



Health Development Agency

Prevention and reduction
of accidental injury in
children and older people

Evidence briefing

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Foreword

In 1999 the white paper, *Saving Lives: Our Healthier Nation*, was published. It signalled that the Health Development Agency (HDA) would be established and that it would have, as one of its roles, building the evidence base in public health with a special focus on reducing inequalities in health. In April 2001 the Department of Health published its Research and Development Strategy. The strategy identified the task the for HDA as:

'Maintaining an up to date map of the evidence base of public health and health improvement, advising on the setting of standards in the light of evidence, for public health and health promotion practice, and effective and authoritative dissemination of evidence to practitioners.' (Department of Health, 2001)

To translate this into reality the HDA has developed a number of ways of taking a systematic approach to compiling the evidence, identifying gaps and making the evidence base accessible.

This evidence briefing is a review about the prevention and reduction of accidental injury in children and older people. The necessity for reviewing reviews of tertiary level research stems from the proliferation over the last decade or more of systematic and other types of review in medicine and public health. Other titles in this series include the prevention and reduction of alcohol misuse, teenage pregnancy and parenthood, HIV, low birth weight, depression in older people, and the promotion of breastfeeding (see HDA catalogue for full list: www.hda.nhs.uk). The HDA will also be publishing evidence briefings on physical activity and transport and the reader is referred to these for information about the areas of overlap between these topics and accidental injury (www.hda.nhs.uk/evidence).

Taken together these briefings will provide a comprehensive synthesis of the evidence drawn

from systematic and other kinds of reviews. They will all be available on the HDA's website www.hda.nhs.uk/evidence and the electronic versions will be updated on a regular basis as new evidence becomes available.

The first editions of the briefings have been based on evidence drawn from systematic and other kinds of reviews. This means that the type of evidence that does not traditionally find its way into reviews has not been considered in detail for these documents. In future editions of the evidence briefings it is planned to extend the coverage of evidence beyond reviews to other methodologies and other types of study, where these are available.

The construction of the evidence base has involved collaboration with a number of partners who have interests and expertise in practical and methodological matters concerning the drawing together of evidence and its dissemination. In particular the HDA would like to acknowledge the following: the NHS Centre for Reviews and Dissemination at the University of York, the EPPI-Centre at the Institute of Education at the University of London, Health Evidence Bulletins Wales, the ESRC UK Centre for Evidence Based Policy and Practice at Queen Mary College, University of London and its nodes at the City University, London, and the MRC Public Health Sciences Unit at the University of Glasgow, members of the Cochrane and Campbell collaborations, the United Kingdom and Ireland Public Health Evidence Group and the members of the Public Health Evidence Steering Group. This latter organisation acts as the overall guide for the HDA's evidence-building project. The cooperation of colleagues in these institutions and organisations has been of significant help in preparing the framework for how we assess the evidence. The HDA is, however, responsible for the presentation and organisation of the material in the briefings.

We would also like to gratefully acknowledge the assistance of the following who helped in the preparation of this document: Colin Cryer, Denise Kendrick, Clare Lynley, Ian Roberts, Elizabeth Towner, Heather Ward and Sandra Williams. We also express our gratitude to HDA colleagues who assisted in organising the literature searches.

Every effort has been made to be as accurate and up to date as possible in the preparation of this document. However, we would be very pleased to hear from readers who would like to comment on the content or on any matters relating to the accuracy of the briefings. We will make every effort to correct any matters of fact in subsequent editions of the briefings.

Comments can be made by using our website,
www.hda.nhs.uk/evidence

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Summary

Introduction

Accidental injury is a leading cause of death and disability – the World Health Organization suggests that by 2020 injury will account for the largest single reason for loss of healthy human life-years (see Towner et al., 2001). In the UK non-fatal injury results in 720,000 people being admitted to hospital a year and more than six million visits to accident and emergency departments (British Medical Association, 2001). It is estimated that in the UK disability from injury is responsible for a considerably greater burden of potential healthy life-years lost than from cancer, or heart disease and stroke (British Medical Association, 2001).

The government's white paper, *Saving Lives: Our Healthier Nation*, identified accidental injury as a priority for action and targets have been set to reduce rates of death and serious injury associated with accidental injury in England. The targets, set in 1999, are to reduce the death rates from accidents by at least one fifth and to reduce the rate of serious injury from accidents by at least one tenth by 2010, which will save up to 12,000 lives in total (Department of Health, 1999). In particular, the white paper identified the following factors:

- Accidents are the greatest single threat to life for children and young people, and children up to the age of 15 years from unskilled families are five times more likely to die from accidental injury than those from professional families
- Falls are a major cause of death and disability for older people (3,000 people aged 65 and over die each year)
- One third of accidental injuries to adults and about half of all deaths among children under five occur in the home
- Every year, about 800,000 people are injured while playing sport, 215,000 of whom are children.

The most important priorities for immediate and longer-term action to meet these targets have been identified in a recent Accidental Injury Task Force Report to the Chief Medical Officer (Department of Health, 2002).

About this briefing

Drawing on a range of recent reviews, this briefing highlights measures that have the potential to prevent or reduce accidental injury, with special reference to children and older people, inequalities, and cost effectiveness of interventions. It also identifies gaps and inconsistencies in the evidence about accidental injury and provides guidance for future research commissioning. The briefing will therefore be useful to those involved in implementing preventive aspects of the *National Service Framework for Older People* (Department of Health, 2001), and later sections of the *Children's National Service Framework* (forthcoming). It is recommended that this briefing is read in conjunction with the Accidental Injury Task Force Report (Department of Health, 2002).

Why children and older people?

This briefing focuses on research on accidental injuries to children and older people. Although these two groups are indeed key targets for accidental injury prevention, it is important to note that there is a lack of research on other age groups. One of the recommendations of the briefing is that more research is needed about other groups.

Briefing contents

The full briefing comprises:

- The background, definition and extent of the accidental injury problem

- Children – the factors that contribute to accidental injury, evidence of effective interventions and gaps and inconsistencies in the evidence
- Older people – the factors that contribute to accidental injury, evidence of effective interventions and gaps and inconsistencies in the evidence
- Gaps in the evidence base
- Improving outcomes, and the information and research infrastructures
- Key points and recommendations.

The following sections summarise the primary findings of the full briefing.

Accidental injury in children

'Injury is the main cause of death and a major cause of ill health and disability in childhood.'

(Towner and Dowswell, 2001)

Evidence for effectiveness of interventions for reducing injury or changing behaviour has been assessed in the three main environments where child accidental injury occurs: on the road, at home and during leisure pursuits. The evidence here has been gathered mainly by Towner et al., 2001.

On the road

Roads are the leading cause of fatalities in children – motor vehicle traffic accidents account for nearly half of all accidental injury fatalities in children (Towner and Dowswell, 2001).

There is good* evidence for:

- 20mph zones (leading to injury reduction and behaviour change)
- Cycle helmet education campaigns (leading to behaviour change)
- Cycle helmet legislation (leading to behaviour change)
- Child restraint loan schemes (leading to behaviour change)
- Child restraint legislation (leading to behaviour change). (Towner et al., 2001)

* The terms 'good', 'reasonable' and 'some' refer to judgements made by Towner and colleagues (2001) about the quality of research evidence they examined. Their definitions were informed by the British National Health Service's Centre for Reviews and Dissemination guidelines on carrying out systematic literature reviews (Arblaster et al., 1995) and the use of data extraction forms and reviewers' consensus decisions.

There is reasonable* evidence for:

- Area-wide urban safety measures (leading to injury reduction)
- Education aimed at parents about pedestrian injuries (leading to behaviour change)
- Cycle training (leading to behaviour change)
- Cycle helmet legislation (leading to injury reduction)
- Child restraint education campaigns (leading to behaviour change)
- Seat belt education campaigns (leading to behaviour change)
- Child restraint legislation (leading to injury reduction). (Towner et al., 2001)

In the home

Significant fatalities and injuries occur in, or near, the home. In descending order these are sustained through:

- Suffocation and foreign bodies*
- Fire and flames
- Drowning and submersion
- Falls
- Poisoning.

There is good evidence for:

- Smoke detector programmes (leading to injury reduction and behaviour change)
- Poisoning – child resistant packaging (leading to injury reduction). (Towner et al., 2001)

There is reasonable evidence for:

- Product design (leading to injury reduction)
- General safety devices (leading to injury reduction)
- Window bars (leading to behaviour change)
- Parent education on hazard reduction (leading to behaviour change). (Towner et al., 2001)

At leisure

There is no good or reasonable evidence of effective interventions, although there is some evidence for interventions targeted at drowning, and play and leisure injuries (Towner et al., 2001).

* The term 'foreign bodies' refers to the ingestion or aspiration of objects or substances which are categorised as food, non-foods, toys, or parts of toys, and other 'unknown' substances (see DTI, 1999a).

Other evidence

There are some general community prevention initiatives targeting a range of injury types in different groups. Reasonable evidence was found for both injury reduction and behaviour change. In addition, there are several mass media and training interventions that are rated as 'reasonable/weak' in effectiveness, although they are not specified by either injury reduction or behaviour change (Towner et al., 2001).

Inequalities and children

Despite clear evidence that social gradients exist in relation to childhood injury mortality, particularly concerning fire and flames, falls, poisoning, submersion, suffocation and foreign bodies, of 155 studies identified by Towner and colleagues (2001), just 32 addressed social deprivation (Dowswell and Towner, 2002). Furthermore, these studies did not necessarily focus on areas where inequalities are known to be associated with accidents.

For example, while there is a strong social gradient in child pedestrian deaths, only one study in this area specifically targeted socially deprived groups. This point is not exclusive to childhood accidental injury. Scrutiny of the National Research Register has revealed very few studies that explicitly investigated accidental injury in relation to inequalities (Ward and Christie, 2000).

Accidental injury in children – research recommendations

General areas

As a result of extensive work concerned with childhood accidental injury, Towner (2001) and Towner et al. (2001) propose research in the following areas:

- There is an urgent need to update our knowledge of accidental injury among 15 to 24 year olds
- Further studies are also required about 12 to 14 year olds
- More studies are needed in the areas of sports and leisure injuries, drownings, falls, child agricultural injuries and community first aid
- Community based injury prevention programmes need to be evaluated
- Different approaches need to be included: child-to-child, use of incentives to change behaviour, tailored health education materials, benefits of programmes

- Research is required to inform how evidence can best be turned into practice
- Comparative research is necessary that employs the same research design in different countries.

Inequalities

Specifically, Dowswell and Towner (2002) noted that:

- For injuries in the road environment there is a striking lack of evidence
- There is limited evidence concerning the effects of cycle helmet programmes on different population subgroups
- There have been no evaluated interventions where environmental changes (eg cycle paths) have been used to reduce the exposure of socially deprived children to injury risk
- There is little information about the differential effect of in-car restraint use campaigns with families in different economic and social circumstances
- There is little evidence that the presence of safety devices (eg electric socket covers, cupboard locks) have any effect on injury risk
- There is very little evidence relating to the effectiveness of interventions to:
 - Increase access to services
 - Achieve broader economic change
- There is also little information on the reach/penetration of different programmes
- Much more evidence is needed about the impact of community wide campaigns, broader policy change and strategies to increase the reach of health promotion campaigns on deprived groups.

Cost effectiveness

- The cost and benefits of injury prevention interventions should be evaluated (Towner, 2001). With the exception of road traffic accidents, there is a lack of cost effectiveness work.
- There is a need to examine the cost effectiveness of interventions to reduce inequalities in childhood home injuries (Kendrick, 2001).
- A systematic review that targets cost effectiveness as the primary focus of inquiry is required to examine the cost effectiveness of interventions. This will also more clearly identify gaps in primary research involving the cost effectiveness of a range of interventions.

Accidental injury in older people

'Over 50% of accidental injury deaths, and over 60% of serious accidental injury, occur in people aged 65 and over.' (Cryer, 2001a)

Rates of accidental injury that result in hospitalisation or fatality are higher for older people, compared to all other age groups (Cryer, 2001a). Almost half of fatalities from accidental injuries (and the majority of non-fatal injuries) occur in the home; a quarter occur on the street/highway and nearly a fifth occur in residential institutions (Cryer, 2001a).

Much research, and consequently the evidence base relating to accidental injury in older people, tends to be organised around falls, road traffic accidents and domestic fires.

