved random allocation to control and intervention groups (Woolf et al 1987, 1992) to evaluate the interventions. The remaining studies used before-and-after designs. Injury outcome data were collected in the studies by Krug et al (1994) and Woolf et al (1992). In the remaining studies the impact of the intervention was assessed by examining participants' knowledge and behaviour following the intervention.

Overall, the results of these studies suggest that educational interventions can improve knowledge among children and parents.

INEQUALITIES

Age

Injury target groups and settings

Both studies involving evaluation of poison packaging regulations focused on the prevention of injury in children under five years. The educational studies also tended to focus on young children under five, the group most at risk of poisoning. One exception was a study that involved a single lecture to school-age children aged 5–9 years (Liller et al 1998). In the studies focusing on younger children, one intervention was aimed directly at children (Krenzelok and Garber, 1981). Here children aged 30–60 months attending day-care centres were taught to recognise poison stickers and to be aware of what poison meant. Four studies aimed to raise awareness among parents of young children, and one was aimed at health professionals caring for children between six months and five years (Eaton-Jones et al 2000).

Intervention design

In the studies focusing on safe packaging of poisons the nature of the intervention was specifically designed to take account of young children's developmental stage. Similarly in the study in South Africa, paraffin storage containers were specifically designed so that young children would have difficulty opening them (Krug et al 1994). The educational interventions also recognised age-related factors in the way the interventions were designed. Liller et al (1998) reported using age-appropriate educational materials, and in the study

aimed at children in childcare centres lessons were structured to take account of the cognitive abilities of these pre-school children.

Key results

Little information is provided in these studies relating to the age-related impact of interventions. The school-based study by Liller et al (1998) involved testing knowledge in two separate age groups (children aged 5–6 and 8–9 years), and results suggested that knowledge scores increased in both groups. The study in childcare centres also reported increases in knowledge in young children.

Gender

The gender of children was not mentioned in these studies in relation to the targeting and design of interventions or in the results. It is not clear whether poison-prevention interventions have a different impact on boys and girls.

Social and economic factors

Injury target groups and settings

There was relatively little information given in these studies on the social and economic background of participants. The studies focusing on regulations included all social groups. In the study described by Liller et al (1998) six schools were included which were selected to represent a range of social/economic groups, but little detail was provided. In one study (Woolf et al 1987) the hospital served a low-income population, with 42% of those attending being in receipt of Medicaid and a further 18% with no medical insurance. In contrast, in a study of poison-centre callers by the same team the participants were described as being predominantly well educated and affluent (Woolf et al 1992). The study of an educational intervention for health professionals reported that the participants mainly cared for families receiving Medicaid (Eaton-Jones et al 2000).

Intervention design

Several of these studies involved distribution of free devices to prevent poisoning. For example, in the study by Krug et al (1994) 20,000 child-resistant containers for the safe storage of paraffin were distributed to overcome economic barriers to their purchase. One study involved the provision of free cupboard locks to intervention families (Woolf et al 1992). Three studies included free or discounted distribution of ipecac, an emetic drug for administration after the ingestion of certain types of poison. A problem with ipecac is that it may be harmful if administered inappropriately. The study by Eaton-Jones et al (2000) suggests that many parents would use ipecac without consulting a health professional. As

discussed above, the provision of devices or equipment free to families, while overcoming economic barriers to purchase, is useful only if these devices are of proven effectiveness and if families are motivated and have the knowledge and skills required to use devices appropriately.

Key results

None of these studies examined the impact of interventions in different social groups. It is not known whether poison-prevention interventions are more or less effective for children from deprived or more affluent backgrounds.

Culture/ethnicity

Injury target groups and settings

There was little information on culture in these studies. The study in South Africa targeted black families where families used paraffin heaters in their homes (Krug et al 1994). In other studies little information on the ethnic background of participants was provided.

Intervention design

The provision of paraffin storage containers (Krug et al 1994) was a response to a particular poisoning hazard faced by children in families where paraffin was stored in the home and where paraffin ingestion was known to be a cause of serious injury. In this respect the intervention was designed to take account of the practices of participants.

The hospital-based educational intervention reported by Woolf et al (1987) reported that educational materials and counselling were provided in both English and Spanish.

Key results

The South African study suggested that the intervention was effective in reducing paraffin ingestion among the group targeted (Krug et al 1994).

None of the studies provided any information on whether the interventions were more or less effective in different cultural groups.

Place

None of these studies provided information on the location or environment that helps us understand the impact of place on injury. The safe storage of poisons in the home is likely to relate to environmental considerations.

Several studies give information on where they were carried out but provide little knowledge on how the setting of the study, or the setting in which injuries occur, was likely to have influenced results.

SUMMARY

- Forty-five studies examined the prevention of injuries in the home environment. Interventions included parent and child education, smoke alarm give-away campaigns and poison-prevention packaging.
- **Age:** most interventions targeted children under five years. Little information is available on the effectiveness of interventions in different age groups.
- **Gender:** little information is provided on the gender of participants in these studies. It is not known whether interventions are equally effective with boys and girls.
- **Social and economic factors:** a relatively large proportion of these studies targeted groups with some sort of social or economic disadvantage. Interventions designed to take account of economic disadvantage included the provision of free devices. Smoke alarm give-away programmes targeted at disadvantaged neighbourhoods achieved some success. There is little information on the effect of programmes in different social groups.
- **Culture/ethnicity:** little attention has been paid to cultural issues.
- **Place:** most of these studies focused on the environment in the homes of individual participants and aimed to modify the environment at this level. There is little information on the hazards associated with particular types of housing or neighbourhoods. Some vulnerable groups, such as those in shared accommodation, have limited ability to change some features of the home environment.

C6 Injuries in the leisure environment

INTRODUCTION

Here we examine seven studies focusing on injuries occurring outdoors in the leisure environment. Three of these studies examined the impact of interventions designed to reduce injuries in children's playgrounds, one examined an intervention to reduce mushroom poisoning, one focused on fireworks injuries, one on drowning, and one on sports injuries.

The approaches used in the different studies varied considerably. The three studies aiming to improve the safety of playgrounds focused on environmental modifications (changes to equipment or surfacing) to reduce hazards. The remaining studies used educational approaches. An intervention to reduce rugby injuries included the provision of mouth guards, and the one to reduce drowning promoted

the use of life jackets bought through bulk-purchase schemes to reduce cost. In the evaluations only two of the seven studies included control groups, the rest used simple before-and-after designs.

All the studies reported positive outcomes, with injury reductions being reported in four studies and increases in knowledge or hazard reduction in the remaining three.

INEQUALITIES ADDRESSED

Age

Injury target groups and settings

The nature of the interventions meant that they targeted a range of different age groups. The target groups reflect the settings in which the interventions took place as well as children's exposure to particular injury risks. In two of the studies focusing on the reduction of school playground hazards, the target groups were children attending primary school (Withaneachi and Meehan, 1998; Roseveare et al 1999). The study aiming to reduce rugby injuries focused on older children attending secondary school (Morton and Burton, 1979). The target group identified as being at risk in a study to prevent fireworks injuries was children aged 10–14 years, while a mushroom poisoning campaign (partly delivered through schools) aimed to reduce injuries in children aged 6–11 years. Finally, a study to prevent drowning by the promotion of life jackets focused on children aged 1–14 years.

Intervention design

Little information was given on how the intervention was designed to take account of the ages of children targeted. In some studies (eg those focusing on school playground injuries) the target age group was relatively narrow and the interventions involved environmental modifications to reduce the exposure of primary school-age children to hazards. Exposure to play equipment and the ways children use it are likely to be age-related.

In the study aiming to reduce mushroom poisoning the materials were specifically designed for children aged 6–11 years.

Key results

Several of these studies provided information on results relating to different age groups. A study to prevent mushroom poisoning reported that children's ages and where they lived had an impact on their knowledge scores (Malinowska-Cieslik and van der Borne, 1998). The greatest increases in knowledge were observed in younger children (6–7 years) living in villages and towns and in older children

(10–11 years) living in cities. The study of fireworks injuries in Italy reported reductions in injury rates for all age groups, but the decline in injuries was most dramatic in the younger children (aged 10–12 years) targeted by this campaign (D'Argenio et al 1996). Similarly, Bennett et al (1999) reported more success with younger children in a campaign to promote the use of life vests. Here, while there was a general modest increase in the number of children reported using life vests, younger children were more likely than older children to use them.

Other studies did not provide a breakdown of results in relation to children's ages so it is not known whether the campaigns were more or less effective with different age groups.

Gender

Little information relating to the gender of participants was provided in these studies. In the study by Morton and Burton (1979), focusing on rugby injuries, the target group was exclusively boys attending secondary school. The study of fireworks injuries in Italy also drew attention to the relatively high risk to boys of sustaining fireworks injuries. Following this campaign, while the overall number of injuries was reported to have declined, the ratio of boys' to girls' injuries worsened. Before the campaign the male to female injury ratio was 9 : 1, following the campaign it was 15 : 1. This suggests that the campaign may have had more impact on girls. In contrast, the results of a campaign in Poland to reduce mushroom poisoning revealed that at post-test boys had greater awareness of the hazards associated with picking and eating wild mushrooms compared to girls (Malinowska-Cieslik and van der Borne, 1998).

Social and economic factors

There was little information on the social and economic background of participants in these studies. In one study aiming to reduce playground hazards, schools were selected to include different social groups. The sample of schools was stratified by size and the socio-economic status of the areas they served, and both control and intervention schools included schools serving relatively deprived as well as affluent areas. No other details were provided, and it was not clear whether the intervention was more or less successful in schools in more or less affluent areas.

None of the remaining studies provided information on the social background of participants, it was not clear whether any interventions had been designed to take account of the social background of participants, nor whether the campaigns were more or less effective with different groups of children.

Culture/ethnicity

Two of the studies were specifically designed to reflect the cultural practices in particular areas. In a study in Naples, Italy the focus was specifically on injuries occurring from fireworks during New Year celebrations (D'Argenio et al 1996). Here a range of community groups were involved, and in addition to educational activities, street cleaning was carried out to remove unexploded fireworks. This campaign was launched in response to a local injury problem. Similarly, the campaign in Poland (Malinowska-Cieslik and van der Borne, 1998) was launched to reflect the particular problem associated with poisoning due to the common practice of foraging for wild mushrooms. Again, a range of community organisations was involved and a variety of mechanisms used to promote safety messages, eg buses on routes to popular mushroom-picking areas displayed posters with safety messages. Both these campaigns responded to local injury surveillance and results were positive for the groups targeted.

The campaign to promote life jackets described by Bennett et al (1999) included information in both Spanish and English. No other studies provided information on the culture of participants or provided a breakdown of findings for different cultural groups.

Place

These studies were carried out in a range of different countries including Poland, Australia, the USA and New Zealand. The focus of campaigns reflected the different leisure activities and environments in different areas. Geographical factors are known to influence injury exposure. For example, the climate in some countries means that outdoor swimming is relatively unpopular, exposure is relatively low and the number of deaths correspondingly small. In other areas, outdoor swimming is a common leisure pursuit. Mushroom foraging is popular in woods, forests and pastures in some parts of Europe but is less likely in more built-up areas.

Only one of these studies compared the impact of the intervention in different places. The Polish study of mushroom poisoning (Malinowska-Cieslik and van der Borne, 1998) revealed that young children living in rural areas and small towns increased their knowledge more than those living in cities.

SUMMARY

- Seven studies focused on interventions to prevent injuries in the leisure environment. These included interventions

to reduce playground injuries, drowning, fireworks injuries and mushroom poisoning.

- **Age:** target age groups varied; interventions to reduce playground injuries targeted primary school-age children. Information on effectiveness in different age groups suggested that some interventions were most effective in younger rather than older children.
- **Gender:** little information was provided on the gender of study participants. A campaign on firework injuries may have been more effective with girls. In a study of mushroom poisoning, increases in knowledge were greater in boys.
- **Social and economic factors:** no information was provided on whether these interventions were more or less effective in children from different social groups.
- **Culture/ethnicity:** two studies described programmes designed to address local injury issues. No information was provided in any of the studies reviewed on whether interventions were equally effective with children from different cultural backgrounds.
- **Place:** studies were carried out in a range of countries. Three studies specifically addressed environmental hazards in playgrounds.