Falls

Single intervention prevention – some tailored home exercise programmes have been found to reduce falls in women aged 80 and over living in the community (Cryer, 2001a).

Multi-faceted intervention prevention – programmes based on falls risk factor assessment and tailored intervention (most of which include some form of exercise), in selected groups of at-risk older people, reduce falls. Attention to postural hypotension, number of medications, balance, transfers and gait is particularly effective, and interventions should be targeted at both intrinsic and environmental risk factors for individual patients (Cryer, 2001a).

Home assessment – home assessment and surveillance can reduce falls in frail older people. This can be carried out by a variety of healthcare workers or volunteers. Home assessment of function, with education in risk areas, and referral to the patient's GP, reduces falls. Identification of patients who attend A&E because they have fallen, with subsequent medical and OT assessment and with referral and follow-up, reduces falls (Cryer, 2001a).

Residential institutions – assessment of residents after falling with recommendations for specific preventive measures decreases falls. Assessment of residents after falling by a nurse practitioner, including laboratory test, electrocardiogram, and 24-hour Holter heart monitoring, decreases hospitalisation. There is also evidence that falls

risk assessment and modification in residential homes can reduce some risk factors for falling (postural hypotension and poor visual acuity), with weak* evidence of a reduction in rate of falling (Cryer, 2001a).

Hip protectors – hip protectors can substantially reduce hip fractures in older people in nursing homes (Cryer, 2001a). A recent systematic review (Parker et al., 2001) reports that hip protectors reduce the risk of hip fracture in selected high-risk populations. However, generalisation of results beyond high-risk populations is unknown and acceptability remains a problem.

Osteoporosis: prevention and treatment – a number of interventions have been found to prevent fracture in postmenopausal women.

- Biophosphates reduce the incidence of new fractures in older women with pre-existing vertebral fractures and reduce bone loss and prevent fractures in postmenopausal women on corticosteroids (Cryer, 2001a).
- Alendronate sodium prevents non-vertebral fractures in women with osteoporosis aged 42 to 85 who have been menopausal for at least four years (Cryer, 2001a).
- Calcitonin appears to be effective in preventing osteoporosis fractures in 68 to 72 year old women with low bone density (Cryer, 2001a).
- Calcium and Vitamin D supplements:
 - Can reduce fractures in older women in nursing homes
 - Result in reduced bone loss and less fractures in older people living in the community (Cryer, 2001a).
- There is consistent evidence from observational studies that physical activity is protective against hip fracture. Observational study evidence suggests that thiazide diuretic users have a 20% reduction in fracture risk and that long-term use may reduce fractures by a similar amount (Cryer, 2001a).
- There is weak evidence that stopping smoking may reduce osteoporotic fractures (Cryer, 2001a).

* The terms 'strong' and 'weak' refer to judgements made by Cryer (2001a) about the quality of research evidence the author examined. The author's definition of 'strong' was predominantly based on at least one randomised controlled trial with no contradictory evidence; the author's definition of 'weak' was predominantly based on no stronger evidence than observational studies.

On the road

General – there is a wide range of general road policies that are applicable to reducing accidents in older people, such as avoiding alcohol before driving, random breath testing, seat belt use, speed limit enforcement, area-wide traffic management schemes, and fitting vehicles with pedestrian protection features (Cryer, 2001a).

Older pedestrians – reduction of risk to older pedestrians (as well as disabled people) can result from a range of interventions, such as traffic calming, low speed limits, pedestrian areas, pedestrian crossing design, reducing kerb heights and audible signals and stippled stones at crossings (Cryer, 2001a).

Car occupants – interventions particularly beneficial for older car occupants include encouraging the use of automatic transmission cars (in advance of cognitive decline); designing signals and road markings for the more limited capabilities of older drivers; replacing junctions with roundabouts and provision of right turn lanes; identifying and correcting health and physical functioning problems (vision, medication review, joint stiffness); encouraging eye tests every two years; advice on tiredness, alcohol and medicines (Cryer, 2001a).

Domestic fires

Smoke alarms – there is strong evidence that the use of smoke alarms will reduce burn injuries. Effective smoke alarms for older people are most viable when they are hard wired or include a battery with at least a ten-year lifetime (Cryer, 2001a).

Electric blankets – there is weak evidence that the replacement of electric blankets that are over ten years old would prevent many electric blanket fires (Cryer, 2001a).

Clothing fires – there is weak evidence that clothing fires among older people can be reduced through the use of electric rather than gas hobs, and use of an electric kettle to make hot drinks rather than the hob (Cryer, 2001a).

Community interventions – evaluation of a number of small-scale initiatives, using before and after methods and surveys, provides evidence that community based interventions can be effective in reducing fire-related injury (Cryer, 2001a).

Inequalities and older people

While there is a geographic variation in falls, and in prevention activity, rates of falling for older people do not appear to increase with deprivation (Cryer, 2001a). Survey data reveals that fires are more likely to occur in lower income and rented households (Cryer, 2001a).

It should be acknowledged that social class gradients relating to accidental injury in older people are not necessarily the same as in other sectors of the population. But there is very little research relating to inequalities in accidental injury among older people and in respect of preventive activity.

Accidental injury in older people – research recommendations

- There is a causal pathway for falls and falls-related injury among older people that has not been adequately elucidated and the evidence should be used to describe this in a systematic way (Cryer, 2001b).
- There is a need for validated risk factor assessment tools/instruments to identify people at high risk of falling, and to identify modifiable risk factors among those high-risk individuals (Cryer, 2001b).
- There is a need to know which subgroups of older people should be targeted for (and who would benefit most from) falls prevention strategies (Cryer, 2001b).
- There is a need to investigate what should be the components of a falls prevention programme; which risk factors are modifiable; whether modification of risk factors results in a reduction in fall rate, and what is the most effective and feasible method for modifying these risk factors (Cryer, 2001b).
- Research is needed to ascertain what might be the most effective strategies for increasing the participation of older people in multi-faceted prevention programmes and in physical activity programmes (Cryer, 2001b).
- There is a need to research the role of hip protectors in preventing fractures in persons who have fallen or who are at risk of falling; this must focus on older people in their homes and those living in institutions, and should investigate what might be the most effective and acceptable designs. Further research may be needed to develop new designs of hip protectors that are effective and acceptable (Cryer, 2001b).
- Research is needed to investigate the effectiveness of the National Service Framework for Older People (NSF-

OP) – what effect it is having, whether the effect is the same in all parts of the country, and what factors influence effectiveness (Cryer, 2001b).

- A range of research needs are required in the area of road traffic accidents, as identified in a recent OECD report (OECD, 1998, in Cryer, 2001b).

Inequalities

- A systematic review that targets inequalities as the primary focus of inquiry is required to examine the effectiveness of interventions in different social groups. This will also more clearly identify gaps in primary research involving a range of social groups.
- Research is required to investigate the association (if any) between accidents and poverty/deprivation and ethnicity among older people. Work is also required to describe and explain geographic variations in accidental injury rates among older people (Cryer, 2001b).

Cost effectiveness

- A systematic review that targets cost effectiveness as the primary focus is required to examine the cost effectiveness of interventions across the range of injuries incurred by older people. This will also more clearly identify gaps in primary research involving the cost effectiveness of a range of interventions.
- The cost effectiveness of guidelines and strategies (including the NSF-OP) should be investigated (Cryer, 2001b).
- No studies in a recent systematic review included a cost analysis of hip protectors, or were able to show that these were cost effective, although two ongoing studies include an economic evaluation (Parker et al., 2001).

Other findings

Inequalities

Evidence suggests that residential areas with higher ratios of lower socio-economic groups have higher accident rates, especially for children (Raine et al., 2000). However, very few injury prevention strategies have been designed to meet the needs of the most disadvantaged communities (BMA, 2001).

There is a need to know where social gradients are steepest, where they are shallow, and where they can be made less steep; and to identify how the inequalities

are different for different accident types, geographical regions and ethnic groups (Ward and Christie, 2000). More research is needed to increase understanding of how deprivation affects and complicates the response to injury and its subsequent treatment (Ward and Christie, 2000).

Cost effectiveness

There is a need to extend the evidence base for effective injury prevention to include details of cost effectiveness, including an urgent need for research into effectiveness and cost effectiveness of rehabilitation interventions to ensure that victims have the best possible chances of recovery (BMA, 2001).

Rural areas

There are gaps in the evidence base relating to accidental injury in rural areas (Ward and Christie, 2000).

Staying healthy, protecting health and reducing risk

Staying healthy, protecting health and reducing risk are identified as actions to reduce accidental injury in *Saving Lives: Our Healthier Nation* (see Ward and Christie, 2000). To meet these criteria more research is needed (Ward and Christie, 2000).

Improving outcomes

More needs to be known about the ways in which both the delivery of more effective treatment services for recovery, rehabilitation and care, and the ways in which cooperation between these services can improve outcomes (Ward and Christie, 2000).

The information infrastructure

Overseas work has highlighted the need to have an adequate information infrastructure to monitor, and respond to, the incidence of accidental injury (Ward and Christie, 2000; Mulder, 2001). There is a need to ensure that evidence is collected, collated and disseminated in a manner that is usable and accessible to all agencies and parties involved in accidental injury research (Ward and Christie, 2000).

The research infrastructure

There is a need to provide training and guidance to the research community on how to disseminate its research findings so they can be translated into practice, and to train local professional people in research methods and encourage bids for funds (Ward and Christie, 2000).

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1 Aims of this briefing

This briefing summarises a number of reviews of the evidence relating to the reduction and prevention of accidental injury in children and older people. Accidents are a leading cause of preventable death and ill health. Through appraisal of relevant research evidence, the aims of this document are to:

- Highlight what measures, including interventions, have the potential to prevent or reduce accidental injury
- Identify gaps and inconsistencies in the evidence and provide a steer on future research commissioning.

Longer-term aims include using this review to provide advice on the setting of standards and on practice that will target health promotion and accident prevention most effectively. A specific long-term aim is to narrow the inequalities associated with accidental injury.

It is recommended that this briefing is read in conjunction with the Accidental Injury Task Force Report (Department of Health, 2002).

2 Introduction

2.1 The background

Prevention and reduction of accidental injury is a national concern. The white paper, *Saving Lives: Our Healthier Nation* (Department of Health, 1999), identifies accidental injury as one of four government priorities for action and sets targets to reduce rates of death and serious injury associated with accidents. In March and November 2001, two major conferences were convened by the Department of Health, the Royal Society for the Prevention of Accidents and the Child Accident Prevention Trust (Department of Health, 2001a) to review evidence on the prevention of accidental injury.

2.2 The problem

Accidental injury is a major cause of mortality and morbidity. The causes of accidental injury are multi-factorial. While age, and particularly maturation or degenerative processes, can influence the likelihood of particular types of accidents, environmental (eg roads), behavioural (eg engaging in sports) and structural (eg resources; stair gates/smoke alarms) factors can also influence the likelihood of incurring accidental injury.

These factors are highlighted in *Saving Lives: Our Healthier Nation* (Department of Health, 1999), as follows:

- Accidental injuries are responsible for 10,000 deaths a year in England
- Accidents are the greatest single threat to life for children and young people and put more children in hospital than any other cause
- Children up to the age of 15 years from unskilled families are five times more likely to die from accidental injury than those from professional families

- Falls are a major cause of death and disability for older people (3,000 people aged 65 and over die each year)
- One third of accidental injuries to adults and about half of all deaths among children under five occur in the home
- Every year, about 800,000 people are injured while playing sport, 215,000 of whom are children
- There were nearly a third of a million road accident casualties in 1998 of whom more than 3,500 died; half these deaths occurred on rural roads
- Rates of fatal accidents for 15 to 24 year olds are higher in rural areas
- Twenty million working days are estimated to be lost from work-related injury and illness, one million of them from trauma.

Morbidity and mortality associated with accidental injury is predicted to rise. The World Health Organization suggests that by 2020 injury will account for the largest single reason for loss of healthy human life-years (see Towner et al., 2001). In the UK non-fatal injury results in 720,000 people being admitted to hospital per year and in more than six million visits to accident and emergency (A&E)* departments (BMA, 2001).**

The estimated cost of injury in England to the NHS (including poisoning and intentional injury) in 2000-01 was £2.2 billion. In 1996 the cost to society of home accidents in the UK was estimated at £25 billion per year. The value of preventing road traffic accidents in the UK in 2000 was estimated at £12.2 billion (Department of Health, 2002). The total economic cost of accidental injuries in London is estimated at £19.7 billion, which includes lost earnings and other indirect costs. Direct costs for health and social care are estimated at £290 million and for the criminal justice

* See Glossary for terms used in this briefing.