C7 Mass media and training interventions

INTRODUCTION

In this section we examine five studies using mass media or professional training to promote general safety. Three of these were carried out in the UK.

The interventions varied and included television safety campaigns (Williams and Sibert, 1983; Sundelin et al 1996), a children's safety centre (Gielen et al 1996), a school-based education programme (Frederick et al 2000), and training in injury prevention for healthcare professionals (Marsh and Kendrick, 1998). One study included the collection of injury outcome data (Williams and Sibert, 1983). In the remaining studies, information on knowledge and attitudes was used to evaluate the impact of programmes.

Overall, studies reported some increases in knowledge following interventions but the study involving the collection of injury data revealed no impact on injury rates.

INEQUALITIES ADDRESSED

Overall these studies provided little information on inequalities.

Age

The ages targeted by the studies varied. School-based studies targeted school-age children. Sundelin et al (1996) described a mass media campaign aimed at children under six years. The intervention aimed at healthcare professionals targeted those working with young children (under five years).

There was little information on how interventions had been designed to take account of children's ages. One exception was the description of the school-based programme described by Frederick et al (2000) aimed at 10–11 year old children. Here the programme was designed to form an integrated part of the school curriculum. Delivered by teachers using specially designed materials, the programme aimed to meet age-specific learning objectives. The intervention described by Gielen et al (1996) – a children's safety centre – was also designed to meet specific learning objectives. None of the studies described the impact of the programmes in different age groups.

Gender

None of these studies provided information on the gender of participants or whether programmes had a different impact on boys and girls.

Social and economic factors

Again little information was provided. As part of the intervention described by Gielen et al (1996), discount coupons for smoke alarms were offered to overcome economic barriers to their purchase.

The impact of a mass media intervention in different social groups was described by Sundelin et al (1996). Here it was reported that the programmes on safety were more likely to have been watched by two-parent rather than lone-parent families. However, parents' unemployment was positively and significantly associated with the number of programmes watched.

None of the other studies provided a breakdown of results in relation to different social groups.

Culture/ethnicity

None of these studies addressed cultural issues.

Place

In the study reported by Gielen et al (1996) there was an attempt to include schools from both urban and rural locations in the evaluation. However, results were not reported for different groups.

SUMMARY

- Five studies used mass media or training approaches to promote safety. These included TV campaigns and school-based programmes.
- **Age:** programmes were targeted at a range of age groups. No information was provided on the impact of interventions on children of different ages.
- **Gender:** none of these studies provided information on the gender of participants or on whether interventions had a different impact on boys and girls.
- **Social and economic factors:** little information was provided on the social background of participants, or on whether programmes were equally effective in different social groups.
- **Culture/ethnicity:** none of these studies addressed cultural issues.
- **Place:** one study included children from urban and rural schools, but results were not reported separately for children from different areas.

C8 Community-based interventions

INTRODUCTION

In this section we examine 10 studies that have evaluated the effectiveness of community-based injury programmes and that included elements related to child safety. Six of these programmes were inspired by the 'safe communities' model developed in Falköping, Sweden (Svanström et al 1995) and include the use of community diagnosis using a local surveillance system and a reference group to coordinate a range of injury-prevention approaches.

The community-based approach can combine both 'passive' environmental measures and 'active' behavioural solutions. The stimulation of a 'common culture of safety allows the adoption of complementary solutions which should allow a multiplier effect to be achieved.' (Moller, 1992b)

Three of the community-based programmes took place in Scandinavia, three in the USA, two in Australia, and one each in New Zealand and Greece. Important elements of community-based approaches are a long-term strategy, effectively focused leadership, multi-agency collaboration, tailoring to the needs of the local community, the use of local injury surveillance systems, and time to coordinate existing networks and develop new ones (Towner and Dowswell, 2002). Community-based approaches allow injury-prevention messages to be repeated in different forms and contexts.

The 10 studies all attempted to deliver a range of different interventions in a defined geographic locality. In the Safe Kids/Healthy Neighbourhoods Program, interventions included environmental measures (renovation of playground), the provision of safety equipment, violence and injury prevention education, and the involvement of young people in safe, supervised activities that taught them useful skills (Davidson et al 1994; Kuhn et al 1994). The Shire of Bulla Safe Living Program (Hennessey et al 1994) documented the implementation of 113 programme components comprising nine major objectives: traffic safety, children's safety, schools, sports safety, occupational safety, seniors' safety, farm safety, public places and community awareness.

None of the community-based studies reviewed included a randomised controlled design, one used several interventions and control communities, eight used one control community, and one study compared outcomes in targeted and non-targeted injuries in the same community.

INEQUALITIES ADDRESSED

Age

Injury target groups and settings

Six studies were targeted at all age groups, with specific components targeted at children. The Shire of Bulla Program in Australia had 62 of 113 programmes specifically related to children's safety, and a higher proportion of these were targeted at pre-school children (Hennessey et al 1994). The Greek island programme targeted two vulnerable age groups: young people and older adults (Petridou et al 1997). The remaining three programmes targeted children: the Lidköping Accident Prevention Programme (Svanström et al 1995) targeted children aged 0–14 years, the Safe Kids/Healthy Neighbourhoods Program (Davidson et al 1994) children aged 5–16 years, and the Statewide Childhood Injury Prevention Program children under five (Guyer et al 1989).

Intervention design

All the studies targeted specific components of their overall programme at children or their parents or carers, and the content of the different interventions reflected the predominant injury type affecting the age group in question.

The Statewide Childhood Injury Prevention Program in the USA, targeted at pre-school children, selected the main injury types affecting this group for which proven countermeasures were available, and thus developed programmes aimed at the prevention of burns, poisoning, falls, suffocation and passenger road traffic accidents (Guyer et al 1989). The

Safe Block Project included specific interventions for pre-school children such as syrup of ipecac (for poisoning) and medication with childproof caps (Schwarz et al 1993). The Safe Kids/Healthy Neighbourhoods Program (Davidson et al 1994) concentrated on interventions to reduce outdoor injuries and assaults in children aged 5–10 years, and the Harstad WHO Safe Community Programme had a burn-prevention programme targeted at pre-school children (Ytterstad and Sogaard, 1995).

Key results

The Harstad programme reported that certain interventions were more effective in specific age groups, eg in children under 10 years the greatest reductions were seen in traffic injury rate, pedestrian injury rate and increased use of cycle helmets. The Latrobe Valley Better Health Project in Australia (Day et al 1997) found that playground injuries declined in 0–5 year olds, and that sports injuries attending emergency rooms increased for 0–14 year olds.

The Waitakere Community Injury Prevention Project aimed to cover all age groups, but in practice focused on children. Coggan et al (2000) concluded that 'community-based injury prevention projects should consider fewer, more targeted interventions'.

Gender

All the studies reviewed targeted both genders, but none reported that interventions had been specifically designed to take account of the differences between boys and girls.

The Harstad WHO Safe Community Programme (Ytterstad and Sogaard, 1995) reported that reduction in injury rates among cyclists was greater for boys (43%) than girls (23%). The Lidköping Accident Prevention Programme (Svanström et al 1995) also reported a greater decrease in hospitalised injuries in boys compared to girls, but it was unclear whether the rates were restricted to target injuries.

Social and economic groups

Community-based injury-prevention programmes have the potential to be particularly effective in more deprived communities through their ability to strengthen neighbourhoods. Both top-down and bottom-up approaches can be used in such programmes. Bottom-up approaches involve the target population in defining the problem and finding solutions. Moller (1992b) believes that:

'the aim is not only to produce effective solutions to a single problem but to develop skills and commitment to generalising what is learnt to other problems.'

He also suggests that bottom-up approaches are valuable in dealing with diffuse problems in environments where regulation and enforcement are difficult to achieve.

Injury target groups and settings

Two studies, both conducted in the USA, focused specifically on disadvantaged communities. The Safe Block Project (Schwarz et al 1993) was based in a poor African-American inner-city community in Philadelphia, and the Safe Kids/Healthy Neighbourhoods Program (Davidson et al 1994) in an inner-city black community in Harlem. In the latter nearly 40% of residents were below the poverty level compared with 19% in the city as a whole (Davidson et al 1994).

Intervention design

The interventions in the two disadvantaged communities described above specifically attempted to increase access to safety equipment by providing free or reduced-cost items. For example the Safe Block Project provided smoke detectors, batteries for smoke detectors, bathwater thermostats and syrup of ipecac (for poisonings), and the Safe Kids/Healthy Neighbourhoods Program provided more than 500 bicycle helmets to reduce the barriers of cost and access to safety equipment.

Key results

In the Safe Block Project (Schwarz et al 1993) the intervention was partially effective for home hazards requiring minimal to moderate effort to correct, but there were fewer differences for home hazards that required a major effort to correct.

Culture/ethnicity

The central ethos of the community-based model is that those most able to solve community problems are people who live in that particular community (Coggan et al 2000). Such an approach also provides an opportunity to change the whole culture of safety in a community.

Injury target groups and settings

The two studies targeting disadvantaged communities described above also related to communities with a high proportion of minority ethnic groups. The Safe Block Project (Schwarz et al 1993) was conducted in a predominantly African-American community. The Safe Kids/Healthy Neighbourhoods Program (Davidson et al 1994) included a predominantly black community as its intervention community and a predominantly Hispanic community as a control. The design of this study meant that it was not possible to determine differences between ethnic groups in the two communities. The Waitakere Community Injury Prevention Project (Coggan et al 2000) was based in a

multi-cultural community where Pakeha/European people represented 67% of the population, Maori people 14%, and Pacific people 11%. In the Australian Shire of Bulla study (Hennessey et al 1994) 77% of residents in the community were born in Australia.

Intervention design

The Waitakere Community Injury Prevention Project in New Zealand (Coggan et al 2000) included different programmes targeting different indigenous or ethnic groups. After community consultation seven priority areas were identified, two of which related to Maori and Pacific people, and working parties were formed to identify priorities for each group. A Maori coordinator was employed who was experienced in the culture and perspectives of the target group. Injury prevention was incorporated into a holistic view of health.

The Safe Block Project (Schwarz et al 1993) used a network of community volunteers to conduct the intervention, and used cascade training to disseminate the messages widely. The Greek islands community injury prevention project (Petridou et al 1997) also used local women to perform weekly home visits and to advise on safety.

Many of the other projects actively involved the target groups in a range of activities (Schelp, 1987; Davidson et al 1994).

Key results

The Safe Block Project showed that the approach of many community representatives was acceptable to the community, and community representatives were recruited for 88% of blocks. The case study of the Waitakere Community Injury Prevention Project showed that the approach adopted was acceptable to community members and a considerable range of projects was stimulated.

Place

Injury target groups and settings

Moller (1992a) defines community injury prevention as:

'any project which seeks to work with a community, whether it is defined by geography or common interest, to identify injury problems and seek to find ways of addressing these problems using means which are generalised or at least agreed to, by the community.'

The notion of identification with a community or sharing a feeling of commonality is an important factor (Moller, 1992b). All of the 10 studies reviewed took place in specific communities, and in most one intervention and one control group were selected.

In the one study with multiple intervention and control communities, the Statewide Childhood Injury Prevention Program in Massachusetts (Guyer et al 1989), nine cities were selected from a potential 351 cities and towns and matched for a number of relevant variables with five control cities. However, the nature of the different intervention and control communities was not elaborated on. In the Shire of Bulla study (Hennessey et al 1994) a control community, the Shire of Melton, was selected. This was a geographically separate community served by different newspapers, with little crossing of municipal boundaries for school, work, shopping etc. The Swedish programme in Falköping (Schelp, 1987) had one control community, Lidköping, an area of similar size and socio-demographic mix to Falköping.

The existence of similar data collection systems in other areas may govern the selection of control communities. In these cases controls may be very different from intervention areas. The Norwegian Harstad Programme (Ytterstad and Sogaard, 1995) was conducted in a small town of 20,000 people north of the Arctic Circle, while the control community of Trondheim was much larger and 1,000 kilometres away.

SUMMARY

Ten studies focused on community-based injury-prevention programmes. These combined a range of passive environmental measures and active behavioural solutions. A coordinating group brought together a range of agendas. This approach can allow messages to be repeated in different forms and contexts.