** Department of Trade and Industry 2000 figures.

system, £17 million (Mallender et al., 2002). Using DALYs (Disability Adjusted Life Years), it is estimated that in the UK disability from injury is responsible for a considerably greater burden of potential healthy life-years lost than from cancer, or heart disease and stroke (BMA, 2001). Furthermore, these lost healthy life-years primarily relate to people of working age (BMA, 2001). In the field of road safety, since 1988 the Department of Transport has valued road accidents using a Willingness to Pay approach (Transport Research Laboratory, 1995). Drawing on surveys of what the public would be willing to pay for reductions in risk, a value of £1,207,670 is placed on avoiding death; £141,490 on avoiding a single serious injury, and £13,940 on avoiding a single slight injury* (BMA, 2001).

While everyone is at risk of injury, the evidence reveals that the poorest in society are at greater risk (BMA, 2001). The gap between the richest and poorest widened during the 1980s and the early 1990s (BMA, 2001).

In addition to environmental, behavioural and structural factors (see above), propensity to risk also includes personal factors (eg demographic), socio-economic factors (eg poor housing, unemployment) and lifestyle factors (eg speeding, vehicle restraint use, substance misuse). Only a small amount of injury is caused by risky behaviour (BMA, 2001).

Injury prevention may be primary (ie the prevention of circumstances that lead to injury), secondary (ie the prevention or reduction of injury severity in incidents that do occur), or tertiary (ie the optimal treatment and rehabilitation of the injured individual to minimise the impact of injury) (BMA, 2001). Approaches to preventing accidental injury broadly relate to education (eg provision of information and training); the environment (eg modification of products/environment, or use of additional safety devices); and enforcement (eg regulations, legislation). The most effective strategies use a combination of such approaches (BMA, 2001).

The implementation of injury prevention intervention requires action at an individual, local and national level. Examples of these are outlined in *Saving Lives: Our Healthier Nation* (Department of Health, 1999) and the Accidental Injury Task Force Report (Department of Health, 2002).

* Department of Environment, Transport and the Regions 1998 figures.

2.3 The nature of the assessment of the evidence

This briefing draws on a range of documents, including systematic reviews and critical reviews of accidental injury. Systematic reviews are particularly important in indicating what interventions have the potential to prevent and reduce accidental injury. Critical and narrative reviews provide essential supplementary evidence. There may, for example, be evidence to suggest that interventions such as protective appliances (eg cycle helmets, hip protectors) have the potential to reduce accidental injury. However, it is also necessary to ensure that individuals readily accept use of these devices, so the reasons for non-compliance and how uptake can be increased are also important factors. In summary, we agree with Roberts who has argued:

'The final stage in the information chain leading to injury reduction will always be the evaluation of the effectiveness of injury prevention programmes [and that] these should be a priority for injury prevention research.' (Roberts, 2001)

We also acknowledge contributions from evidence collected using a wide range of methods.

2.4 Characteristics of accidental injury assessment

Research on accidental injury is made complex by a variety of factors. For example, there is no consensus about definitions of severity of injury. *Saving Lives: Our Healthier Nation* (Department of Health, 1999) defines serious injury as an inpatient stay of more than three days; however, additional measures are called for (Cryer, 2001b). There is also debate about how research outcomes relating to the prevention and reduction of accidental injury should be measured and surrogate measures are often used (eg observed use of seat restraints). Assessment can include a range of general or health outcome measures. General outcome measures may include changes in attitudes, knowledge, behaviours or hazard reductions. Health outcome measures may include hospital data (eg changes in A&E, admission or discharge data relating to cycling injuries, head injuries etc). While the nature of outcomes may be observed, they may also be based on reported criteria (eg cycle helmet use/cycle helmet sales can be observed and/or reported). Of profound

importance is that there is a lack of reliable measures of outcomes relating to non-fatal injury. Consequently, some outcome measures are only proxies for non-fatal accidental injury (eg hospital admissions of more than three days denoting 'severe' injury) (Towner et al., 2001).

Interventions to prevent or reduce accidents can include a range of designs, including randomised controlled trials; controlled trials without randomisation, and before and after designs. The unit of analysis may vary (eg randomisation of individuals, groups, organisations, locations and/or areas). Linked to this, target sampling can be organised around individuals (eg those sustaining an accident), groups of individuals (eg pupils, disadvantaged parents), institutions (eg schools, residential homes), or geographic locations (eg urban, rural locations).

Delivery of interventions depends on the nature and aims of the study. Sites of delivery can include the home, child health clinics, public health clinics, hospitals, the school environment, residential homes and wider community based population studies. Modes of delivery can include neighbourhood and media campaigns, policy interventions and regulations, and legislation. A conceptual framework of intervention evaluation, 'The Safety Promotion Matrix', has recently been developed to organise literature on different types of interventions (Svanström and Haglund, 2000).

There are certain settings and environments in which specific sections of the population may be more likely to incur particular types of accidental injury. For example, the road environment has been associated with cyclists incurring head injuries. Some types of injury are common to certain sub-populations. So both the young and older people have been associated with accidental injury as a result of falls. The environment in which such falls occur may be common to both such sub-populations (eg the home), or be distinctly different (eg playgrounds and residential care homes). Importantly, distributional issues may also be associated with the likelihood of incurring some injuries. Disadvantaged sectors may lack certain resources that help prevent accidental injury. Absence of smoke detectors in rented accommodation is an example.

In summary, the characteristics of the population, the setting and environment, and the type of accidental injury sustained have interrelated associations and many configurations are possible.

Several additional points need to be made. First, while interventions may decrease rates of accidental injury in one area, they may unintentionally increase accidental injury in another area (Roberts, 2001; Towner and Dowswell, 2001). As Roberts (2001) remarks:

'A rise in injury occurrence is quite consistent with the implementation of an effective injury prevention intervention.'

For example, a Danish study (Jørgenson, 1985) reviewed by Towner and colleagues (2001) found that while cycle tracks decreased accidents involving cycle users and car users, accidents involving cycle users and other road users (eg pedestrians and other cycle users) increased. Second, trends in accidental injury are influenced by trends in other areas. For example, declining childhood pedestrian death rates (for the period 1985 to 1992) occurred at the same time as average distances walked by children declined (Roberts et al., 1998, in Towner and Dowswell, 2001). Third, 'global outcomes' of interventions are important (eg the reduction of serious injury relative to minor injury). Linked to this are cost effectiveness issues whereby scarce resources should be targeted at cost effective measures (Roberts, 2001). Fourth, injury rates are not solely contingent upon prevention activities. They are influenced by economic and social factors over which there may be little control (Roberts, 2001). Indeed, reducing and preventing accidental injury are related to attitudes and behaviours; to factors at individual, group, community and policy levels; to socio-economic and environmental issues; and also to the ways in which these areas interact.

2.5 The questions

Our starting point is *'to provide information that will lead to a sustained reduction in the burden of injury, whether measured in terms of mortality, morbidity, disability, or cost of injury'* (Roberts, 2001). The framework adopted in this briefing identified four key steps (Towner et al., 2001):

- Determining the problem
- Identifying the factors
- Assessing what preventive/reduction measures can be instigated
- Implementing the most promising interventions on a broader scale.

This framework was used to develop a number of questions. In relation to the final point, however, in many areas interventions require further assessment to demonstrate their effectiveness for wider implementation. With this in mind, a range of work (eg Cryer, 2001a, 2001b; Hayes and Towner, 1998; Kendrick, 2001; Ward and Christie, 2000) was appraised in relation to what additional research might be necessary to strengthen the accidental injury prevention/reduction evidence base.

Within the framework (Towner et al., 2001), this briefing therefore addresses a series of questions as follows:

- To what extent is accidental injury associated with mortality and morbidity? (Determining the problem)
- What factors contribute to accidental injury? (Identifying the factors)
- How effective are interventions in preventing accidental fatality and injury? How strong is the evidence? How timely is the evidence? (Assessing what preventive/reduction measures can be instigated)
- Are there any gaps and inconsistencies in the evidence? What additional research might be necessary to strengthen the accidental injury prevention/reduction evidence base? (Implementing effective interventions on a broad scale)

Distributional issues (ie inequalities) and the cost effectiveness of interventions were also considered in relation to the questions above.

2.6 Methods and audit trail

The following protocol was adopted in preparing this briefing:

- Systematic reviews (eg Dowswell and Towner, 2002; Parker et al., 2001; Towner et al., 2001) and strategic documents (eg Hayes and Towner, 1998; Ward and Christie, 2000) were scrutinised
- Specialists (Cryer, 2001a; Easterbrook et al., 2001; Towner and Dowswell, 2001) were commissioned to compile expert critical review syntheses based on original research, systematic reviews, guidance documents and strategic documents (a selection of these references appear in Appendix A)
- A series of meetings was convened to consult with a reference group, which resulted in additional summary

papers from a number of parties (Cryer, 2001b; Kendrick, 2001; Towner 2001)

- The material gathered from these sources was compared, key findings were collated and gaps and inconsistencies were identified
- The framework outlined by Towner et al. (2001) was used to develop the questions addressed in this briefing (see Section 2.5) and the work of a range of specialists (eg Cryer, 2001a, 2001b; Dowswell and Towner, 2002; Easterbrook et al., 2001; Hayes and Towner, 1998; Kendrick, 2001; Ward and Christie, 2000) was appraised in relation to what additional research might be necessary to strengthen the accidental prevention/reduction evidence base
- The reference group who contributed to this briefing was invited to evaluate its content.

The process included consideration of the characteristics of target populations (eg individual, groups, population); the level of intervention (eg organisational, policy); the design of intervention approaches (eg randomised controlled trials, before and after design without randomisation and/or control groups); the outcome measure(s) adopted (eg behavioural change, injury rates); the timeliness of original and review research and the volume of original research. The proportion of research output stemming from the UK compared to overseas was also appraised in line with recommendations that interventions shown to be effective overseas should be evaluated and costed in the UK (Cryer, 2001b).

Points considered included the volume of studies that have targeted disadvantaged groups and issues of cost effectiveness. As a range of different types of documents were used (eg systematic and critical reviews), information relating to all of these factors was not readily available within each of the sub-population and topic areas discussed (eg older people/domestic fires); however, where readily accessible, these are outlined.

The evidence presented in this briefing has been collated from a range of recent robust reports including critical or systematic reviews of interventions designed to reduce or prevent accidental injury. The term 'robust' relates to methodologically sound evaluation principles, which designate criteria and strategies for identifying research, selecting studies, monitoring and extracting data, assessing quality of evidence and synthesising data (eg Altman et al., 2000; CRD-DARE, 2000; CRD, 2001). Where relevant, reviews were cross-referenced to avoid duplication.

For example, the results of a recent systematic review on interventions for falls in older people (Gillespie, et al., 2001)* were incorporated into a subsequent critical review by Cryer (2001b), so the latter served as the principal source. In addition, more recent material (eg Parker et al., 2001)** and strategic documents of research priorities were also scrutinised (eg Ward and Christie, 2000). The final product is a synthesis of the evidence, and gaps and inconsistencies in the knowledge base, relating to the prevention and reduction of accidental injury, as reflected by expert review.

Statements in this briefing relating to the strength of the overall evidence are based upon the terminology adopted in source documents. For example, Towner and colleagues (2001) use distinctions such as 'some evidence', 'reasonable evidence' and 'good evidence'*** to reflect the degree of quality of evidence from individual studies. In contrast, Cryer (2001a) uses an alternative range of terminology regarding evidence of effectiveness****.

For this briefing, four points are of note. First, to ensure that the authors' views have been conveyed correctly, evidence-based statements and research recommendations reflect the authors' original text. Second, the listing does not reflect a hierarchical order. Third, all evidence statements and research recommendations are referenced, to provide an audit trail. Fourth, it is important to note that although there are inevitable gaps and inconsistencies in the evidence base, this should not be taken to mean that the general public health messages derived from the evidence are insecure. Although there is certainly a need for more and better research in some areas and this report highlights them, the general direction for prevention interventions is clear.

The principal documents used to identify the strengths of the evidence were:

- Cryer, C. (2001a). *What works to prevent accidental injury among older people*. HDA report, London.
- Cryer, C. (2001b). *Developing the future of public health research relating to accidents and unintentional injury* – Support for the development of a brief to be submitted to the Department of Health. Paper to the HDA, London. Centre for Health Services Studies, University of Kent.
- Dowswell, T. and Towner, E. (2002). Social deprivation and the prevention of unintentional injury in childhood: A systematic review. *Health Education Research* (17) 2: April.
- Easterbrook, L., Horton, K., Arber, S. and Davidson, K. (2001). *International review of falls in older people*. A report for the Health Development Agency (HDA) and Department of Trade and Industry (DTI). London: Department of Trade and Industry.
- Kendrick, D. (2001). *Priorities for research in the area of childhood home injuries and inequalities*. Paper to the HDA, London.
- Towner, E. (2001). *Informing the future direction of research in the area of accidents and unintentional injury*. A paper prepared for the HDA. Department of Child Health, University of Newcastle upon Tyne.
- Towner, E., et al. (2001). *What works in preventing unintentional injuries in children and young adolescents? An updated systematic review*. HDA, London. Department of Child Health, University of Newcastle upon Tyne. www.hda.nhs.uk/downloads/pdfs/prevent_injuries.pdf
- Ward, H. and Christie, N. (2001). *Strategic review of research priorities for accidental injury*. Report for the Department of Health. Centre for Transport Studies, University College London and Transport Research Laboratory, Berks.

* The Gillespie and colleagues review (2001) was last substantially updated on 26/8/97.

** The Parker and colleagues review (2001) was last substantially updated on 1/3/01.

*** Towner and colleagues' definitions were informed by the British National Health Service's Centre for Reviews and Dissemination guidelines on carrying out systematic literature reviews (Arblaster et al., 1995) and the use of data extraction forms and reviewers' consensus decisions.

**** Cryer's (2001a) definition of 'strong' was predominantly based on at least one randomised controlled trial with no contradictory evidence; the author's definition of 'weak' was predominantly based on no stronger evidence than observational studies.

2.7 Definitions

This briefing adopts the term 'accidental injury' to describe 'injury occurring as a result of an unplanned and unexpected event which occurs at a specific time from an external cause' (Ward and Christie, 2000). This definition incorporates 'unintentional'. The term 'injury' is relative to an event that leads to mortality and/or morbidity (eg impairment with resulting disablement). However, the argument and debate about definitions continues

(see Davis and Pless, 2001). 'Intentional injury' (eg deliberate self harm) is excluded from this review. 'Injury reduction' is relative to both reductions in the number of cases of injury and reductions in the severity of injuries. 'Behaviour change' has been used as a loose, shorthand term to denote measures that help to modify the behaviour of individuals to prevent and reduce accidental injury (eg restraint use resulting from legislation).

'Children' in the current briefing are largely defined as those aged 0 to 14 years of age. This reflects the age banding adopted in official (eg Department of Health, 1999) and academic publications (eg Towner et al., 2001).

Older people are defined as those over 60 years of age, although debate in this area is acknowledged. In some cases criteria apply to particular sub-groups (eg people having over-75 year old health checks) (Cryer, 2001a).

2.8 Limitations

In assessing the state of the evidence base relating to the reduction and prevention of accidental injury several points are of note (Towner et al., 2001):

- Some documents only include articles in English
- Reviews report under-representation of articles in some areas (eg product safety and engineering), which may introduce bias
- Systematic reviews rely on published evidence and yet publication policies may exclude articles with inconclusive or negative findings. Conversely, publication policies may over-represent studies with particular methodological designs (eg randomised controlled trials)
- Macro/population/policy-level measures may be difficult to assess using intervention designs
- Some interventions focusing on longitudinal change (eg poverty reduction strategies) may not have immediate effects and might well impact on accidental injury in the longer-term
- Some incremental interventions (eg product designs) may not have been formally evaluated
- Finally, as the boundary between 'accidental injury' and 'intentional injury' is often not clear, excluding 'intentional injury' (which is associated with 1,800 deaths per year) may lead to an underestimation of the burden of 'accidental injury' (Ward and Christie, 2000).

2.9 The format of this briefing

Due to the diverse approaches adopted in accidental injury research (see Section 2.4), the evidence is presented by sub-population (eg children/older people) and by topic (eg falls, sports injuries). These distinctions reflect protocols adopted in the majority of existing research and mutually inform the nature of the evidence base.

With regard to older children (over 14 years of age), there is an urgent need to increase the knowledge base about this group. Furthermore, where prevention programmes have been conducted, these have been found to be methodologically weak and evidence of effectiveness remains limited (Svanström and Haglund, 2000). Due to these shortfalls, older children/adolescents are not separately addressed.

Inequalities and cost effectiveness are addressed both within sub-population/topic sections and within a separate general section. Further parts of the briefing relate to rural areas; staying healthy, protecting health and reducing risk; improving outcomes; the information infrastructure, multi-disciplinary working, the research infrastructure, and ongoing work.

The majority of sections are underpinned by the framework outlined in Section 2.5. Namely:

- Determining the problem
- Identifying the factors
- Assessing what preventive/reduction measures can be instigated
- Identifying further research measures to strengthen the accidental injury prevention/reduction evidence base.

Section 11 outlines key points and recommendations. Appendix A details a selection of references that have been drawn upon; Appendix B details selected further reading; and Appendix C outlines a number of websites containing other relevant information. A glossary details acronyms and abbreviations.

A final issue is that the multitude of variables associated with accidental injury research can be configured in numerous ways. Where, for example, area-wide traffic management schemes appear within the evidence relating to more than one sub-population (eg children and older people), this denotes evidence directly relevant to the sub-population being discussed.

3 Children

3.1 Determining the problem of accidental injury in children

Children are particularly vulnerable to accidental injury; *'Injury is the main cause of death and a major cause of ill health and disability in childhood'* (Towner and Dowswell, 2001). Maturation processes, coupled with children's extension into new activities and environments, expose them to different risk factors at different stages of their development. Mortality rates disproportionately affect boys, compared to girls, and at years 1 to 14 accidental injury is twice as likely to result in fatality for boys than it is for girls; this increases with age. There is also a strong link between the degree of physical activity and accidental injury (Towner and Dowswell, 2001).

3.1.1 Inequalities and childhood accidental injury

A strong association between childhood injury and social deprivation has been revealed (Towner and Dowswell, 2001) and the risk of injury can increase with socio-economic deprivation (Laflamme and Diderichsen, 2000). In the UK in recent years, the gap between accidental injury mortality rates in children from advantaged and disadvantaged environments has widened (Roberts and Power, 1996, in Towner and Dowswell, 2001).

Deaths from house fires and pedestrian injuries are particularly associated with children from the most disadvantaged sectors. Fatality from residential fires is fifteen times greater for children in social class V, compared to children in social class I and for pedestrian mortality the ratio stands at five to one (Towner and Dowswell, 2001). In England, children in the 10% most deprived wards are three times more likely to be hit by a car, compared to children in the 10% least deprived wards and these higher rates in deprived areas are not simply due to the increased risk in urban areas (Grayling et al., 2002). It has been observed that within a diverse

range of international countries higher rates of pedestrian injury are found in ethnic minority children, compared to the country's normative data. It is unknown whether there are cultural differences that influence propensity to accidental injury, over and above those that follow from ethnic minority socio-economic status (Department of the Environment, Transport and the Regions, 2001).

There are also steep gradients for fatality resulting from falls, poisoning, submersion, suffocation and foreign bodies* (Roberts, 1997, in Kendrick, 2001). Evidence suggests that 'the social gradient reflects differential exposure of children to various hazards (as opposed to propensity to behave in any particular manner)' (Laflamme and Diderichsen, 2000).

Only recently has the evidence relating to inequalities and childhood accidental injury been systematically reviewed (MacKay, 1999; Dowswell and Towner, 2002). Two international reviews, one stemming from Canada (MacKay, 1999) and the other from the UK (Dowswell and Towner, 2002), have both revealed difficulties in synthesising evidence of what might be effective in preventing/reducing accidental childhood injury in disadvantaged groups. This results from the paucity of original research that targets disadvantaged individuals or groups, the lack of good quality evidence and the multiple ways in which concepts relating to disadvantage are defined and/or operationalised.

For example, MacKay focused on the relationship between childhood injury and socio-economic status (SES) (MacKay, 1999) but included a range of search terms that were not limited to occupation or income (eg poverty, underprivileged, educational achievement, ethnicity). When examining the measures of SES that had been used

* The term 'foreign bodies' refers to the ingestion or aspiration of objects or substances which are categorised as food, non-foods, toys, or parts of toys, and other 'unknown' substances (see DTI, 1999a).

in original studies, 47 different types were revealed (eg crowding, area of residency, income assistance, cooking equipment, school type), the majority of which had different operational definitions. Dowswell and Towner (2002) found a range of characteristics to define social deprivation. These included: inner city wards; certain schools, child care centres or medical settings; low income families; unmarried, teenaged, low income pregnant women; types of housing occupied; different social groups (Dowswell and Towner, 2002).

3.1.2 Cost effectiveness and childhood accidental injury

Notably, the former DETR, collaboratively with the HSE and HO, have produced values for the prevention of a road traffic accident fatality (Ward and Christie, 2000). The cost effectiveness of other interventions, however, has yet to be examined (Towner et al., 2001). The difficulties of establishing the cost effectiveness of interventions has been highlighted by Roberts (2001). He argues that in some areas it is difficult to evaluate effectiveness information because valid data do not exist, or where they do, data collection and indexing techniques are often inadequate and impede access to the kinds of information necessary. This point is, of course, not just applicable to childhood injury.

3.2 Identifying the factors that contribute to accidental injury in children

While factors that contribute to accidental injury include: familial characteristics, such as single parenthood, low maternal education, low maternal age, large family size; environmental circumstances, such as poor housing; and behavioural factors, such as drug or alcohol misuse, much research, and consequently the evidence base, is organised around environmental factors. These include, the road, the home and the leisure environments (Towner et al., 2001).

3.2.1 On the road

Roads are the leading cause of fatalities in children. Motor vehicle traffic accidents account for nearly half of all accidental injury fatalities in children (Towner and Dowswell, 2001). Fatal motor traffic accidents are sustained by children, in descending order, as follows:

- Pedestrians
- Cyclists
- Passengers.

Pedestrian fatalities occur much more frequently than cycling or passenger fatalities (Towner and Dowswell, 2001). In the UK the pedestrian road traffic accident mortality rate is twice that in the Netherlands and nearly four times that in Sweden (BMA, 2001). Comparisons of pedestrian risk between English and Dutch children have revealed that the difference is not due to English children being more exposed than Dutch children; rather, exposure rates are comparable. What differs is that in Dutch children half of pedestrian time is spent in traffic calmed/controlled areas, whereas only 10% of English children are so protected (Bly et al., 1999, in BMA, 2001). In addition, a recent OECD report suggests that in the UK, enforcement of vehicle restraint legislation is not as advanced as in other developed countries with similar legislation (Towner and Towner, 2001, in BMA, 2001).

Approaches to reduce/minimise fatalities/injuries on the road take several forms. The key ones are:

- Pedestrian
 - Skills training
 - Traffic clubs
 - General traffic education programmes, including safe pedestrian areas and safe bus boarding strategies
- Cyclist
 - Cycle training
 - Cycle helmet campaigns
 - Cycle helmet legislation
- Passenger
 - Car seat restraint campaigns
 - Car seat loan schemes
 - Seat belt campaigns
 - Seat restraint legislation.

Approaches have also included:

- Transport policies
- Traffic calming/engineering.

3.2.2 In the home

Significant fatalities and injuries occur in, or near, the home. In descending order these are sustained through:

- Suffocation and foreign bodies
- Fire and flames
- Drowning and submersion
- Falls
- Poisoning.