- **Age:** six studies were targeted at all age groups, with special programmes directed at children. One programme targeted two vulnerable age groups and three were directed at children. Two programmes provided some evidence that they had been effective with specific age groups.
- **Gender:** all 10 programmes targeted both genders, but none reported different tailoring of content for boys and girls. Two studies reported greater improvements for boys compared with girls.
- **Social and economic factors:** two studies focused particularly on disadvantaged neighbourhoods. Free or reduced-cost safety equipment was provided.
- **Culture/ethnicity:** three studies targeted communities with high priorities for ethnic/indigenous groups. One project based in a multi-cultural community included a separate intervention designed with the Maori community in mind and with a Maori coordinator.

- **Place:** all 10 studies took place in specific communities. Intervention and control communities are often demographically matched, but the nature of the community is rarely given much attention.

C9 Key points from all the intervention studies

- Few intervention studies explicitly address inequalities; even fewer attempt to take account of inequalities in the design of the intervention and report on any differential impact in relation to them.
- **Age:** many interventions target specific age groups of children, but there are few examples of results comparing the impact of an intervention on different age groups.
- **Gender:** despite the great differences in injury rates in boys and girls, few interventions have targeted this factor.
- **Social and economic factors:** interventions have increasingly been targeted at deprived individuals or groups. The main strategy adopted in interventions is the provision of safety equipment.
- **Culture/ethnicity:** cultural differences are rarely addressed. A few interventions have involved the target group in the design of the intervention. Few studies compare interventions in different ethnic groups.
- **Place:** when communities have been matched in controlled interventions, broad demographic variables have been used and little attention paid to the context.

D: Discussion and recommendations

D1 Discussion

The key points are drawn together at the end of each section A–C. Below we discuss how definitions need to be improved, and how observational and intervention studies could be improved to address inequalities. Finally, we consider the role of targeted and universal approaches to injury prevention.

Improving definitions

A recurring theme of this review relates to the lack of consistency of definitions, both in how injuries are defined, and in the definition of other terms. The way injuries themselves are defined may reflect health service utilisation rather than a particular severity level of an injury. A child's age may influence whether or not parents seek medical attention for injury, and also the medical management of that injury. Thus a pre-school child with a mild head injury may be admitted to hospital for observation, while an older child may not. Similarly, a child from a disadvantaged background may be admitted to hospital, while a child with a similar injury from a more affluent background may not. Clear definitions of injury are fundamental to understanding inequalities between groups. The report to the Accidental Injury Task Force, *Measuring and monitoring injury* (Department of Health, 2002b), recommends that a minimum data set should be established to include both the accident and personal characteristics of each person injured. We support this recommendation for clearer definitions so that agencies collecting data relevant to unintentional injury can adopt a more coordinated approach.

This report also comments on the problems of defining terms such as 'ethnic group' and 'homelessness'. Even in one country, these definitions can vary over time. When comparing studies from the international literature it may be even more difficult to obtain comparable definitions. In section B on the causes of injury and section C on

intervention studies, there is little consensus about what social deprivation means. Definitions of social deprivation can be based on the characteristics of geographic areas such as inner-city wards; on the characteristics of individuals themselves or the places where they live, such as 'low-income' families or those living in multi-occupancy housing; or on the characteristics of schools, childcare centres or medical settings serving more deprived communities (Dowswell and Towner, 2002).

More attention needs to be paid to definitions and how they affect study findings. Greater consistency in definition across studies, particularly in the international literature, may help us to understand why a programme works in specific circumstances or localities and not in others, and how transportable it is to other settings.

Observational studies related to inequalities in childhood injury

This report examines a range of factors that may influence injury risk. For some factors – age, gender and socio-economic group – the patterns have been well described at a variety of geographic scales. For other factors – ethnic groups, vulnerable groups such as children from homeless families, disabled children – it is difficult to obtain a national picture in the UK and evidence can be obtained only from small-scale studies. Few studies have examined broader cultural variations. For all factors, the reasons why the differences occur are even less clear.

Age

Children of different ages and stages of development have different patterns of injury types and severities. Thomson et al (1996) reviewed the role of child development in relation to pedestrian injuries, but a similar detailed review has not been conducted for other injury types.

Gender

Boys and girls have distinct patterns of injury, with boys generally having much higher rates of injury. A detailed review drawing on other areas of health promotion in relation to gender differences needs to be conducted.

Social and economic factors

Increasing attention is being paid to why children from different social and economic groups have very different rates of injury, but the complex causal pathways are being unravelled only slowly. Many indices of social and economic deprivation correlate with accidents because they increase exposure, decrease supervision and undermine children's ability to deal with hazards.

The evidence related to causal mechanisms is patchy and unbalanced, with more studies being conducted on the individual characteristics of children and parents, and fewer on social and environmental influences. Broader studies are needed in this area, such as the case-control study of child pedestrian injuries conducted by Christie (1995a,b) dissecting both behavioural and structural components.

From these broader studies it would be possible to examine whether factors such as family income, maternal education and overcrowding independently predict risk. Further application of multivariate analyses which have been conducted in some studies could also help in identifying dimensions of socio-economic position which had particularly powerful effects on injury risk.

Culture/ethnicity

In relation to minority ethnic groups, the reasons why children from these groups suffer a disproportionately higher injury rate than majority culture peers has often been explained in terms of socio-economic differences. Thomson et al (2001) examined the involvement of children from minority ethnic groups in road accidents, and hypothesise that other factors may come into play that cause additional risk for children from these groups. These issues need to be explored more fully in relation both to the road environment and other settings in which children are exposed to hazards. For such studies to provide meaningful results they need to recognise that factors that make up ethnicity, such as language, religion, ancestry and forms of identity, are constantly changing and that it may not be possible to draw a distinct boundary around categories such as 'Indian' or 'Asian'.

Place

The idea of 'place' adopted by most epidemiological studies of injury is that of place as a portion of geographical space. Patterns of injury can be identified that relate to factors such as the distribution of more affluent or more deprived wards or enumeration districts. Fewer studies have incorporated the physical or environmental attributes of places (eg different layouts of roads or housing types). The identification and mapping of specific hazards in the environment could be conducted by members of the local community and by professionals, eg checklists of a child's journey to school or of playgrounds. The third idea of place, as an area to which people attach certain meanings or actions, has been little explored in the field of analytical injury epidemiology research. Section C8, on community-based injury-prevention programmes, shows that place has a potential role to play in understanding the differences between different communities.

What emerges in section B of this review is that the causes of injury are multi-faceted and inter-related. Factors such as age, gender, social and economic groups, cultural and ethnic groups and place do not in themselves cause injury. Instead they are closely associated with more direct factors that include children's exposure to hazards, parents/carers' and communities' ability to protect children, and children's capacity to manage and avoid hazards.

The lack of clarity in the examination of causal pathways has had an impact on the development and evaluation of interventions in the field of childhood injury prevention.

Developing effective interventions to address inequalities in childhood injury

How is it possible to develop injury interventions when the causes of injury are multi-factoral and inter-related? Graham (1999) asserts that 'multiple causes point to the need for wide ranging policy solutions'. In section B2 we discussed three tiers of factors: the proximate, intermediate and ultimate tiers that underlie injury. The *Independent inquiry into inequalities in health* (Acheson, 1998), discussing the ultimate tier of social, political, cultural and economic factors, argues that the more a potential intervention relates to the wider determinants of inequalities in health, the less possibility there is of using the methodologies of a controlled trial to evaluate it. This is equally true in the field of injury prevention, and the intervention studies discussed in section C relate to the proximate and intermediate tiers, not the ultimate tier. The latter has been little addressed in injury

prevention through controlled experiments. Whitehead et al (2000) emphasise that macro-level policies cannot normally be subjected to controlled experiments and that tools and methodologies to do so are underdeveloped. They suggest some pragmatic solutions to this problem, including studying a cross-section of localities in which different levels of policy on a specific issue are in operation; studying changes over time in one country where different levels of policy on a specific issue are in operation; and studying the period before and after the introduction of a new policy in several countries.

In section C it is clear that few intervention studies systematically set out the problem in relation to age or social and economic group or design the intervention with this factor in mind, then report whether there has been a differential impact in relation to that factor. Instead what emerges is a patchwork of examples – the threads are not woven throughout the studies.

Many evaluated studies do not provide a full description of participants to allow us to interpret results in relation to different subgroups (children of different ages or social groups). Information on programme reach is also limited – are all groups exposed to interventions in a similar way? Such process information is essential in helping us to understand what elements of an intervention are successful, and how positive results in one particular area could be transferred to other settings. Pawson and Myhill (2001) believe that instead of simply asking what works in injury prevention, we should pose the question ‘What works for whom, in what circumstances, and in what particular respects?’. It is thus essential that more attention is paid to the context of where and how an intervention takes place.

In this review there are few examples of the relative effectiveness of injury interventions on different subgroups of the population. Moller (1997) reminds us that ‘Marketing strategies are aware that products need to be designed to appeal to different target groups’.

In section C, when considering whether interventions have been designed with, for example, social and economic factors in mind, relatively few strategies emerge. The main emphasis is on the use of low-cost or free items of safety equipment, but even in this case, what is the most effective approach? Free items of safety equipment may not be valued by recipients, and a small charge may be more effective (Kim et al 1997).

Involving different target groups in the development of an intervention has been under-utilised in the injury field. Programmes may be piloted with the target audience, but

more actively involving children and their parents in the design of interventions and their evaluation needs to be greatly encouraged. Roberts (2000), in her review of *What works in reducing inequalities in child health*, believes that ‘parents and children living in particular environments are experts in identifying local risks’ and that effective injury prevention needs to draw more on ‘the specialist local knowledge of children and parents’. The role of qualitative studies in contributing to the evidence base in this area is important. This report does not systematically review the contribution that qualitative studies could make in the field of inequalities and injury, but a number of examples are quoted. Qualitative research studies could help illuminate some of the mechanisms whereby age, gender, social and economic position, culture/ethnicity and place influence risk. The experiences of parents and children are also fundamental in designing and implementing interventions to reduce risk. Such perspectives would provide valuable insights into why potentially useful interventions work or do not work in specific contexts.

Targeted and universal approaches to injury prevention

Finally, in a review of inequalities in childhood injury prevention we must consider whether injury prevention should be targeted at high-risk groups, or whether it should focus on the wider population.

There has been considerable debate about universal (population-based) versus targeted or high-risk approaches in relation to health and welfare, but little in the injury field until recently. The journal *Injury Prevention* (Volume 3, Issue 3, 1997) contains three articles and an editorial comment on this subject. Roberts (2000), in her review of inequalities in child health, also discusses the different approaches. Kendrick and Marsh (1997), in a study on general practice in the UK, suggest that injury prevention targeted at higher-risk groups is not worthwhile and that a universal approach is preferable. Roberts (2000) agrees, arguing that universal approaches are non-stigmatising and affect a great number. Moller, on the other hand, disagrees, asserting:

‘A universal approach to injury prevention will only exacerbate the problem of the disadvantaged. Targeted programs are necessary to ensure that those health differences between the rich and poor do not increase.’ (Moller, 1997)

This debate has mainly been conducted in relation to social and economic factors, but it is equally relevant to the other inequalities considered in this review.

Pless (1997), in his editorial comment in *Injury Prevention*, suggests that both population and high-risk approaches could co-exist, citing the example of:

'A nationwide campaign to reduce speeds, which if successful would benefit everyone, alongside more rigorous enforcement of reduced speed limits in poor areas.'

We agree with Pless's dual approach, and in this review we highlight ways in which inequalities can be better described and understood, and how interventions could more effectively address inequalities in childhood injuries.

D2 Recommendations for practitioners, researchers and policy makers

Practitioners

What can practitioners glean from this review? How is it possible for practitioners to address the issues of inequalities in their injury-prevention work?

The following suggestions are drawn from examples of good practice in the intervention studies reviewed in this report. No one study, however, combines all these elements. Other potential themes that should be considered for good practice have not been rigorously tested and are summarised in the recommendations for research.

Age

How can programmes be designed specifically to target the issue of a child's age and stage of development?