Scalds, which may result from fire or liquids, affect a relatively small number of casualties, but are profoundly distressing. Dependent, very young children are more vulnerable in house fires. In 1997 and 1998 the under fives represented 71% of childhood fatalities from fire (Towner and Dowswell, 2001). In the UK, household fire deaths in childhood are three and a half times those in Austria (BMA, 2001). A recent OECD report suggests that UK legislation for domestic fire protection is weak compared to other developed countries (Towner and Towner, 2001, in BMA, 2001). Furthermore, in the UK there is no requirement for cigarette lighters to be made child-resistant (BMA, 2001). With regard to drowning, the mortality to morbidity ratio is high (Towner and Dowswell, 2001). Drowning hazards include baths, ponds, swimming pools, inland waters and seas, with hazards nearer the home being more perilous. While falls account for comparatively fewer deaths, they are the leading cause of hospital visits and admissions (Towner and Dowswell, 2001). Child poisoning fatalities in the UK are more than five times those in Sweden (BMA, 2001).

Approaches to reduce/minimise fatalities/injuries in the home take several forms. The key ones relate to:

- General prevention of accidents in the home environment. These include targeting suffocation, burns and scalds, drowning, falls, poisoning, electrocution and lacerations, and include counselling, child surveillance and provision of free or subsidised safety devices such as socket covers, safety catches and smoke alarms
- Specific home accidents. These include:
 - Prevention of falls from windows (eg with use of guards)
 - Product redesign (eg fridge/freezer, plastic bags, babies cribs) to prevent suffocation, strangulation and entrapment
- Prevention of burns and scalds, including education and counselling and the provision of smoke alarms and anti-scald devices
- Burns legislation and regulation focusing on domestic product design, installation of smoke alarms and pre-set water heater temperatures
- Prevention of poisoning by education, including instruction on safe storage of substances (eg paraffin)
- Poisoning regulations relating to the packaging of medications.

3.2.3 At leisure

Injuries that occur in leisure pursuits relate to a range of environments such as the school, playground, rivers, railways, dumps etc. Approaches to reduce/minimise fatalities/injuries in the leisure environment have focused on sports injuries, playground injuries, drowning injuries, injuries from fireworks and, in Poland, poisoning from wild mushrooms. While the majority of approaches relate specifically to accidental injury sustained in the road, home and leisure environments, wider approaches that intervene at the community or mass media level have also been adopted (Towner et al., 2001).

3.2.4 Community prevention programmes

A feature of community based prevention programmes is involvement of a range of agencies (eg health, local authority, voluntary and commercial). These programmes often combine educational, environmental and policy approaches (Towner et al., 2001).

3.2.5 Mass media and training approaches

Mass media and training approaches have included television broadcasts/campaigns, delivery of safety advice by police and fire officers, and child injury prevention workshops for healthcare professionals working with families (Towner et al., 2001).

3.3 Evidence of interventions to prevent/reduce accidental injury in children

This section summarises the evidence relating to the reduction and prevention of accidental injury in children. The most up-to-date evidence is to be found in two recent systematic reviews (Towner et al., 2001; Dowswell and Towner, 2002). The first appraised 155 studies dating from 1975 to 2000 (Towner et al., 2001). Details of this work, including references to the 155 studies, is available online*. The second appraised the same primary research in relation to social deprivation (Dowswell and Towner, 2002). A number of other reviews also contribute to the evidence base (eg Hayes and Towner, 1998; Kendrick, 2001).

The following sections identify interventions designed to prevent and/or reduce accidental injury incurred on the road, in the home, within leisure environments and those delivered through wider community and mass media programmes. Following scrutiny of the data, a number of

* www.hda.nhs.uk/downloads/pdfs/prevent_injuries.pdf

points are made about the key findings, the strength of the evidence, whether the interventions led to injury reductions (eg reduction in casualty attendances) and/or behaviour change (eg wearing seat belts), the gaps and inconsistencies in the data, the evidence relating to inequalities and cost effectiveness, and the characteristics of the data (eg the volume of data relating to UK work). The convention followed in the key findings and inequalities sections uses italics to emphasise the places where more evidence is needed.

3.3.1 On the road

3.3.1.1 On the road – key findings

A recent systematic review (Towner et al., 2001) has revealed a number of points about accidental injury in pedestrians, passengers and cyclists.

Pedestrians

- Pedestrian skills training has improved children's individual and combined skills; roadside experience is a necessary feature as are programmes with specific targets. *More evidence is needed to demonstrate links with injury reduction* (Towner et al., 2001).
- There is some* evidence that traffic clubs reduce casualties. *More evidence is needed.* There is good evidence that teaching parents and children at traffic clubs, using age-appropriate materials, leads to behaviour change (Towner et al., 2001).
- Integrating educational and environmental issues (eg school-based education, fenced pedestrian areas, school crossings) have shown potential in reducing accidents. *Additional evidence based on more rigorous research is needed* (Towner et al., 2001).
- There is some evidence that adult school-crossing patrol policies reduce road traffic accidents. *More evidence is needed* (Towner et al., 2001).

Summarising what interventions work to prevent and/or reduce injuries in pedestrians:

- There is some evidence of education/enforcement aimed at drivers and behaviour change

* The terms 'good', 'reasonable' and 'some' refer to judgements made by Towner and colleagues (2001) about the quality of research evidence they examined. Their definitions were informed by the British National Health Service's Centre for Reviews and Dissemination guidelines on carrying out systematic literature reviews (Arblaster et al., 1995) and the use of data extraction forms and reviewers' consensus decisions.

- There is reasonable evidence of education aimed at children/parents and behaviour change
- There is some evidence of education aimed at children/parents and injury reduction. (Towner et al., 2001)

Cyclists

- In the case of cycle tracks, there is some evidence that these reduce some cycle injuries. *However more evidence is needed to demonstrate these links, including consideration of whether cycle tracks may increase risk of accidents with other road users* (Towner et al., 2001).
- There is now some evidence that cycle training schemes can improve safe riding behaviour (Towner et al., 2001).
- Cycle helmet education can increase the use of helmets; younger children and girls showed the greatest effects. Discount schemes facilitate uptake of cycle helmet use (Towner et al., 2001).
- Cycle helmet legislation has been associated with injury reductions; legislation supported by education increases observed helmet use. *More evidence is needed to demonstrate links between legislation and injury reduction and whether legislation discourages cycle use/exposure* (Towner et al., 2001).

Summarising what interventions work to prevent and/or reduce injuries in cyclists:

- There is reasonable evidence of cycle training and behaviour change
- There is good evidence of cycle helmet educational campaigns and behaviour change
- There is good evidence of cycle helmet legislation and behaviour change
- There is reasonable evidence of cycle helmet legislation and injury reduction. (Towner et al., 2001)

Passengers

- The loan of car safety seats is an effective strategy to increase safe transportation of children in cars, at least in the short term (Towner et al., 2001).
- Education effectively increases the use of restraints with babies and children. Increased intensity is associated with more positive outcomes; however, initial gains may not be sustained. In older children, teenagers appear less amenable to change (Towner et al., 2001).

- Legislation requiring children to be restrained in cars is associated with injury and fatality reductions and increased observed restraint use in children; *many, however, remain unprotected* (Towner et al., 2001).
- Enforcement of car passenger restraint legislation has achieved some increases in observed restraint use (Towner et al., 2001).

Summarising what interventions work to prevent and/or reduce injuries in car passengers:

- There is reasonable evidence of child restraint educational campaigns and behaviour change
- There is reasonable evidence of seat belt educational campaigns and behaviour change
- There is good evidence of child restraint loan schemes and behaviour change
- There is good evidence of child restraint legislation and behaviour change
- There is reasonable evidence of child restraint legislation and injury reduction. (Towner et al., 2001)

Summarising what interventions work to prevent and/or reduce injuries in bus passengers:

- There is some evidence of education aimed at children and behaviour change (Towner et al., 2001).

General interventions in the road environment

- There is good evidence that area-wide engineering schemes and traffic-calming measures reduce accidents; these engineering schemes are cost effective, and vulnerable road users (eg child pedestrians and cyclists) benefit from these interventions (Towner et al., 2001).

Summarising what general interventions work to prevent injuries in the road environment:

- There is reasonable evidence of area-wide urban safety measures and injury reduction
- There is good evidence of 20mph zones and injury reduction
- There is good evidence of 20mph zones and behaviour change (speed reduction). (Towner et al., 2001)

3.3.1.2 On the road – gaps and inconsistencies

In terms of gaps and inconsistencies, there are a number of general points.

- More evidence is needed to demonstrate links between enhanced pedestrian skills and injury reduction (Towner et al., 2001).
- More evidence is needed to demonstrate the link between traffic clubs and casualty reduction (Towner et al., 2001).
- School-based traffic clubs have not been found to enhance children's road safety knowledge (Towner et al., 2001).
- More rigorous research combining educational and environmental measures is needed (Towner et al., 2001).
- There is a paucity of studies assessing the effectiveness of policy interventions, such as school crossing patrols; just one study was identified, so more evidence is needed to demonstrate links between adult school-crossing patrols and reductions in road traffic accidents (Towner et al., 2001).
- More evidence is needed to evaluate the association between cycle track schemes and injury reduction; although accidents involving cyclists and cars users have been found to decrease, accidents involving cyclists with other road users (eg pedestrians/other cyclists) have been found to increase (Towner et al., 2001).
- Cycle helmet promotion programmes are more successful with primary school children, compared to secondary school children and in higher income areas, compared to lower income areas (Towner et al., 2001).
- Research is needed to examine the appropriateness of off-road skills training for younger cyclists aged 6/7 years, taking account of the difficulty in encouraging younger children to cycle, which may be inappropriate (Hayes and Towner, 1998).
- More research is needed to evaluate the effectiveness of home zones in relation to injury reduction and opportunity for play (Hayes and Towner, 1998).

A recent systematic review (Towner et al., 2001) has identified that:

- Health outcomes were not used in studies focusing on pedestrian skills training; just one traffic club study used mortality/morbidity data
- Cycling skills programmes all used behavioural outcomes; however, of 18 studies focusing on promotion of helmets, just three used health data

- No restraint loan schemes or restraint education programmes included injury data
- Studies focusing on enforcement of restraint legislation all used observation techniques
- Of all studies in the systematic review (n=155) (Towner et al., 2001), 94 related to accidents incurred on the road. Of these, 16 studies (17% of 94) were UK-based
- There are further gaps within the inequalities evidence base, as detailed in the following section.

3.3.1.3 On the road – inequalities

There are a number of points to be made about accidental injury incurred on the road and inequalities.

- Of all 'on the road' studies in a recent systematic review (n=94 of a total of 155: Towner et al., 2001), 16 (17% of 94) focused on social deprivation (Dowswell and Towner, 2002).

In addition to the key findings above (Section 3.3.1.1), the following is of note (Dowswell and Towner, 2002):

- There is good evidence that wearing seat restraints reduces the risk of injury and death, so approaches to increase use in all social groups is likely to be beneficial
- *Overall for injuries in the road environment there is a striking paucity of evidence relating to deprived groups*
- *There is limited evidence concerning the effects of cycle helmet programmes on different population subgroups*
- *There have been no evaluated interventions where environmental changes (eg cycle paths) have been used to reduce the exposure of socially deprived children to injury risk*
- *There is little information about the differential effect of in-car restraint use campaigns with families in different economic and social circumstances.*

3.3.1.4 On the road – summary of primary studies (Towner et al., 2001)

The evidence about 'on the road' interventions is underpinned by a number of primary studies. These studies are characteristically different and vary by volume, level of study intervention (eg school setting, media, legislative), intervention design (eg randomised controlled trial), timeliness and the age range of the children targeted.

A summary table of the 'on the road' primary studies reviewed by Towner and colleagues (2001) follows on p21. References to these studies are located in the source document (Towner et al., 2001), which is available online*.

3.3.2 In the home

3.3.2.1 In the home – key findings

A recent systematic review (Towner, et al., 2001) has identified the following.

- There is some evidence that smoke alarm giveaway programmes can achieve reductions in fire injuries. There is little evidence that devices to control temperatures of hot water are effective in reducing water temperatures. Education campaigns have been partially effective in increasing knowledge of burn and scald prevention, *although there is little evidence that education alone has achieved reductions in injuries* (Towner et al., 2001).
- All studies focusing on burns legislation/regulation (n=3) reported reductions in injury rates, *although associations between smoke alarm installation and death rates were not clear*. Improved product design has been associated with reductions in specific burn and scald injuries. *More evidence is needed to demonstrate links between smoke alarm and hot water heater legislation and burn and scald injuries* (Towner et al., 2001).

Summarising what interventions work to prevent and/or reduce burns and scalds:

- There is good evidence of smoke detector programmes and injury reduction
- There is good evidence of smoke detector programmes and behaviour change
- There is some evidence of tap water temperature reduction and injury reduction
- There is some evidence of tap water temperature reduction and behaviour change
- There is some evidence of parent and child education and behaviour change. (Towner et al., 2001)

- Interventions to increase the safe storage of non-medicinal poisons may be an effective means of preventing poisoning injury. *More evidence is needed*. Educational interventions aimed at children and

* See www.hda.nhs.uk/downloads/pdfs/prevent_injuries.pdf

On the road – data characteristics by area (Townner et al., 2001)

Study focus	Number of original studies	Level of intervention	Intervention design	Date of original research	Age range of children targeted/focus
Pedestrian skills training	10	School (n=7); other (n=3)	RCT (n=2); controlled without randomisation (n=5); before and after intervention (n=3)	1987 to 1997	4 to 10 years
Traffic clubs	5	School (n=1); home (n=4)	RCT (n=1); controlled without randomisation (n=4)	1981 to 1995	3 to 7 years
General traffic education programmes	7	School (n=6, of which one included mass media coverage); community (n=1)	RCT (n=2); controlled without randomisation (n=3); before and after intervention (n=2)	1984 to 1996	3 to 14 years; includes one study to age 18 and one study that also targeted drivers
Transport policies	1	Policy (n=1)	Controlled without randomisation (n=1)	1988	'School-aged children'
Traffic calming/engineering	6	Roads by areas/cities, inc. engineering measures (n=6)	Controlled without randomisation (n=3); before and after intervention (n=3), including one involving over 200 sites	1982 to 1996	Children; vulnerable road users; general population; road environment; cities; communities
Cycle skills training	3	School (n=3)	RCT (n=2); controlled without randomisation (n=1)	1994 to 1998	8 to 10 years
Promotion of cycle helmets	18	School (n=15, of which 5 included a community media campaign); community/media/information alone (n=1); healthcare based (n=2)	RCT (n=5); controlled without randomisation (n=9); before and after intervention (n=1); time series study (n=1); prospective observation (n=1); review (n=1)	1988 to 2000	Children to age 18, parents, communities, general population
Cycle legislation	5	Legislative (n=5)	Controlled without randomisation (n=4); before and after studies (n=1); observational studies (n=6)	1991 to 1997	1 to 17 years; communities; rural and urban settings; general population (contingent on whom legislation is applicable to, eg children or adults)
					(cont.)

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On the road – data characteristics by area (Townner et al., 2001) (cont.)

Study focus	Number of original studies	Level of intervention	Intervention design	Date of original research	Age range of children targeted/focus
Child restraint loan schemes	9	Hospital/primary care (n=9)	RCT (n=2); controlled without randomisation (n=5); before and after intervention (n=2)	1978 to 1993	Newborn to 2 years
Education to increase child restraint/seat belt use	16	School (n=5); day centre/nursery/pre-school (n=3); child health clinic/primary care/hospital (n=8)	RCT (n=9); controlled without randomisation (n=3); before and after intervention (n=4)	1976 to 1995	Children 0 to 19 years; parents; teachers
Child restraint/seat belt legislation	9	Legislative (n=9)	Before and after intervention (n=7); controlled without randomisation (n=1); time series data (n=1)	1984 to 1996	0 to 15 years (contingent upon variation in legislation)
Enforcement of car restraint legislation	5	Community/school-based with media campaigns (n=5)	Controlled without randomisation (n=4); before and after intervention (n=1)	1989 to 2000	Children up to and including school age; communities; general population

PASSENGERS

parents have been associated with increased knowledge of poisons and poison prevention. *It is not known whether these approaches achieve reductions in injuries* (Towner et al., 2001).

- There is increasing evidence that child-resistant packaging may be an effective means of reducing poisoning injury and deaths. *More research is needed in this area* (Towner et al., 2001).

Summarising what interventions work to prevent and/or reduce poisoning:

- There is good evidence of child resistant packing and injury reduction
- There is some evidence of parent education and behaviour change. (Towner et al., 2001)
- General interventions designed to prevent accidental injury in the home may lead to positive behavioural or environmental effects, demonstrated by reduction of hazards in homes. Provision of safety equipment leads to use by families. *There is little evidence of these and reductions in injuries that need medical attention in young children* (Towner et al., 2001).
- Two studies relating to specific home accidents (window guards and product redesign, respectively) reported reductions in deaths following interventions. *There is limited evidence that such campaigns are linked to reductions in injury* (Towner et al., 2001).

Summarising what general and falls-related interventions work to prevent and/or reduce injuries in the home:

- There is reasonable evidence of general product design/redesign and injury reduction
- There is reasonable evidence of general safety devices and injury reduction
- There is some evidence of falls prevention window bars (education/environmental modification/legislation) and injury reduction
- There is reasonable evidence of falls prevention window bars (education/environmental modification/legislation) and behaviour change
- There is some evidence of falls prevention parent education and injury reduction
- There is reasonable evidence of general campaigns that educate parents on hazard reduction and behaviour change. (Towner et al., 2001)

3.3.2.2 In the home – gaps and inconsistencies

In terms of gaps and inconsistencies, there are a number of general points.

- There is little evidence that campaigns to prevent general home accidents lead to any reduction in medically attended injuries in young children. While counselling, home assessment and provision of home safety equipment can achieve some positive benefits results are, overall, inconclusive (Towner et al., 2001).
- There is limited evidence that campaigns focusing on specific injuries (ie window guards and product redesign) are associated with reductions in injury (Towner et al., 2001).
- There is little evidence that burns/scalds education alone has achieved reductions in injuries. There is little evidence that campaigns involving the distribution of devices to control hot water temperatures are an effective means of reducing water temperatures; a large majority were found to have been removed due to scale build up and consequent flow impediment (Towner et al., 2001).
- More evidence is needed of legislation relating to smoke alarms and hot water heaters on burn and scald injuries (Towner et al., 2001).
- Research is needed to determine rates and ownership of correctly functioning smoke alarms (Hayes and Towner, 1998).
- More evidence is needed to demonstrate the links between safe storage techniques and reductions in poisoning injury and it is unclear whether educational interventions achieve injury reductions (Towner et al., 2001).
- Research is needed into international best practice poison prevention strategies and agent-specific prevention approaches (Hayes and Towner, 1998).
- A recent systematic review (Towner et al., 2001) has reported that a range of outcome measures have been used; however, there is a lack of evidence that burns and scald prevention measures and the prevention of poisoning by education achieve reductions in injury.
- Of all studies in the systematic review (n=155) (Towner et al., 2001), 39 related to accidental injury in the home. Of these, seven studies (18% of 39) were UK-based.
- There are further gaps within the inequalities evidence base, as detailed in the following section.

3.3.2.3 In the home – inequalities

There are a number of points to be made about accidental injury incurred in the home and inequalities.

- Of all 'in the home' studies in a recent systematic review (n=39, of a total of 155: Towner et al., 2001), 14 (36% of 39) focused on social deprivation (Dowswell and Towner, 2002).

In addition to the key findings above (Section 3.3.2.1), the following is of note:

- As children from deprived backgrounds are at particularly high risk of injury in house fires, promoting smoke alarms in deprived areas may be effective in addressing inequalities (Dowswell and Towner, 2002)
- There is little evidence that the presence of safety devices (eg electric socket covers, cupboard locks) have any effect on injury risk (Dowswell and Towner, 2002).

Denise Kendrick (2001) has also appraised research priorities in childhood home injuries and inequalities. These include:

- *Monitoring inequalities over time:*
 - *To examine trends in injury morbidity by social group over time*
- *Explaining inequalities:*
 - *To examine the relationship between exposure to risk, especially for home injuries and social disadvantage*
 - *To examine the relationship between exposure to hazards and injury occurrence*
 - *To examine the response to risk of childhood injury and post-injury survival by social group*
 - *To define area-level variables that may explain the range in injury inequalities; there is an associated need to confirm and quantify the contribution of these area-level variables, to examine the effect of varying the definition of neighbourhoods/communities, and also to examine the relationship between individual and area-level factors and exposure to risk of injury*
- *Access to and effectiveness of injury prevention:*
 - *To explore access to childhood injury prevention by social group*
 - *To examine reasons for differential access and how inequalities might be reduced*
 - *To examine effectiveness of interventions across social groups*

– *To examine the effectiveness of existing prevention activity (eg advice in child health surveillance programmes) and access to such activity by social group.*

- *Cost effectiveness:*
 - *To examine the cost effectiveness of interventions to reduce inequalities in childhood home injuries.*

3.3.2.4 In the home – summary of primary studies (Towner et al., 2001)

The evidence about 'in the home' interventions is underpinned by a number of primary studies. These studies are characteristically different and vary by volume, level of study intervention (eg school setting, media, legislative), intervention design (eg randomised controlled trial), timeliness and the age range of the children targeted. A summary table of the 'in the home' primary studies reviewed by Towner and colleagues (2001) follows on p25. References to these primary studies are located in the source document (Towner et al., 2001), available online.*

3.3.3 The leisure environment

3.3.3.1 The leisure environment – key findings

A recent systematic review (Towner et al., 2001) has revealed the following:

- Interventions focusing on safety promotion in the leisure environment have produced positive results (Towner et al., 2001).
- Playground hazards have been reduced following interventions conducted in schools (Towner et al., 2001).
- There is some evidence that interventions have resulted in reduced injury rates, including fractures (Towner et al., 2001).
- *More evidence is needed in this area* (Towner et al., 2001).

Summarising what interventions work to prevent and/or reduce drowning:

- There is some evidence of parent and child education and behaviour change
- There is some evidence of adult supervision of public pools/beaches etc and injury reduction
- There is some evidence of pool design and protection and injury reduction. (Towner et al., 2001)

* See www.hda.nhs.uk/downloads/pdfs/prevent_injuries.pdf

In the home – data characteristics by area (Townner et al., 2001)

Study focus	Number of original studies	Level of intervention	Intervention design	Date of original research	Age range of children targeted/focus
General prevention of home accidents	11	Home (n=2); primary care (n=5); community (n=4, of which 3 included media campaigns)	RCT (n=7); controlled without randomisation (n=1); before and after intervention (n=3)	1977 to 1999	Children aged under 5 years; communities
Specific home accidents	2	Legislative (n=1); at-risk areas, including media campaign (n=1)	Before and after intervention (n=2)	1977 and 1985	0 to 16 years
Prevention of burns/scalds	16	School (n=5); healthcare setting (n=4); community, including media campaigns (n=4); high risk/deprived areas (n=2); general population (n=1)	RCT (n=7); controlled without randomisation (n=3); before and after intervention (n=6)	1979 to 2000	Children 0 to 14 years; parents; general populations
Burns legislation and regulation	3	Legislative (n=3)	Controlled without randomisation (n=2); before and after intervention (n=1)	1976 to 1991	General population
Prevention of poisoning by education	5	Daycare/school (n=2); hospital (n=3)	RCT (n=2); controlled without randomisation (n=1); before and after intervention (n=1); post-intervention with control group (n=1)	1981 to 1998	Children 0 to 9 years; parents
Poisoning regulations	2	Pharmaceutical industry agreement (n=1); legislative (n=1)	Before and after intervention (n=1); time series data (n=1)	1985 to 1996	0 to 4 years

Summarising what interventions work to prevent and/or reduce play and leisure injuries:

- There is some evidence of environment improvement and hazard reduction
- There is little evidence of training schemes for adult supervision
- There is some evidence of protective equipment and injury reduction.
(Towner et al., 2001)

3.3.3.2 The leisure environment – gaps and inconsistencies

In terms of gaps and inconsistencies, there are a number of general points.

- More evidence is needed to demonstrate the association between effective interventions and accidental injury in the leisure environment (Towner et al., 2001).
- More research is needed on how drowning and near drowning can be prevented (eg in private and public pools, ponds, waterways, reservoirs and baths) (Ward and Christie, 2000).
- More research is needed on sports and leisure injuries (Towner et al., 2001) and on sports injuries from a public health view (Ward and Christie, 2000).
- Research is needed on participation rates in sports and recreation activities and exposure-specific risks for different sports (Hayes and Towner, 1998).
- More research is needed on playground injuries and types of surfacing in playgrounds (Hayes and Towner, 1998).
- Research is needed to inform which methods and interventions are most effective in reducing risk in school environments (Hayes and Towner, 1998).