- Educational materials need to be age-specific, developed and piloted for particular ages of children
- Age-paced educational materials can be developed that are related to different stages of development and distributed at appropriate intervals (eg children's traffic club materials distributed every six months)
- Attitudes and concerns of children and young people of a particular age need to be addressed (eg peer pressure and social acceptability of bicycle helmets)
- Home visits as a routine part of child surveillance can be used for tailored safety advice.

Gender

How can programmes be designed specifically to target the issue of gender?

- Attitudes and concerns of boys and girls need to be addressed (eg boys and girls have different attitudes towards wearing bicycle helmets)

(Few interventions have targeted gender issues.)

Social and economic factors

How can programmes be designed specifically to target the issues related to social and economic groups?

- Free or low-cost safety equipment needs to be provided
- Equipment needs to be installed by professionals
- Specific advice focused on the needs of target groups is required
- Materials should be easy to read, taking literacy levels into account
- There should be less reliance on written media
- No-cost or low-cost interventions are more likely to be implemented
- Free crèche facilities, provision of transport etc should be considered for families attending training
- Home visits can be utilised to provide support and advice
- Lay workers from the same community as the target group can be recruited and trained
- Specific groups and injuries need to be targeted (eg window guards provided for tenants of high-rise flats to prevent window-fall injuries)
- Some programmes need to be modified for specific groups (eg equipment loan schemes with free equipment for those receiving state benefits).

Culture/ethnicity

How can programmes be designed specifically to target the issues relating to culture/ethnicity?

- Materials can be produced in different languages, or translators made available
- Programme coordinators can be drawn from the same ethnic group as the target promotion
- Community volunteers can be trained
- Community, church or political leaders need to be involved in the development of programmes
- Target groups should be involved in designing interventions
- Programmes need to be delivered sensitively by trained investigators
- Programmes may need to emphasise different cultural values (eg a holistic view of health)
- Specific injuries affecting members of a particular ethnic group need to be targeted.

(Few interventions have addressed variations in majority cultures.)

Place

How can programmes be designed specifically to target the issues related to place?

- Programmes need to draw on local data when available
- Context of the intervention area needs to be addressed as fully as possible (eg physical characteristics of area, housing type, road layout, social and economic, cultural and ethnic composition).

(Few interventions have specifically addressed variations related to place.)

Researchers

- National injury data systems do not routinely provide information on ethnic groups or vulnerable groups such as children in homeless families or disabled children. Research is required to obtain a clear picture of the scale of injuries in these groups.
- There are considerable gaps in research relating to the causal mechanisms of injury. For some factors, such as gender, ethnicity and culture, little substantial research has been conducted. These gaps in research need to be addressed.
- The ideas and methodologies being explored in the wider ESRC Health Variations Programme are only now starting to enter the field of injury research. The field has until recently been dominated by engineering and medical approaches, with little input from behavioural and social sciences. National, regional and local spatial variations in injury patterns tend to be descriptive, rather than a starting point for understanding injury variations. A broader view of place needs to be explored in relation to injury, eg the physical and environmental attributes of places, and the idea of place to which people attach certain meanings or actions. The issue of majority cultures, how they vary in and between countries and how they relate to injury, has rarely been addressed. The concept of social capital needs to be explored in relation to childhood injury, particularly in relation to its contribution to understanding the context in which an intervention takes place. Qualitative studies have an important role to play, in addition to quantitative studies.
- Programmes designed specifically to target the issues related to inequalities need to be evaluated within the UK context. There should be an emphasis on understanding the process of how an intervention develops, and the programme's effect on specific subgroups (eg boys/girls, older or younger children) needs to be incorporated into programme evaluation.

- Programmes in which there is greater emphasis on involvement of the target group need to be evaluated.

Policy makers

- Injury-prevention initiatives have rarely addressed inequalities (age, gender, social and economic factors, culture and ethnicity, place) in a systematic manner. These factors merit greater attention.
- Some groups of children and young people are in positions of extreme vulnerability and exposed to much higher levels of injury risk where risk factors are additive and cumulative over time. More information is needed on these groups as specific interventions may be required to address their needs.
- This review highlights the fact that few policy-level interventions have been explored. This important gap in the evidence needs to be addressed by innovative initiatives and research.

References

- Acheson, D. (1998). *Report of the independent inquiry into inequalities in health*. London: The Stationery Office.
- Agran, P.F., Winn, D.G. and Anderson, C.L. (1994). Differences in child pedestrian injury events by location. *Pediatrics* 93 (2): 284-8.
- Alwash, R. and McCarthy, M. (1988). Accidents in the home among children under 5: ethnic differences or social disadvantage? *British Medical Journal* 296: 1450-3.
- Ampofo-Boateng, K. and Thompson, J.A. (1991). Children's perception of safety and danger on the road. *British Journal of Developmental Psychology* 82: 487-505.
- Arblaster, L., Entwistle, V., Lambert, M., Forster, M., et al. (1995). *Review of the research on the effectiveness of health service interventions to reduce variations*. CRD Report 3. York: NHS Centre for Reviews & Dissemination, University of York.
- Avery, J.G., Vaudin, J.N., Fletcher, J.L. and Watson, J.M. (1990). Geographical and social variations in mortality due to childhood accidents in England and Wales 1975-84. *Public Health* 104: 171-82.
- Balarajan, R. (1995). Ethnicity and variations in the nation's health. *Health Trends* 27: 114-9.
- Barry, A., Carr-Hill, R. and Glanville, I. (1991). *Homelessness and health: What do we know? What should be done?* York: University of York.
- Berger, L. and Mohan, D. (1996). *Injury control: a global view*. Delhi: World Health Organization.
- Bijur, P., Stewart-Brown, S. and Butler, N. (1986). Child behavior and accidental injury in 11,966 preschool children. *American Journal of Diseases of Children* 140: 487-92.
- Bijur, P., Golding, J. and Haslum, M. (1988a). Persistence of occurrence of injury: can injuries of preschool children predict injuries of school-aged children? *Pediatrics* 82: 707-12.
- Bijur, P., Golding, J., Haslum, M. and Kurzon, M. (1988b). Behavioural predictors of injury in school-age children. *American Journal of Diseases of Children* 142: 1307-12.
- Bone, M. and Meltzer, H. (1986). *The prevalence of disability among children*. London: Office of Population Censuses and Surveys.
- Botting, B. and Crawley, R. (1995). Trends and patterns in childhood mortality and morbidity. In: Botting, B. (ed.) *The health of our children: a review in the mid-1990s*. Decennial supplement OPCS DS No. 11, 62-81. London: Office of Population Censuses and Surveys.
- Campbell, H. and O'Driscoll, S. (1995). The epidemiology of leisure accidents in Scotland. *Health Bulletin* 53 (5): 280-3.
- Christie, N. (1995a). *The high risk child pedestrian: socio-economic and environmental factors in their accidents*. Project Report 117. Crowthorne, Berkshire: Transport Research Laboratory.
- Christie, N. (1995b). *Social, economic and environmental factors in child pedestrian accidents: a research review*. Project Report 116. Crowthorne, Berkshire: Transport Research Laboratory.
- Curtis, S. and Rees-Jones, I. (1998). Is there a place for geography in the analysis of health inequality? *Sociology of Health and Illness* 20 (5): 645-72.
- Cushman, R., Down, J., MacMillan, N. and Waclawik, H. (1991). Helmet promotion in the emergency room following a bicycle injury: a randomized trial. *Pediatrics* 88 (1): 43-7.

- Department of Health, D. (2002a). *Preventing accidental injury – priorities for action*. Report to the Chief Medical Officer from the Accidental Injury Task Force. www.doh.gov.uk/accidents. London: Department of Health.
- Department of Health. (2002b). *Measuring and monitoring injury*. Report to the Accidental Injury Task Force from the Measuring and Monitoring Injury Working Group. www.doh.gov.uk/accidents. London: Department of Health.
- DiGuseppi, C., Roberts, I., Li, L. and Allen, D. (1998). Determinants of car travel on daily journeys to school: cross sectional survey of primary school children. *British Medical Journal* 316: 1426-8.
- Dowswell, T. and Towner, E. (2002). Social deprivation and the prevention of unintentional injury in childhood: a systematic review. *Health Education Research* 17 (2): 221-37.
- DTLR (2002). *Road safety research. Compendium of research projects 2001/2001*. London: Department for Transport, Local Government and the Regions.
- Gallagher, S., Finison, K., Guyer, B. and Goodenough, S. (1984). The incidence of injuries among 87,000 Massachusetts children and adolescents: results of the 1980–81 Statewide Childhood Injury Prevention Program Surveillance System. *American Journal of Public Health* 74 (12): 1340-7.
- Gesler, W. and Kearns, R. (2002). *Culture/place/health. Critical geographies*. London: Routledge.
- Godkin, M. (1980). Identity and place: clinical applications based on notions of rootedness and uprootedness. In: Buttner, A. and Seamon, D. (eds) *The human experience of space and place*. London: Croom Helm.
- Gordon, D. and Heslop, P. (1999). Poverty and disabled children. In: Dorling, D. and Simpson, S. (eds) *Statistics in society. The arithmetic of politics*. London: Arnold.
- Gorman, D., Ramsay, L., Wilson, G. and Freeland, P. (1999). Using routine accident and emergency department data to describe local injury epidemiology. *Public Health* 113: 285-9.
- Graham, H. (1999). Inquiry into inequalities in health. *Health Variations* 3: 2-4.
- Grossman, D. and Rivara, F. (1992). Injury control in childhood. *Pediatric Clinics of North America* 39 (3): 471-85.
- Grundy, S., Towner, E., Sparks, G., Hughes, K., et al. (2002). *Taking chances: the lifestyles, leisure worlds and leisure risks of young people*. Report prepared for the National Lotteries Charity Board. London: Child Accident Prevention Trust.
- Hapgood, R., Kendrick, D. and Marsh, P. (2000). How well do sociodemographic characteristics explain variation in childhood safety practices? *Journal of Public Health Medicine* 113: 285-9.
- Hawe, P. and Shiell, A. (2000). Social capital and health promotion: a review. *Social Science and Medicine* 51: 871-85.
- Hillman, M., Adams, J. and Whitelegg, J. (1990). *One false move: a study of children's independent mobility*. London: Policy Studies Institute.
- Jarvis, S., Towner, E. and Walsh, S. (1995). Accidents. In: Botting, B. (ed.) *The health of our children: a review in the mid 1990s*. Decennial Supplement OPCS DS No. 11, 95-112. London: HMSO.
- Judge, K. and Benzeval, M. (1993). Health inequalities: new concerns about the children of single mothers. *British Medical Journal* 306: 677-80.
- Kemp, A. and Sibert, J. (1992). Drowning and near drowning in children in the United Kingdom: lessons for prevention. *British Medical Journal* 304: 1143-6.
- Kendrick, D. (1993). Accidental injury attendances as predictors of future admission. *Journal of Public Health Medicine* 15 (2): 171-4.
- Kendrick, D. and Marsh, P. (1997). Injury prevention programmes in primary care: a high risk group or a whole population approach? *Injury Prevention* 3: 170-5.
- Kendrick, D. and Marsh, P. (1998). Babywalkers: prevalence of use and relationship with other safety practices. *Injury Prevention* 4: 295-8.
- Kendrick, D. and Marsh, P. (2000). Inequalities in receipt of injury prevention in primary care. *Health Education Journal* 59: 150-6.
- Kendrick, D. and Marsh, P. (2001). How useful are socio-demographic characteristics in identifying children at risk of unintentional injury? *Public Health* 115: 103-7.
- Kendrick, D., West, J., Wright, S. and Presbury, M. (1995). Does routine child health surveillance reach children most at risk of accidental injury? *Journal of Public Health Medicine* 17 (1): 39-45.