- While just over half of the studies reviewed by Towner and colleagues (2001) used injury outcome data, the quality of studies was generally weak and several had no control groups.
- Of all studies in a recent systematic review (n=155) (Towner et al., 2001), seven related to accidents incurred in the leisure environment. Of these, one study (14% of 7) was UK-based.
- The extent to which ‘leisure environment’ studies have focused on inequalities is detailed in the following section.

3.3.3.3 The leisure environment – inequalities

- Of all ‘leisure environment’ studies in a recent systematic review (n=7, of a total of 155: Towner et al., 2001), *none focused on social deprivation* (Dowswell and Towner, 2002).

3.3.3.4 The leisure environment – summary of primary studies (Towner et al., 2001)

The evidence about ‘leisure environment’ interventions is underpinned by a number of primary studies. These studies are characteristically different and vary by volume, level of study intervention (eg school setting, media, legislative), intervention design (eg randomised controlled trial), timeliness and the age range of the children targeted.

A summary table of the ‘leisure environment’ primary studies reviewed by Towner and colleagues (2001) follows below. References to these primary studies are located in the source document (Towner et al., 2001), available online at:

www.hda.nhs.uk/downloads/pdfs/prevent_injuries.pdf

The leisure environment – data characteristics (Towner et al., 2001)

Number of original studies	Level of intervention	Intervention design	Date of original research	Age range of children targeted/focus
7	School (n=4, of which 1 included a community media campaign and 1 included an engineering scheme); community, including media campaign (n= 1); general population, including media campaign (n=1); playground environment (n=1)	Controlled without randomisation (n=2); before and after intervention (n=5)	1979 to 1999	Children age 12 months to high school age; parents

3.3.4 Community prevention programmes

3.3.4.1 Community prevention programmes

– key findings

A recent systematic review (Towner et al., 2001) has revealed the following.

- Community based approaches permit injury prevention messages to be repeated in different forms and contexts (Towner et al., 2001).
- Important elements of these approaches include long-term strategy, effective focused leadership, multi-agency collaboration, involvement of the local community, appropriate targeting and time to develop a range of local networks and programmes (Towner et al., 2001).
- The use of local surveillance systems (eg injury surveillance) is essential for targeting interventions, for motivating participants and for evaluating interventions (Towner et al., 2001).

Summarising what community based interventions work:

- There is reasonable evidence that programmes targeting a range of injury types in a range of different groups can impact on injury reduction and behaviour change (Towner et al., 2001).

3.3.4.2 Community prevention programmes

– gaps and inconsistencies

In terms of gaps and inconsistencies, there are a number of general points.

- Programmes must include the important elements outlined above and utilise surveillance systems (Towner et al., 2001).
- A well-evaluated trial has not been conducted in relation to community first aid for families with young children (Towner, 2001).

- Community based injury prevention programmes need to be evaluated (Towner, 2001).
- In a recent systematic review (Towner et al., 2001) gaps and inconsistencies were not a key issue. Most studies used injury surveillance data as a source of outcome. Overall, a wide variety of outcomes were used which were programme-specific.
- Of all studies in a recent systematic review (n=155) (Towner et al., 2001), 10 were assessed as 'community prevention programmes' studies. None were UK-based.
- The extent to which 'community prevention programme' studies have focused on inequalities is detailed in the following section.

3.3.4.3 Community prevention programmes

– inequalities

- Of all 'community prevention programme' studies in a recent systematic review (n=10 of a total of 155) (Towner et al., 2001), two studies (20% of 10) focused on social deprivation (Dowswell and Towner, 2002).

3.3.4.4 Community prevention programmes – summary of primary studies (Towner et al., 2001)

The evidence about 'community prevention' interventions is underpinned by a number of primary studies. These studies are characteristically different and vary by volume, level of study intervention (eg school setting, media, legislative), intervention design (eg randomised controlled trial), timeliness and the age range of the children targeted. A summary table of the 'community prevention' primary studies reviewed by Towner and colleagues (2001) follows below. References to these studies are located in the source document (Towner et al., 2001), at:

www.hda.nhs.uk/downloads/pdfs/prevent_injuries.pdf

Community prevention programmes – data characteristics (Towner et al., 2001)

Number of original studies	Level of intervention	Intervention design	Date of original research	Age range of children targeted/focus
10	General population; sub-populations including young people aged 0 to 18 years and older people	Controlled without intervention (n=9); before and after intervention (n=1)	1987 to 2000	Children aged 0 to 18; general population

3.3.5 Mass media and training interventions

3.3.5.1 Mass media and training interventions – key findings

- General mass media campaigns and training events have been shown to increase safety knowledge, *although there is no evidence that they lead to reductions in injuries* (Towner et al., 2001).

3.3.5.2 Mass media and training interventions – gaps and inconsistencies

In terms of gaps and inconsistencies, there are a number of general points.

- There is no evidence that general mass media or training events lead to a reduction in child injuries (Towner et al., 2001).
- Of all studies in a recent systematic review (Towner et al., 2001) (n=155), five related to ‘mass media and training’ studies. Of these, one (20% of 5) used injury outcome data.
- Of five studies relating to ‘mass media and training’, three (60% of 5) were UK-based.
- The extent to which ‘mass media and training’ studies have focused on inequalities is detailed in the following section.

3.3.5.3 Mass media and training interventions – inequalities

- Of all ‘mass media and training’ studies in a recent systematic review (n=5, of a total of 155; Towner et al., 2001), *none focused on social deprivation* (Dowswell and Towner, 2002).

3.3.5.4 Mass media and training interventions – summary of primary studies (Towner et al., 2001)

The evidence about ‘mass media and training’ interventions is underpinned by a number of primary studies. These studies are characteristically different and vary by volume, level of study intervention (eg school setting, media, legislative), intervention design (eg randomised controlled trial), timeliness and the age range of the children targeted. A summary table of the ‘mass media and training’ primary studies reviewed by Towner and colleagues (2001) follows below. References to these primary studies are located in the source document (Towner et al., 2001), available online at:

www.hda.nhs.uk/downloads/pdfs/prevent_injuries.pdf

3.3.6 Further conclusions about accidental injury in children

There are a number of other observations in addition to those made above.

Further general points. There is a need:

- To update our knowledge of accidental injury among 15 to 24 year olds
- For more interventions that focus on young adolescents (Towner, 2001; Towner et al., 2001)
- To know more about child agricultural injuries (Towner, 2001)
- To know more about childhood accidental injury involving falls (Towner, 2001)
- For research focusing on different approaches (eg child to child, use of incentives to change behaviour, tailored health education materials) (Towner, 2001; Towner et al., 2001).

Mass media and training interventions – data characteristics (Towner et al., 2001)

Number of original studies	Level of intervention	Intervention design	Date of original research	Age range of children targeted/focus
5	School (n=2, of which one was in a rural area and one involved a hospital setting); community, including media campaign (n= 1); mass media campaign (n=1); healthcare training (n=1)	Controlled without randomisation (n=3); before and after intervention (n=2)	1983 to 2000	Children aged 0 to 14 years; parents; healthcare professionals

- To emphasise the behavioural changes of older children, acknowledging that environmental risk broadens from the home to the road setting, the school setting and to sports and water settings (Ward and Christie, 2000)
- To determine which methods and interventions are most effective in reducing injuries in the school environment (Hayes and Towner, 1998)
- To know about the impact of interventions on the quality of life of children, adolescents and families (Towner, 2001)
- For studies that target professionals and policy makers (Towner et al., 2001)
- For studies that employ the same research design in different countries (Towner et al., 2001).

Further points about inequalities

Dowswell and Towner (2002) report that although there are strong links between accidental childhood injury and social deprivation, of 155 studies focusing on accidental childhood injury, just 32 (21%) targeted social deprivation. Dowswell and Towner (2002) revealed that:

- There is very little evidence relating to the effectiveness of interventions to:
 - Increase access to services
 - Achieve broader economic change
- There is also little information on the reach/penetration of different programmes
- Much more evidence is needed in respect of the impact of community wide campaigns, broader policy change and strategies to increase the reach of health promotion campaigns on deprived groups.

There is also a need:

- For research to focus on deprived communities (Towner, 2001)
- For more evaluated intervention studies comparing relative impacts on deprived and affluent communities (Hayes and Towner, 1998)
- For research to define more clearly high-risk populations (Hayes and Towner, 1998)
- For more descriptive studies which include social indicators (Hayes and Towner, 1998)
- For qualitative research to determine strategies for risk reduction (Hayes and Towner, 1998). This should draw on the experience of children and families in deprived communities (Towner and Dowswell, 2001).

Mackay (1999) recommends development of a coordinated research agenda that focuses on understanding the mechanisms by which socio-economic status (SES) leads to an increased injury incidence and lower uptake of safety measures.

Further points about cost effectiveness

- The cost and benefits of injury prevention interventions should be evaluated (Towner, 2001). With the exception of road traffic accidents, there is a lack of cost effectiveness work.
- A systematic review that targets cost effectiveness as the primary focus of inquiry is required to examine the cost effectiveness of interventions. This will also more clearly identify gaps in primary research involving the cost effectiveness of a range of interventions.

4 Older people

4.1 Determining the problem of accidental injury

'Over 50% of accidental injury deaths, and over 60% of serious accidental injury, occur in people aged 65 and over' (Cryer, 2001a). Rates of accidental injury that result in hospitalisation or fatality are higher for older people, compared to all other age groups (Cryer, 2001a). Almost half of fatalities from accidental injuries (and the majority of non-fatal injuries) occur in the home; a quarter occur on the street/highway and nearly a fifth occur in residential institutions (Cryer, 2001a). The burden of accidental injury in older people is described in more detail below (Section 4.2), in relation to the specific factors and topic areas that are associated with accidents in this population.

4.1.1 Inequalities and older people

The associations between social class gradients and accidental injury are not necessarily the same in older people as in other sectors of the population. The extent to which such gradients might be apparent in older people remains an empirical question as there is little literature available. Concerning falls, some evidence suggests that while there is a geographic variation in falls, and in prevention activity, rates of falling in older people do not appear to increase with deprivation (Cryer, 2001a). Concerning fires, survey data reveal they are more likely to occur in lower income and rented households (Cryer, 2001a).

4.1.2 Cost effectiveness and older people

Easterbrook and colleagues (2001) reviewed primary research in relation to the cost effectiveness of strategies to prevent/reduce falls in older people. Their findings reveal that the UK cost of treating hip fracture is estimated at £12,000 per person* with total annual costs reaching £1.7 billion by 2000**. One pair of hip protectors

* Department of Health 1994 figures.

**Department of Health 2001 figures.

costs between £23.50 and £42, of which three to four pairs are provided per year, resulting in annual costs of approximately £94 to £168 per person. This does not, however, include costs of staff time in support and encouragement (Easterbrook et al., 2001). Fitting handrails or grab rails to stairs can cost less than £50 and overseas work has suggested that providing 10 hours of unskilled labour and under \$100 (US) of materials for grab rails led to a 60% reduction in the number of falls (Easterbrook et al., 2001).

4.2 Identifying the factors that contribute to accidental injury

Risk factors associated with accidental injury in older populations include intrinsic and extrinsic factors (Cryer, 2001a; Easterbrook et al., 2001). Intrinsic factors include such things as strength, balance, gait, physical performance, physical functioning, health conditions, sensory impairment, medicines and mental functioning. Extrinsic factors include such things as surface levels, carpeting, baths, showers, lighting, steps/stairs and absence of grab bars/rails/banisters.

Much research, and consequently the evidence base relating to accidental injury in older people tends to be organised around the following topic areas:

- Falls
- Road traffic accidents
- Domestic fires.

These areas reflect the highest causes of accidental injury mortality in older people (falls 62%, road traffic accidents 13%, fire and flames 3%, respectively) (Cryer, 2001a). Information about the burden of accidental injury associated within each of these areas follows.

4.2.1 Falls

'Falls are a major cause of disability and the leading cause of mortality due to injury in older people aged over 75 in the UK' (Department of Health, 2001b). In England and Wales each year approximately 4,600 people aged 75 and over die as a result of injury, largely due to falls (BMA, 2001). New standards have been set to reduce the number of falls and their impact on older people (Department of Health, 2001b).