- King, D., Lawson, S., Proctor, S., et al. (1987). Child pedestrian accidents in inner city areas: patterns and treatment. In: *Proceedings of the PTRC Summer Annual Meeting*, University of Bath, 7–11 September 1987. Crowthorne, Berkshire: Transport Research Laboratory.
- Klein, D. (1980). Societal influences on childhood accidents. *Accident Analysis and Prevention* 12: 275-81.
- Laing, G. and Logan, S. (1999). Patterns of unintentional injury in childhood and their relation to socio-economic factors. *Public Health* 113: 291-4.
- Lawson, S.D. and Edwards, P.J. (1991). The involvement of ethnic minorities in road accidents: data from three studies of young pedestrian casualties. *Traffic Engineering and Control* (Jan): 12-19.
- Lissauer, T., Richman, S., Tempia, M., Jenkins, S., et al. (1993). Influence of homelessness on acute admissions to hospital. *Archives of Disease in Childhood* 69: 423-8.
- Lynam, D. and Harland, D. (1992). *Child pedestrian safety in the UK. Proceedings of the Conference 'Road Safety in Europe'*, Berlin, Germany, 30 September–2 October 1992. VTI Report No. 380A. Linköping, Sweden: Swedish Road and Transport Research Institute (VTI).
- Macintyre, S., Maciver, S. and Soomans, A. (1993). Area, class and health: should we be focusing on places or people? *Journal of Social Policy* 22 (2): 213-34.
- Matthews, H. (1995). Culture, environmental experience and environmental awareness: making sense of young Kenyan children's views of place. *Geographical Journal* 161: 285-95.
- Millard, A. (1994). A causal model of high rates of child mortality. *Social Science and Medicine* 38 (2): 253-68.
- Moller, J. (1992a). Major issues and debates in injury control. In: *Community based injury prevention. A practical guide*, 9-15. South Australia: National Safety Council of Australia.
- Moller, J. (1992b). *Community based injury prevention. A practical guide*. South Australia: National Safety Council of Australia.
- Moller, J. (1997). Population strategies for prevention? If only it were that simple! *Injury Prevention* 3: 162-4.
- Morrison, A., Stone, D., Redpath, A., Campbell, H., et al. (1999). Trend analysis of socioeconomic differentials in deaths from injury in childhood in Scotland, 1981-95. *British Medical Journal* 318: 567-8.
- Morrow, V. (2002). Children's experiences of 'community': implications of social capital discourses. In: Swann, C. and Morgan, A. (eds) *Social capital for health*. London: Health Development Agency.
- Mott, A., Evans, R., Rolfe, K., Potter, D., et al. (1994). Patterns of injuries to children on public playgrounds. *Archives of Disease in Childhood* 71 (4): 328-30.
- Ohn, T., Gilmour, W. and Stone, D. (1995). Pattern and risks of accidental injuries in children presenting to a paediatric accident and emergency department. *Maternal and Child Health Journal* (Dec): 404-7.
- OPCS (1988). *Occupational mortality: childhood supplement. Registrar General's decennial supplement for England and Wales, 1979-80, 1982-83*. London: Office of Population Censuses and Surveys.
- Pawson, R. and Myhill, A. (2001). *Learning lessons: enhancing evaluation through research review*. Crowthorne, Berkshire: Transport Research Laboratory.
- Phillimore, P. and Morris, D. (1991). Discrepant legacies: premature mortality in two industrial towns. *Social Science and Medicine* 33 (2): 139-52.
- Pless, I. (1997). Difficult choices. Editorial. *Injury Prevention* 3: 153-4.
- Pless, I., Peckham, C. and Power, C. (1989). Predicting traffic injuries in childhood: a cohort analysis. *Journal of Pediatrics* 115: 932-8.
- Preston, B. (1972). Statistical analysis of child pedestrian accidents in Manchester and Salford. *Accident Analysis and Prevention* 4: 323-32.
- Purdon, S. (1997). Non fatal accidents. In: Prescott-Clarke, P. and Primatesta, P. (eds) *The Health Survey for England 1995*, Vol 1: Findings. London: The Stationery Office.
- Raleigh, V. and Balarajan, R. (1995). The health of infants and children among ethnic minorities. In: Botting, B. (ed.) *The health of our children: a review in the mid-1990s*. Decennial Supplement OPCS DS No. 11. London: Office of Population Censuses and Surveys.
- Richman, S., Roderick, P., Victor, C. and Lissauer, T. (1991). Use of acute hospital services by homeless children. *Public Health* 105 (4): 297-302.
- Roberts, H. (2000). *What works in reducing inequalities in child health*. Ilford, Essex: Barnardo's.

- Roberts, H., Smith, S. and Bryce, C. (1995). *Children at risk? Safety as a social value*. Buckingham: Open University Press.
- Roberts, I. (1997). Cause specific social class mortality differentials for child injury and poisoning in England and Wales. *Journal of Epidemiology and Community Health* 51: 334-5.
- Roberts, I. and Power, C. (1996). Does the decline in child injury mortality vary by social class? A comparison of class specific mortality in 1981 and 1991. *British Medical Journal* 313: 784-6.
- Sandels, S. (1975). *Children in traffic*. Revised. London: Elek Books.
- Scott, A., Pearce, D. and Goldblatt, P. (2001). The sizes and characteristics of the minority ethnic populations of Great Britain – latest estimates. *Population Trends* 105: 6-15.
- Scottish Development Department (1989). *Must do better: a study of child pedestrian accidents and road crossing behaviour in Scotland*. Consultants' report to Scottish Development Department. London: MVA Consultancy.
- Secretary of State for Health (1999). *Saving lives: our healthier nation*. London: The Stationery Office.
- Sellar, C., Ferguson, J. and Goldacre, M. (1991). Occurrence and repetition of hospital admissions for accidents in preschool children. *British Medical Journal* 302: 16-19.
- Sharples, P., Storey, A., Aynsley-Green, A. and Eyre, J. (1990). Causes of fatal childhood accidents involving head injury in Northern region, 1979–86. *British Medical Journal* 301: 1193-7.
- Shaw, K., McCormick, M., Kustra, S., Ruddy, R., et al. (1988). Correlates of reported smoke detector usage in an inner-city population: participants in a smoke detector give-away program. *American Journal of Public Health* 78 (6): 650-3.
- Shelter (2002). *Growing up homeless*. London: Shelter.
- Sparks, G., Craven, M.A. and Worth, C. (1994). Understanding differences between high and low childhood accident rate areas: the importance of qualitative data. *Journal of Public Health Medicine* 16 (4): 439-46.
- Spencer, C. and Blades, M. (1993). Children's understanding of places: the world at hand. *Geography* 78: 367-72.
- Spencer, N. (1993). Commentary on Lissauer et al. (1993). *Archives of Disease in Childhood* (69): 428-9.
- Stewart-Brown, S., Peters, T., Golding, J. and Bijur, P. (1986). Case definition in childhood accident studies: a vital factor in determining results. *International Journal of Epidemiology* 15 (3): 352-60.
- Stone, D. (1997). *All about homelessness*. London: Shelter.
- Swann, C. and Morgan, A. (2002). Social capital for health: insights from qualitative research. In: Swann, C. and Morgan, A. (eds) *Social capital for health*. London: Health Development Agency.
- Taylor, B., Wadsworth, J. and Butler, N. (1983). Teenage mothering, admission to hospital, and accidents during the first 5 years. *Archives of Disease in Childhood* 58: 6-11.
- Thomson, J., Tolmie, A., Foot, H. and McLaren, B. (1996). *Child development and the aims of road safety education – a review and analysis*. DoT Road Safety Research No. 1. Norwich: The Stationery Office.
- Thomson, J., Tolmie, A. and Mamoon, T. (2001). *Road accident involvement of children from ethnic minorities: a literature review*. Road Safety Research Report No. 19. London: Department of the Environment, Transport and the Regions.
- Towner, E. and Dowswell, T. (2002). Community-based childhood injury prevention interventions: what works? *Health Promotion International* 17 (3): 273-84.
- Towner, E. and Errington, G. (2002). *The epidemiology of choking in childhood and implications for prevention*. A report prepared for the Department of Health. London: Department of Health.
- Towner, E., Jarvis, S., Walsh, S. and Aynsley-Green, A. (1994). Measuring exposure to injury risk in schoolchildren aged 11–14. *British Medical Journal* 308: 449-52.
- Towner, E., Dowswell, T., Mackereth, C. and Jarvis, S. (2001). *What works in preventing unintentional injuries in children and young adolescents? An updated systematic review*. London: Health Development Agency. www.hda-online.org.uk/downloads/pdfs/prevent_injuries.pdf
- Wadsworth, J., Burnell, I., Taylor, B. and Butler, N. (1983). Family type and accidents in preschool children. *Journal of Epidemiology and Community Health* 37: 100-4.
- Waller, A.E. and Marshall, S.W. (1993). Childhood thermal injuries in New Zealand resulting in death and hospitalization. *Burns* 19 (5): 371-6.

Walsh, S. and Jarvis, S. (1992). Measuring the frequency of 'severe' accidental injury in childhood. *Journal of Epidemiology and Community Health* 46: 26-32.

Walsh, S., Barton, S., Jarvis, S. and Clark, W. (1990). *Children injured in road traffic accidents: a collaborative project with Northumbria Police*. NERRL Research Report 90/3. Newcastle: North East Regional Research Laboratory.

Ward, H., Cave, J., Morrison, A., Allsop, R., et al. (1994). *Pedestrian activity and accident risk*. Basingstoke, Hants: AA Foundation for Road Safety Research.

Whitehead, M., Diderichson, F. and Burström, B. (2000). Researching the impact of public policy on equalities in health. In: Graham, H. (ed.) *Understanding health inequalities*, 203-18. Buckingham: Open University Press.

Whitelegg, J. (1987). A geography of road traffic accidents. *Transactions of the Institute of British Geographers* 12: 161-76.

Widdowfield, R. (1999). The limitations of official homelessness statistics. In: Dorling, D. and Simpson, S. (eds) *Statistics in society. The arithmetic of politics*, 181-8. London: Arnold.

Williams, F., Lloyd, O. and Dunbar, J. (1991). Deaths from road traffic accidents in Scotland: 1979-1988. Does it matter where you live? *Public Health* 105: 319-26.

Wilson, M.H., Baker, S.P., Tenet, S.P., Shock, S., et al. (1991). *Saving children. A guide to injury prevention*. Oxford: Oxford University Press.

References for Appendix Tables C2–C8

C2(i) Pedestrian injuries – transport policy and traffic calming (N = 7)

- 1 Engel, U. (1982). Short-term and area-wide evaluation of safety measures implemented in a residential area named Osterbro. A case study. *Seminar on short-term and area-wide evaluation of safety measures*, Amsterdam. Amsterdam: Netherlands Institute for Road Safety Research.
- 2 Jorgensen, E. (1985). Bicycle tracks in urban areas in Denmark. Evaluation of the effect on safety. In: Biecheler, M., Lacombe, C., Muhlrad, N. (eds) *Evaluation 85: International meeting on the evaluation of local traffic safety measures*, Proceedings of the Paris conference, 20–23 May 1985, pp. 755-61.
- 3 Boxall, J.A. (1988). School crossing patrols: how effective are they? *Traffic Engineering and Control* 29 (11): 586.
- 4 i Walker, R.T., Gardner, G., McFetridge, M. (1989). *Urban safety project: the Nelson scheme*. Contractor's Report CR191. Department of Transport, Transport and Road Research Laboratory. Crowthorne, Berkshire: Transport and Road Research Laboratory.
ii Ward, H., Norrie, J., Sang, A., Allsop, R. (1989a). *Urban safety project: the Reading scheme*. Contractor's Report CR138. Crowthorne, Berkshire: Transport and Road Research Laboratory.
iii Ward, H., Norrie, J., Sang, A. and Allsop, R. (1989b). *Urban safety project: the Sheffield scheme*. Contractor's Report CR134. Crowthorne, Berkshire: Transport and Road Research Laboratory.
iv Ward, H., Norrie, J., Allsop, R., Sang, A. (1989c). *Urban safety project: the Bristol scheme*. Contractor's Report CR192. Crowthorne, Berkshire: Transport and Road Research Laboratory.
v Walker, R., McFetridge, M. (1989). *Urban safety project: the Bradford scheme*. Contractor's Report CR190. Crowthorne, Berkshire: Transport and Road Research Laboratory.
vi Mackie, A., Ward, H., Walker, R. (1988). *Urban safety project. 2. Interim results for area wide schemes*. Research Report 154. Crowthorne, Berkshire: Transport and Road Research Laboratory.
vii Mackie, A., Ward, H., Walker, R. (1990). *Urban safety project. 3. Overall evaluation of area wide schemes*. Research Report 263. Crowthorne, Berkshire: Transport and Road Research Laboratory.
viii Tillman, M. (1992). A study of the longer term effects of the Urban Safety Project. The case of Reading, Berkshire. MSc, Newcastle upon Tyne: Transport Operations Research Group.
- 5 Janssen, S. (1991). Road safety in urban districts: final results of accident studies in the Dutch demonstration projects of the 1970s. *Traffic Engineering and Control* 32: 292-6.
- 6 Vis, A., Dijkstra, A., Slop, M. (1992). Safety effects of 30 km/h zones in the Netherlands. *Accident Analysis and Prevention* 24 (1): 75-86.
- 7 Webster, D., Mackie, A. (1996). *Review of traffic calming schemes in 20 mph zones*. TRL Report 215. Crowthorne, Berkshire: Transport Research Laboratory.

C2(ii) Pedestrian injuries – pedestrian and traffic education (N = 23)

- 1 Downing, C. (1987). Evaluation of the impact and penetration of a children's traffic club. In: Rottengatter, J., De Bruin, R. (eds) *Road User Behaviour. Theory and Practice*. The Netherlands: Van Gorcum.

- 2 Preusser, D., Blomberg, R. (1984). Reducing child pedestrian accidents through public education. *Journal of Safety Research* 15: 47-56.
 - 3 Antaki, C., Morris, P.E., Flude, B.M. (1986). The effectiveness of the 'Tufty Club' in road safety education. *British Journal of Educational Psychology* 56: 363-5.
 - 4 Young, D., Lee, D. (1987). Training children in road crossing skills using a roadside simulation. *Accident Analysis and Prevention* 19 (5): 327-41.
 - 5 Preusser, D., Lund, A. (1988). 'And keep on looking.' A film to reduce pedestrian crashes among 9 to 12 year olds. *Journal of Safety Research* 19 (4): 177-85.
 - 6 van Schagen, I. (1988). Training children to make safe crossing decisions. In: Rothengatter, J., de Bruin, R. (eds) *Road user behaviour: theory and research*. Assen, the Netherlands: Van Gorcum.
 - 7 Malenfant, L., Van Houten, R. (1989). Increasing the percentage of drivers yielding to pedestrians in three Canadian cities with a multifaceted safety program. *Health Education Research* 5 (2): 275-9.
 - 8 Renaud, L., Suissa, S. (1989). Evaluation of the efficacy of simulation games in traffic safety education of kindergarten children. *American Journal of Public Health* 79 (3): 307-9.
 - 9 Nishioka, N., Ieda, S., Takahashi, H., Okajima, Y. et al. (1991). An experimental study on the safety behavior of children in a dashing-out situation – effects of verbal instructions and traffic conditions on safety behavior. *International Association of Traffic and Safety Sciences (IATSS) Research* 15 (1): 39-45.
 - 10 Rivara, F.P., Booth, C.L., Bergman, A.B., Rogers, L.W., et al. (1991). Prevention of pedestrian injuries to children: effectiveness of a school training program. *Pediatrics* 88 (4): 770-5.
 - 11 Thomson, J., Ampofo-Boateng, K., Pitcairn, T., Grieve, R., et al. (1992). Behavioural group training of children to find safe routes to cross the road. *British Journal of Educational Psychology* 62: 173-83.
 - 12 i Tucker, S. (1992). The operation of the Eastern Region traffic club. Unpublished. WP/RUS/116. Department of Transport, Transport and Road Research Laboratory.
 - ii Bryan-Brown, K. (1994). *The effectiveness of the General Accident Eastern Region children's traffic club*. Project Report 99. Crowthorne, Berkshire: Transport Research Laboratory.
 - iii Bryan-Brown, K. (1995). *The effects of a children's traffic club. Road accidents: Great Britain 1994*. London: Department of Transport.
 - 13 Ampofo-Boateng, K., Thomson, J.A., Grieve, R., Pitcairn, T., et al. (1993). A developmental and training study of children's ability to find safe routes to cross the road. *British Journal of Developmental Psychology* 11: 31-45.
 - 14 Demetre, J., Lee, D., Grieve, R., Pitcairn, T. et al. (1993). Young children's learning on road-crossing simulations. *British Journal of Educational Psychology* 63 (2): 349-59.
 - 15 West, R., Sammons, P., West, A. (1993). Effects of a traffic club on road safety knowledge and self-reported behaviour of young children and their parents. *Accident Analysis and Prevention* 25 (5): 609-18.
 - 16 Gregersen, N.P., Nolen, S. (1994). Children's road safety and the strategy of voluntary traffic safety clubs. *Accident Analysis and Prevention* 26 (4): 463-70.
 - 17 Harland, G., Tucker, S. (1994). 'Let's Decide Walk Wise' – the development and testing of a pedestrian training resource. 14th Annual Conference of the British Health and Safety Society. Crowthorne, Berkshire: Transport Research Laboratory.
 - 18 Penna, C. (1994). 'Streets ahead' evaluation. GR 94-13 VIC ROADS KEW.VIC.3101. Victoria, Australia: Monash University.
 - 19 Tziotis, M. (1994). *Evaluation of the 'Safe routes to schools' and 'Walk with care' programs*. Melbourne, VIC, Australia: Road Safety Department, VicRoads.
 - 20 Wright, M., Rivara, F., Ferse, W. (1995). Evaluation of the 'Think First' head and spinal cord injury prevention program. *Injury Prevention* 1: 81-5.
 - 21 Burke, G., Lapidus, G., Banco, L., Zavoski, R., et al. (1996). Evaluation of the effectiveness of a pavement stencil in promoting safe behavior among elementary school children boarding school buses. *Pediatrics* 97: 520-3.
 - 22 Thomson, J., Whelan, K. (1997). *A community approach to road safety education using practical training methods. The Drumchapel project*. Road Safety Research Report No. 3. London: Department of Transport.
 - 23 Cross, D., Stevenson, M., Hall, M., Burns, S., et al. (2000). Child pedestrian injury prevention project: student results. *Preventive Medicine* 30: 179-87.
- ### C3 Car occupant child restraints (N = 39)
- 1 Scherz, R. (1976). Restraint systems for the prevention of injury to children in automobile accidents. *American Journal of Public Health* 66 (5): 451-6.
 - 2 Miller, J., Pless, I. (1977). Child automobile restraints: evaluation of health education. *Pediatrics* 59 (6): 907-11.

- 3 Reisinger, K., Williams, A. (1978). Evaluation of programs designed to increase the protection of infants in cars. *Pediatrics* 62 (3): 280-7.
- 4 Reisinger, K., Williams, A., Wells, J., John, C., et al. (1981). Effect of pediatricians' counseling on infant restraint use. *Pediatrics* 67 (2): 201-6.
- 5 Christophersen, E., Sullivan, M. (1982). Increasing the protection of newborn infants in cars. *Pediatrics* 70: 21-5.
- 6 Geddis, D., Pettengell, R. (1982). Parent education: its effect on the way children are transported in cars. *New Zealand Medical Journal* 95: 314-6.
- 7 Greenberg, L., Coleman, A. (1982). A prenatal and postpartum safety education program: influence on parental use of infant car restraints. *Journal of Developmental and Behavioral Pediatrics* 3 (1): 32-4.
- 8 Berger, L.R., Saunders, S., Armitage, K., Schauer, L. (1984). Promoting the use of car safety devices for infants: an intensive health education approach. *Pediatrics* 74 (1): 16-19.
- 9 Decker, M., Dewey, M., Hutcheson, R., Schaffner, W. (1984). The use and efficacy of child restraint devices. The Tennessee experience, 1982 and 1983. *Journal of the American Medical Association* 252 (18): 2571-5.
- 10 Chang, A., Dillman, A., Leonard, E., English, P. (1985). Teaching car passenger safety to preschool children. *Pediatrics* 76 (3): 425-8.
- 11 Christophersen, E., Sosland-Edelman, D., LeClaire, S. (1985). Evaluation of two comprehensive infant car seat loaner programs with 1-year follow-up. *Pediatrics* 76 (1): 36-42.
- 12 Goodson, J., Buller, C., Goodson, W. (1985). Prenatal child safety education. *Obstetrics and Gynaecology* 65: 312-5.
- 13 Guerin, D., MacKinnon, D. (1985). An assessment of the California child passenger restraint requirement. *American Journal of Public Health* 75 (2): 142-4.
- 14 Colletti, R. (1986). Longitudinal evaluation of a statewide network of hospital programs to improve child passenger safety. *Pediatrics* 77 (4): 523-9.
- 15 Roberts, M., Fanurik, D. (1986). Rewarding elementary school children for their use of safety belts. *Health Psychology* 5 (3): 185-96.
- 16 Sewell, C., Hull, H., Fenner, J., Graff, H. et al. (1986). Child restraint law effects on motor vehicle accident fatalities and injuries: the New Mexico experience. *Pediatrics* 78 (6): 1079-84.
- 17 Wagenaar, A., Webster, D. (1986). Preventing injuries to children through compulsory automobile safety seat use. *Pediatrics* 78 (4): 662-72.
- 18 Agran, P.F., Dunkle, D.E., Winn, D.G. (1987). Effects of legislation on motor vehicle injuries to children. *American Journal of Diseases of Children* 141: 959-64.
- 19 Bowman, J., Sanson-Fisher, R., Webb, G. (1987). Interventions in preschools to increase the use of safety restraints by preschool children. *Pediatrics* 79 (1): 103-9.
- 20 Macknin, M., Gustafson, C., Gassman, J., Barich, D. (1987). Office education by pediatricians to increase seat belt use. *American Journal of Diseases of Children* 141: 1305-7.
- 21 Sowers-Hoag, K., Thyer, B., Bailey, J. (1987). Promoting automobile safety belt use by young children. *Journal of Applied Behavior Analysis* 20: 133-8.
- 22 Jamark, S., Ljungblom, B.A., Turbell, T. (1988). *Infant carriers – a trial in two counties*. Linköping, Sweden: Swedish Road and Traffic Research Institute.
- 23 Margolis, L., Wagenaar, A., Liu, W. (1988). The effects of a mandatory child restraint law on injuries requiring hospitalization. *American Journal of Diseases of Children* 142: 1099-103.
- 24 Roberts, M.C., Fanurik, D., Wilson, D. (1988). A community program to reward children's use of seat belts. *American Journal of Community Psychology* 16 (3): 395-407.
- 25 Seekins, T., Fawcett, S., Cohen, S., Elder, J. et al. (1988). Experimental evaluation of public policy: the case of state legislation for child passenger safety. *Journal of Applied Behavior Analysis* 21 (3): 233-43.
- 26 Downing, C., Franklin, J. (1989). An evaluation of two local infant restraint loan schemes. *First World Conference on Accident and Injury Prevention; secondary conference on Child Accident Prevention*, Stockholm. Stockholm: Karolinska Institute.
- 27 Liberato, C., Eriacho, B., Schmiesing, J., Krump, M. (1989). SafeSmart Safety Seat Intervention Project: a successful program for the medically indigent. *Patient Education and Counseling* 13: 161-70.
- 28 Lund, A., Stuster, J., Fleming, A. (1989). Special publicity and enforcement of California's belt use laws: making a secondary law work. *Journal of Criminal Justice* 17: 329-41.
- 29 Morrow, R. (1989). A school-based program to increase seatbelt use. *Journal of Family Practice* 29 (5): 517-20.
- 30 Robitaille, Y., Legault, J., Abbey, H., Pless, I. (1990). Evaluation of an infant car seat program in a low-income community. *American Journal of Diseases of Children* 144: 74-8.

- 31 Streff, F., Molnar, L., Christoff, C. (1992). Increasing safety belt use in a secondary enforcement state: evaluation of a three-county special enforcement program. *Accident Analysis and Prevention* 24 (4): 369-83.
- 32 Lindqvist, K. (1993). Does the use of child safety seats increase as a result of loan schemes? *Accident Analysis and Prevention* 25 (4): 421-9.
- 33 Stuy, M., Green, M., Doll, J. (1993). Child care centers: a community resource for injury prevention. *Journal of Developmental and Behavioral Pediatrics* 14 (4): 224-9.
- 34 Decina, L., Temple, M., Dorer, H. (1994). Increasing child safety-seat use and proper use among toddlers. Evaluation of an enforcement and education program. *Accident Analysis and Prevention* 26 (5): 667-73.
- 35 Russell, J., Kresnow, M.-J., Brackbill, R. (1994). The effect of adult belt laws and other factors on restraint use for children under age 11. *Accident Analysis and Prevention* 26 (3): 287-95.
- 36 Hazinski, M., Eddy, V., Morris, J. (1995). Children's traffic safety program: influence of early elementary school safety education on family seat belt use. *Journal of Trauma* 39: 1063-8.
- 37 Margolis, L., Bracken, J., Stewart, J. (1996). Effects of North Carolina's mandatory safety belt law on children. *Injury Prevention* 2: 32-5.
- 38 Williams, A., Wells, J., Ferguson, S. (1997). Development and evaluation of programs to increase proper child restraint use. *Journal of Safety Research* 28: 197-202.
- 39 Hanfling, M., Mangus, L., Gill, A., Bailey, R. (2000). A multifaceted approach to improving motor vehicle restraint compliance. *Injury Prevention* 6: 125-9.
- 4 i Cushman, R., Down, J., MacMillan, N., Waclawik, H. (1991a). Helmet promotion in the emergency room following a bicycle injury: a randomized trial. *Pediatrics* 88 (1): 43-7.
- ii Cushman, R., James, W., Waclawik, H. (1991b). Physicians promoting bicycle helmets for children: a randomized trial. *American Journal of Public Health* 81 (8): 1044-6.
- 5 i Leicester, P., Nassau, F., Wise, A. (1991). *The introduction of compulsory bicycle helmet wearing in Victoria*. Report GR 91-4. Melbourne, VIC, Australia: Road Safety Department, VicRoads.
- ii Cameron, M., Heiman, L., Neiger, D. (1992). *Evaluation of the Bicycle Helmet Wearing Law in Victoria during its first 12 months*. Report No. 32. Victoria, Australia: Accident Research Centre, Monash University.
- iii Vulcan, A., Cameron, M., Watson, W. (1992). Mandatory bicycle helmet use: experience in Victoria, Australia. *World Journal of Surgery* 16: 389-97.
- iv Finch, C., Newstead, S., Cameron, M., Vulcan, A. (1993). *Head injury reductions in Victoria two years after introduction of mandatory bicycle helmet use*. Report No. 51. Victoria, Australia: Accident Research Centre, Monash University.
- v Cameron, M., Vulcan, A., Finch, C., Newstead, S. (1994). Mandatory bicycle helmet use following a decade of helmet promotion in Victoria, Australia – an evaluation. *Accident Analysis and Prevention* 26 (3): 325-37.
- vi McDermott, F. (1995). Bicyclist head injury prevention by helmets and mandatory wearing legislation in Victoria, Australia. *Annals of the Royal College of Surgeons of England* 77: 38-44.

C4 Bicycle injuries (N = 28)

- 1 Wood, T., Milne, P. (1988). Head injuries to pedal cyclists and the promotion of helmet use in Victoria, Australia. *Accident Analysis and Prevention* 20 (3): 177-85.
- 2 i DiGuseppi, C., Rivara, F., Koepsell, T., Polissar, L. (1989). Bicycle helmet use by children. Evaluation of a community-wide helmet campaign. *Journal of the American Medical Association* 262 (16): 2256-61.
- ii Bergman, A., Rivara, F., Richards, D., Rogers, L. (1990). The Seattle children's bicycle helmet campaign. *American Journal of Diseases of Children* 144: 727-31.
- 3 Moore, D., Adair, V. (1990). Effects of a school-based education programme on safety helmet usage by 11- to 13 year old cyclists. *Educational Psychology* 10 (1): 73-8.
- 4 Morris, B., Trimble, N. (1991). Promotion of bicycle helmet use among schoolchildren: a randomized clinical trial. *Canadian Journal of Public Health* 82 (Mar/Apr): 92-4.
- 7 Pendergrast, R., Ashworth, C., DuRant, R., Litaker, M. (1992). Correlates of children's bicycle helmet use and short-term failure of school-level interventions. *Pediatrics* 90 (3): 354-8.
- 8 Puczynski, M., Marshall, D. (1992). Helmets! All the pros wear them. *American Journal of Diseases of Children* 146: 1465-7.
- 9 Towner, P., Marvel, M. (1992). A school-based intervention to increase the use of bicycle helmets. *Family Medicine* 24: 156-8.

- 10 i Dannenberg, A., Gielen, A., Beilenson, P., Wilson, M., et al. (1993). Bicycle helmet laws and educational campaigns: an evaluation of strategies to increase children's helmet use. *American Journal of Public Health* 83 (5): 667-74.
- ii Coté, T., Sacks, J., Lambert-Huber, D., Dannenberg, A. et al. (1992). Bicycle helmet use among Maryland children: effect of legislation and education. *Pediatrics* 89 (6): 1216-20.
- 11 Parkin, P., Spence, L., Hu, X., Kranz, K., et al. (1993). Evaluation of a promotional strategy to increase bicycle helmet use by children. *Pediatrics* 91 (4): 772-7.
- 12 Macknin, M., Medendorp, S. (1994). Association between bicycle helmet legislation, bicycle safety education, and use of bicycle helmets in children. *Archives of Pediatric and Adolescent Medicine* 148: 255-9.
- 13 van Schagen, I., Brookhuis, K. (1994). Training young cyclists to cope with dynamic traffic situations. *Accident Analysis and Prevention* 26 (2): 223-30.
- 14 Mock, C., Maier, R., Boyle, E., et al. (1995). Injury prevention strategies to promote helmet use to decrease severe head injuries at a Level 1 Trauma Centre. *Journal of Trauma* 39: 29-33.
- 15 Parkin, P., Hu, X., Spence, L., Kranz, K. (1995). Evaluation of a subsidy program to increase bicycle helmet use by children of low-income families. *Pediatrics* 96 (2): 283-7.
- 16 Farley, C., Haddad, S., Brown, B. (1996). The effects of a 4-year program promoting bicycle helmet use among children in Quebec. *American Journal of Public Health* 86: 46-51.
- 17 Savill, T., Bryan-Brown, K., Harland, G. (1996). *The effectiveness of child cycle training schemes*. TRL Report 214. Crowthorne, Berkshire: Transport Research Laboratory.
- 18 Abularrage, J., De Luca, A., Abularrage, C. (1997). Effect of education and legislation on bicycle helmet use in a multiracial population. *Archives of Pediatric and Adolescent Medicine* 151: 41-4.
- 19 Ekman, R., Schelp, L., Welander, G., Svanstöm, L. (1997). Can a combination of local, regional and national information substantially increase bicycle-helmet wearing and reduce injuries? Experiences from Sweden. *Accident Analysis and Prevention* 29: 321-8.
- 20 Kim, A., Rivara, F., Koepsell, T. (1997). Does sharing the cost of a bicycle helmet help promote helmet use? *Injury Prevention* 3: 38-42.
- 21 Ni, H., Sacks, J., Curtis, L., Cieslak, P., et al. (1997). Evaluation of a statewide bicycle helmet law via multiple measures of helmet use. *Archives of Pediatric and Adolescent Medicine* 151: 59-65.
- 22 Britt, J., Silver, I., Rivara, F. (1998). Bicycle helmet promotion among low income preschool children. *Injury Prevention* 4: 280-3.
- 23 Hendrickson, S., Becker, H. (1998). Impact of a theory based intervention to increase bicycle helmet use in low income children. *Injury Prevention* 4: 126-31.
- 24 Logan, P., Leadbetter, S., Gibson, R., Schieber, R. (1998). Evaluation of a bicycle helmet giveaway program – Texas, 1995. *Pediatrics* 101: 578-82.
- 25 Macarthur, C., Parkin, P., Sidky, M., Wallace, W. (1998). Evaluation of a bicycle skills training program for young children: a randomized controlled trial. *Injury Prevention* 4: 116-21.
- 26 George, A., Koerner, C. (2000). Childhood injury prevention services (CHIPS) bicycle helmet intervention: save your head by knowing the rules. *Journal of Investigative Medicine* 48 (1).
- 27 Lee, A., Mann, N., Takriti, R. (2000). A hospital led promotion campaign aimed to increase bicycle helmet wearing among children aged 11–15 living in West Berkshire 1992–98. *Injury Prevention* 6: 151-3.
- 28 Scuffham, P., Alsop, J., Cryer, C., Langley, J.D. (2000). Head injuries to bicyclists and the New Zealand bicycle helmet law. *Accident Analysis and Prevention* 32: 565-73.

C5(i) Prevention of falls and general injuries in the home (N = 18)

- 1 Spiegel, C., Lindaman, F. (1977). Children can't fly: a program to prevent childhood morbidity and mortality from window falls. *American Journal of Public Health* 67 (12): 1143-7.
- 2 i Dershewitz, R., Williamson, J. (1977). Prevention of childhood household injuries: a controlled clinical trial. *American Journal of Public Health* 67 (12): 1148-53.
- ii Dershewitz, R. (1979). Will mothers use free household safety devices? *American Journal of Diseases of Children* 133: 61-4.
- 3 Colver, A., Hutchinson, P., Judson, E. (1982). Promoting children's home safety. *British Medical Journal* 285: 1177-80.

- 4 Minchom, P., Sibert, J., Newcombe, R., Bowley, M. (1984). Does health education prevent childhood accidents? *Postgraduate Medical Journal* 60 (Apr): 260-2.
- 5 Gallagher, S., Hunter, P., Guyer, B. (1985). A home injury prevention program for children. *Pediatric Clinics of North America* 32 (1): 95-112.
- 6 Kraus, J. (1985). Effectiveness of measures to prevent unintentional deaths of infants and children from suffocation and strangulation. *Public Health Reports* 100 (2): 231-40.
- 7 Kelly, B., Sein, C., McCarthy, P.L. (1987). Safety education in a pediatric primary care setting. *Pediatrics* 79 (5): 818-24.
- 8 Paul, C.L., Sanson-Fisher, R.W., Redman, S., Carter, S. (1994). Preventing accidental injury to young children in the home using volunteers. *Health Promotion International* 9 (4): 241-9.
- 9 Olds, D., Henderson, C., Kitzman, H. (1994). Does prenatal and infancy nurse home visitation have enduring effects on qualities of parental caregiving and child health at 25 to 50 months of life? *Pediatrics* 93: 89-98.
- 10 Bablouzian, L., Freedman, E., Wolski, K., Fried, L. (1997). Evaluation of a community based childhood injury prevention program. *Injury Prevention* 3: 14-16.
- 11 Clamp, M., Kendrick, D. (1998). A randomised controlled trial of general practitioner safety advice for families with children under 5 years. *British Medical Journal* 316: 1576-9
- 12 Thompson, R., Edwards, P., Jarvis, S., Avery, A., et al. (1998). Childhood accidents: is it time to prescribe safety equipment? *Community Practitioner* 71 (4): 138-40.
- 13 Kendrick, D., Marsh, P., Fielding, K., Miller, P. (1999). Preventing injuries in children: cluster randomised controlled trial in primary care. *British Medical Journal* 318: 980-83.
- 14 Johnston, B., Britt, J., D'Ambrosio, L., Mueller, B., et al. (2000). A preschool program for safety and injury prevention delivered by home visitors. *Injury Prevention* 6: 305-9.
- 15 Mullan, C., Smithson, R. (2000). *Community childhood accident prevention project: using home visits to promote child safety in deprived areas*. Belfast: Co-operation and Working Together.
- 16 King, W., Klassen, T., LeBlanc, J., Bernard-Bonnin, A.C., Robitaille, Y., Pham, B., Coyle, D., Tenenbein, M., Pless, I. (2000). The effectiveness of a home visit to prevent childhood injury. *Pediatrics* 108: 382-8.
- 17 Gielen, A., Wilson, M., McDonald, E., Serwint, J., Andrews, J., Hwang, W.T., Wang, M.C. (2001). Randomised trial of enhanced anticipatory guidance for injury prevention. *Archives of Pediatric and Adolescent Medicine* 155: 42-9.
- 18 Campbell, N., Ayala, G., Litrownik, A., Slymen, D., et al. (2001). Evaluation of a first aid and home safety program for Hispanic migrant adolescents. *American Journal of Preventive Medicine* 20 (4): 258-65.

C5(ii) Prevention of burns and scalds (N = 19)

- 1 Sorensen, B. (1976). Prevention of burns and scalds in a developed country. *Journal of Trauma* 16 (4): 249-58.
- 2 Linares, A.Z., Linares, H.A. (1979). Burn prevention programmes for children: are they effective? *Burns* 6 (2): 73-9.
- 3 i McLoughlin, E., Healer, C., Crawford, J.D. (1979). Burn education intervention: a controlled study. *Burns* 6 (1): 26-9.
- ii McLoughlin, E., Vince, C., Lee, A., Crawford, J. (1982). Project burn prevention: outcome and implications. *American Journal of Public Health* 72 (3): 241-7.
- iii MacKay, A., Rothman, K. (1982). The incidence and severity of burn injuries following Project Burn Prevention. *American Journal of Public Health* 72 (3): 248-52.
- 4 Miller, R., Reisinger, K., Blatter, M., Wucher, F. (1982). Pediatric counseling and subsequent use of smoke detectors. *American Journal of Public Health* 72 (4): 392-3.
- 5 Thomas, K., Hassanein, R., Christophersen, E. (1984). Evaluation of group well-child care for improving burn prevention practices in the home. *Pediatrics* 74 (5): 879-82.
- 6 Eckelt, K., Fannon, M., Blades, B., Munster, A. (1985). A successful burn prevention program in elementary schools. *Journal of Burn Care and Rehabilitation* 6 (6): 509-10.
- 7 McLoughlin, E., Marchone, M., Hanger, L., German, P., et al. (1985). Smoke detector legislation: its effect on owner-occupied homes. *American Journal of Public Health* 75 (8): 858-62.
- 8 Varas, R., Carbone, R., Hammond, J. (1988). A one-hour burn prevention program for grade school children: its approach and success. *Journal of Burn Care and Rehabilitation* 9 (1): 69-71.
- 9 Katcher, M., Landry, G., Shapiro, M. (1989). Liquid-crystal thermometer use in pediatric office counseling about tap water burn prevention. *Pediatrics* 83 (5): 766-71.

- 10 Erdmann, T., Feldman, K., Rivara, F., Heimbach, M. et al. (1991). Tap water burn prevention: the effect of legislation. *Pediatrics* 88 (3): 572-7.
- 11 Grant, E., Turney, E., Bartlett, M., Winbon, C. et al. (1992). Evaluation of burn prevention program in a public school system. *Journal of Burn Care and Rehabilitation* 13 (6): 703-7.
- 12 Fallat, M.E., Rengers, S.J. (1993). The effect of education and safety devices on scald burn prevention. *Journal of Trauma* 34 (4): 560-3.
- 13 Waller, A., Clarke, J., Langley, J. (1993). An evaluation of a program to reduce home hot tap water temperatures. *Australian Journal of Public Health* 17 (2): 116-23.
- 14 Mallonee, S., Istre, G., Rosenberg, M., Reddish-Douglas, M., et al. (1996). Surveillance and prevention of residential-fire injuries. *New England Journal of Medicine* 335: 27-31.
- 15 McConnell, C., Leeming, F., Dwyer, W. (1996). Evaluation of a fire-safety training program for preschool children. *Journal of Community Psychology* 24: 213-27.
- 16 Shults, R., Sacks, J., Briske, L., Dickey, P., et al. (1998). Evaluation of three smoke detector promotion programs. *American Journal of Preventive Medicine* 15 (3): 165-71.
- 17 DiGuseppi, C., Slater, S., Roberts, I., Adams, L., et al. (1999). The 'Let's Get alarmed' initiative: a smoke alarm giveaway programme. *Injury Prevention* 5: 177-82.
- 18 King, L., Thomas, M., Gatenby, K., Georgiou, A., et al. (1999). 'First Aid for Scalds' campaign: reaching Sydney's Chinese, Vietnamese, and Arabic speaking communities. *Injury Prevention* 5: 104-8.
- 19 Harré, N., Coveney, A. (2000). School-based scalds prevention: reaching children and their families. *Health Education Research* 15 (2): 191-202.
- 4 Woolf, A.D., Saperstein, A., Forjuoh, S. (1992). Poisoning prevention knowledge and practices of parents after a childhood poisoning incident. *Pediatrics* 90 (6): 867-70.
- 5 Krug, A., Ellis, J.B., Hay, I.T., Mokgabudi, N.F., et al. (1994). The impact of child-resistant containers on the incidence of paraffin (kerosene) ingestion in children. *South African Medical Journal* 84 (11): 730-4.
- 6 Rodgers, G. (1996). The safety effects of child-resistant packaging for oral prescription drugs: two decades of experience. *Journal of the American Medical Association* 275: 1661-5.
- 7 Liller, K., Craig, J., Crane, N., McDermott, R. (1998). Evaluation of a poison prevention lesson for kindergarten and third grade students. *Injury Prevention* 4: 218-21.
- 8 Eaton-Jones, S., Fields, K., Rasco, T., Akintemi, O. (2000). Preventing childhood poisoning: an intervention in a family medicine residency program. *North Carolina Medical Journal* 61 (6): 333-5.

C6 Injuries in the leisure environment (N = 7)

C5(iii) Prevention of poisoning (N = 8)

- 1 Krenzelok, E., Garber, R. (1981). Teaching poison prevention to preschool children, their parents, and professional educators through child care centers. *American Journal of Public Health* 71: 750-2.
- 2 Sibert, J.R., Clarke, A.J., Mitchell, M.P. (1985). Improvements in child resistant containers. *Archives of Disease in Childhood* 60: 1155-7.
- 3 Woolf, A., Lewander, W., Filippone, G., Lovejoy, F. (1987). Prevention of childhood poisoning: efficacy of an educational program carried out in an emergency clinic. *Pediatrics* 80 (3): 359-63.
- 1 Morton, J.G., Burton, J.F. (1979). An evaluation of the effectiveness of mouthguards in high-school rugby players. *New Zealand Dental Journal* 75 (July): 151-3.
- 2 D'Argenio, P., Cafaro, L., Santonastasi, F., Taggi, F., et al. (1996). Capodanno Senza Danno: the effects of an intervention program on fireworks injuries in Naples. *American Journal of Public Health* 86: 84-6.
- 3 Malinowska-Cieslik, M., van der Borne, B. (1998). Prevention of mushroom poisoning of children: effectiveness of a community-based school education programme. *Health Education Research* 13: 13-23.
- 4 Withaneachi, D., Meehan, T. (1998). Promoting safer play equipment in primary schools: evaluation of an educational campaign. *Health Promotion Journal of Australia* 8: 125-9.
- 5 Bennett, E., Cummings, P., Quan, L., Lewis, F. (1999). Evaluation of a drowning prevention campaign in King County, Washington. *Injury Prevention* 5: 109-13.
- 6 Roseveare, C., Brown, J., Barclay-McIntosh, J., Chalmers, D. (1999). An intervention to reduce playground equipment hazards. *Injury Prevention* 5: 124-8.
- 7 Sibert, J., Mott, A., Rolfe, K., James, R. et al. (1999). Preventing injuries in public playgrounds through partnership between health services and local authority: community intervention study. *British Medical Journal* 318: 1595.

C7 Mass media and training intervention (N = 5)

- 1 Williams, H., Sibert, J. (1983). Untitled. (Play it Safe campaign and children's injuries). *British Medical Journal* 286: 1893.
- 2 Gielen, A., Dannenberg, A., Ashburn, N., Kou, J., et al. (1996). Teaching safety: evaluation of a children's village in Maryland. *Injury Prevention* 2: 26-31.
- 3 Sundelin, C., Rasmussen, F., Berfenstram, R., Troedsson, K. (1996). Information through television: does it promote child safety? *Injury Prevention* 2: 36-40.
- 4 Marsh, P., Kendrick, D. (1998). Injury prevention training: is it effective? *Health Education Research* 13: 47-56.
- 5 Frederick, K., Bixby, E., Orzel, M., Stewart-Brown, S., et al. (2000). An evaluation of the effectiveness of the Injury Minimization Programme for Schools (IMPS). *Injury Prevention* 6: 92-5.

C8 Community-based intervention (N = 10)

- 1 i Schelp, L. (1987). Community intervention and changes in accident pattern in a rural Swedish municipality. *Health Promotion* 2 (2): 109-25.
- ii Svanström, L., Schelp, L., Ekman, R., Lindstrom, A. (1996). Falköping, Sweden, ten years after: still a safe community? *International Journal for Consumer Safety* 3 (1): 1-7.
- 2 Guyer, B., Gallagher, S., Chang, B., Azzara, C., et al. (1989). Prevention of childhood injuries: evaluation of the Statewide Childhood Injury Prevention Program (SCIPP). *American Journal of Public Health* 79 (11): 1521-7.
- 3 Schwarz, D., Grisso, J., Miles, C., Holmes, J., et al. (1993). An injury prevention program in an urban African-American community. *American Journal of Public Health* 83 (5): 675-80.
- 4 i Davidson, L., Durkin, M., Kuhn, L., O'Connor, P., et al. (1994). The impact of the Safe Kids/Healthy Neighborhoods Injury Prevention program in Harlem, 1988 through 1991. *American Journal of Public Health* 84 (4): 580-86.
- ii Kuhn, L., Davidson, L.L., Durkin, M.S. (1994). Use of Poisson regression and time series analysis for detecting changes over time in rates of child injury following a prevention program. *American Journal of Epidemiology* 140 (10): 943-55.
- 5 i Ozanne-Smith, J., Sherrard, J., Brumen, I., Vulcan, P. (1994). *Community based injury prevention evaluation report: Shire of Bulla Safe Living Program*. Victoria, Australia: Accident Research Centre, Monash University.
- ii Hennessey, M., Arnold, R., Harvey, P. (1994). *The first three years: final report of the first three years of the Shire of Bulla's Safe Living Program (1991-1993)*. Victoria, Australia: Shire of Bulla.
- 6 i Ytterstad, B. (1995). The Harstad Injury Prevention Study: hospital-based injury recording used for outcome evaluation of community-based prevention of bicyclist and pedestrian injury. *Scandinavian Journal of Primary Health Care* 13: 141-9.
- ii Ytterstad, B., Sogaard, A. (1995). The Harstad Injury Prevention Study: prevention of burns in small children by a community-based intervention. *Burns* 21 (4): 259-66.
- iii Ytterstad, B., Wasmuth, H. (1995). The Harstad Injury Prevention Study: evaluation of hospital-based injury recording and community-based intervention for traffic injury prevention. *Accident Analysis and Prevention* 27 (1): 111-3.
- iv Ytterstad, B., Smith, G., Coggan, C. (1998). Harstad injury prevention study: prevention of burns in young children by community based intervention. *Injury Prevention* 4 (4): 176-80.
- 7 Svanström, L., Ekman, R., Schelp, L., Lindstrom, A. (1995). The Lidköping accident prevention programme – a community approach to preventing childhood injuries in Sweden. *Injury Prevention* 1: 169-72.
- 8 Day, L., Ozanne-Smith, J., Cassell, E., McGrath, A. (1997). *Latrobe Valley Better Health Project. Evaluation of injury prevention program 1992-1996*. Report No. 114. Victoria, Australia: Accident Research Centre, Monash University/Victorian Health Promotion Foundation.
- 9 Petridou, E., Tolma, E., Dessypris, N., Trichopoulos, D. (1997). A controlled evaluation of a community injury prevention project in two Greek islands. *International Journal of Epidemiology* 26 (1): 173-9.
- 10 i Coggan, C., Patterson, P., Brewin, M., Douthett, M. et al. (1998). *Process evaluation report of the Waitakere Community Injury Prevention Project*. Auckland, New Zealand: Injury Research Centre, University of Auckland.
- ii Coggan, C., Patterson, P., Brewin, M., Hooper, R., et al. (2000). Evaluation of the Waitakere Community Injury Prevention Project. *Injury Prevention* 6: 130-4.

Notes