A recent critical review (Cryer, 2001a) reveals that at age 65 and over falls account for 71% of serious injuries (involving hospitalisation of four or more days); at age 85 and over falls account for 78% of accidental injury deaths. Fracture is diagnosed in approximately 40% of deaths and more than 50% of non-fatal injuries, with most being of the lower limbs (Cryer, 2001a). Within 50 years, the ageing population will lead to a doubling of rates of osteoporotic fractures (Cryer, 2001a). Bone mineral density (BMD) is an important risk element and is influenced by genetic and environmental factors (Cryer, 2001a).

Approaches to reduce/minimise fatalities/injuries from falls focus on:

- Physical activity, which maintains functioning and protects against injury
- Assessments in the home and residential institutions
- Hip protectors
- Osteoporosis: prevention and treatment.

4.2.2 Road traffic accidents

In 1999, 859 people aged 60 and over suffered fatalities on UK roads and 5,038 were seriously injured (Cryer, 2001a). Older people are more likely to be injured as pedestrians, drivers or passengers, or cyclists or motorcyclists, respectively (Cryer, 2001a). Of those aged 60 and above who are injured or killed on roads, 37% are pedestrians; for those aged 80 and above 61% are pedestrians (Cryer, 2001a).

Approaches to reduce/minimise fatalities/injuries from road traffic accidents focus on:

- Use of seat belts
- Speed limit reductions
- Alterations to road design (inc. calming, guard rails, pedestrianised areas, refuges at crossings, kerb heights)
- Traffic management schemes

- Car designs (including permanent lighting on cars/day running lights).

4.2.3 Domestic fires

A recent critical review (Cryer, 2001a) reveals that in the UK in 1999, 219 deaths and 3,000 casualties occurred in people aged 65 and over (Cryer, 2001a). The rate of death and injury from domestic fire, flames, heat and hot substances increases with age (Cryer, 2001). The causes of fires leading to fatality are smoking, heating, cooking and electric blankets; the causes of fires leading to non-fatal injury are cooking, smoking, electric fires and heating (Cryer, 2001a). British Crime Survey data for the year 2000 suggest that 60% of domestic fires are related to cooking (Cryer, 2001a). Loose fitting/flowing garments are frequently implicated in clothing related fires (Cryer, 2001a).

Older people aged 65 and over have six times the national average rate of fatal injury and twice the national average for non-fatal injuries resulting from electric blanket fires (Sambrook Research International, 1999, in Cryer, 2001a). Approximately 99% of electric blanket fires are believed to involve blankets that are more than 10 years old (Cryer, 2001a).

Approaches to reduce/minimise fatalities/injuries from domestic fires focus on:

- Smoke alarms
- Electric blanket replacement
- Replacing gas cooking appliances with electric versions
- Smoking prevalence.

4.3 Evidence of interventions to prevent/reduce accidental injury

This section summarises the evidence relating to the reduction and prevention of accidental injury in older people. The most up to date evidence is to be found in two recent reviews (Cryer 2001a; Easterbrook et al., 2001). A number of other reviews also contribute to the evidence base (eg Ward and Christie, 2000).

The following sections identify interventions designed to prevent and/or reduce accidental injury incurred through falls, road traffic accidents and domestic fires. Following scrutiny of the data a number of points are made about the key findings, the strength of the evidence, the gaps and inconsistencies in the data and the evidence relating

to inequalities and cost effectiveness. The convention followed in the key findings and inequalities sections uses italics to emphasise the places where more evidence is needed.

4.3.1 Falls

4.3.1.1 Falls – key findings

The most recent evidence comes from two critical reviews: one focusing on single intervention prevention measures, multi-faceted intervention prevention measures, home assessment, residential institutions, hip protectors, and osteoporosis prevention and treatment (Cryer, 2001a); and another focusing on identification and assessment of risk factors, promotion of balance and strength, support of safe mobility, provision of safe home environments, and professional and multiple interventions (Easterbrook et al., 2001). Key findings from these and other relevant work follows.

Single intervention prevention measures

- Individually tailored home exercise programmes focusing on muscle strengthening and balance retraining have been found to reduce falls in women aged 80 and over, living in the community, when:
 - Administered by a qualified physiotherapist (found to be sustainable over two years)
 - Delivered by a trained district nurse from a home health service based in a geriatric assessment and rehabilitation hospital
 - Delivered by trained nurses based in general practices (Cryer, 2001a).
- Exercise based on tai chi forms can reduce falls in older people (Cryer, 2001a); even in the short term, tai chi exercises can achieve significant health gains (Easterbrook et al., 2001).
- Exercise is effective in lowering risk in selected groups and should form part of falls prevention programmes (Cryer, 2001a; Easterbrook et al., 2001).
- Most exercise programmes without other interventions do not reduce falls in unselected community living older people (Cryer, 2001a).
- *There is no evidence that exercise programmes for nursing home residents, who are not at increased risk of falling, reduces falls* (Cryer, 2001a).
- The greater number of different drugs a patient takes, the greater their risk of falling. Drug regimes should be carefully monitored on a regular basis and individuals should receive drug-free periods of treatment wherever

possible (Easterbrook et al., 2001). Withdrawal of psychotropic medication significantly reduces the risk of falling but permanent withdrawal is difficult to achieve (Cryer, 2001a).

- Visual impairment appears to be a strong indicator of being at risk of falling; checking vision may help identify those at risk (Easterbrook et al., 2001).

Multi-faceted intervention prevention measures

- Programmes based on falls risk factor assessment and tailored intervention (most of which include some form of exercise), in selected groups of at-risk older people, reduce falls. Assessment can be made by a variety of healthcare workers or volunteers, in a variety of settings (Cryer, 2001a).
- Attention to postural hypotension, number of medications, balance, transfers and gait is particularly effective (Cryer, 2001a).
- Interventions should be targeted at both intrinsic and environmental risk factors for individual patients (Cryer, 2001a).

Home assessment

- In respect of the effectiveness of home assessments, *reviews are contradictory* (Cryer, 2001a):
 - Little evidence exists in favour of the effectiveness of preventive home visits to older people living in the community
 - Multi-factorial home assessment of older people at risk, with advice, referrals or other actions aimed at dealing with the hazards observed, had no effect
 - Home assessment and surveillance can reduce falls in frail older people. This can be carried out by a variety of healthcare workers or volunteers
 - Home assessment of function, with education in risk areas, and referral to the patient's GP, reduces falls.
- Easterbrook and colleagues (2001) report that *evidence in the area of home assessment is limited*; that no data are given for costs of home visits, nor the period of time over which these should take place, and that the importance of the emotional support and encouragement provided by professionals to older people may be underestimated.
- Identification of patients who attend A&E because they have fallen, with subsequent medical and OT assessment and with referral and follow-up, reduces falls (Cryer, 2001a).

- A programme of health promotion has been found to reduce the rate of falls-related hospitalisation. The intervention included a wide range of approaches (eg community education, policy development, home hazard reduction) and risk factors (eg footwear, vision, physical activity) (Cryer, 2001a).
- *The evidence is uncertain regarding whether assessment and modification of the home on its own is effective in reducing falls or falls injury among older people* (Cryer, 2001a).
- Older people with a history of recent falls discharged home from hospital who had an assessment of environmental hazards in the home by an occupational therapist (experienced in the care of older people), with supervision of the necessary home modifications, had lower rates of falling than a control group (Cryer, 2001a).
- In respect of safe home environments, Easterbrook and colleagues (2001) report that *more research is needed regarding types of walking surfaces and flooring*; that taking stairs out of use (eg by stair lifts, removing bedroom furniture to a downstairs room, providing a commode) can disempower older people and that changes in individual behaviour and environmental changes may be equally important. In addition, suitable lighting can help reduce falls – *however further work is necessary to investigate how lighting design can improve easy-to-change light bulb features*. While there appears to be good evidence for providing grab rails, *other home living area modifications require more research to identify their effectiveness*.

Residential institutions

- *There is no evidence that exercise programmes for nursing home residents, who are not at increased risk of falling, reduce falls* (Cryer, 2001a).
- Assessment of residents after falling with recommendations for specific preventive measures decreases falls (Cryer, 2001a).
- Assessment of residents after falling by a nurse practitioner, including laboratory test, electrocardiogram, and 24-hour Holter heart monitoring, with probable cause and therapeutic recommendation to the primary physician, decreases hospitalisation (Cryer, 2001a).
- There is evidence that falls risk assessment and modification in residential homes can reduce some risk factors for falling (postural hypotension and poor visual acuity), with weak evidence of a reduction in rate of falling (Cryer, 2001a).

- For patients on elderly care rehabilitation wards, there is weak* evidence that the rate of falling is less when there is vinyl flooring in the bed area compared with carpeted flooring (Cryer, 2001a); Easterbrook et al. (2001) report that while there may be fewer falls on vinyl than carpet, those who do fall on vinyl are far more likely to be injured than those falling on carpet. Patterned carpet should be avoided, particularly on stairs.

General

- In respect of exercise interventions generally, Laventure (2001) comments that:
 - Studies targeting older people have reported satisfactory longer-term class or group participation rates
 - Such interventions can demonstrate significant improvements in functional capacity in a relatively short space of time (also in Easterbrook et al., 2001)
 - Significant gains in strength and muscle mass can be achieved
 - Both stand-alone and combined interventions have been found to be effective in preventing accidental falls among older people.
- Easterbrook and colleagues (2001) prioritise five key interventions as successful in preventing/reducing falls in older people, as follows:
 - Strength and balance exercises
 - Shoes with thin soles and high collars
 - Grab rails and plain light-coloured stair carpets
 - Good vision (corrected if needed)
 - Regular review of medication.

Hip protectors

- Hip protectors can substantially reduce hip fractures in older people in nursing homes. However compliance, particularly in the long term, is poor. This conclusion is based on five trials of low to moderate quality (Cryer, 2001a).
- The use of hip protectors reduces hip fractures among frail older people either resident in geriatric long-stay facilities or supported by outpatient care units while living at home (Cryer, 2001a).

* The terms 'strong' and 'weak' refer to judgements made by Cryer (2001a) about the quality of research evidence the author examined. The author's definition of 'strong' was predominantly based on at least one randomised controlled trial with no contradictory evidence; the author's definition of 'weak' was predominantly based on no stronger evidence than observational studies.

- Easterbrook et al. (2001) report that *hip protectors do not appear to be particularly suited to those living in their own homes, especially if living alone*. They may be useful for a minority of older people at risk of falling who live in institutionalised settings, *but among those they will not prevent all fractures*.
- A recent systematic review (Parker et al., 2001) reports that hip protectors reduce risk of hip fracture in selected high-risk populations; *generalisation of results beyond high-risk populations is unknown; acceptability remains a problem*.
- Alendronate sodium prevents non-vertebral fractures in women with osteoporosis aged 42 to 85 who have been menopausal for at least four years (Cryer, 2001a).
- Calcitonin appears to be effective in preventing osteoporosis fractures in 68 to 72 year old women with low bone density (Cryer, 2001a).
- Calcium and Vitamin D supplements:
 - Can reduce fractures in older women in nursing homes (Cryer, 2001a)
 - Result in reduced bone loss and less fractures in older people living in the community (Cryer, 2001a)
 - *Cryer (2001a) reports there is weak evidence that a dietary increase in calcium and vitamin D will result in fewer fractures, although Easterbrook and colleagues (2001) report that there is no evidence that taking supplements will reduce the risk or incidence of falling. It is not clear that taking these supplements will significantly reduce the numbers of fractures following falls.*

Osteoporosis: prevention and treatment

- Cryer (2001a) reports that a number of interventions have been found to prevent fracture in post-menopausal women. Levels of evidence for these interventions on different parts of the body, based on A (eg evidence from meta-analysis of randomised controlled trials or at least one well-designed controlled trial without randomisation), and B (eg evidence from at least one other type of well-designed quasi-experimental study) are as follows:
 - Spine: Alendronate, A; Calcitonin, A; Calcitriol, A; Calcium, A; Cyclic etidronate, A; HRT, A; Raloxifene, A; Risedronate, A
 - Non-vertebra: Alendronate, A; Calcitonin, B; Calcitriol, A; calcium, B; calcium + vitamin C, A; Cyclic etidronate, B; HRT, A; physical exercise, B; Risedronate, A; vitamin D, B
 - Hip: Alendronate, A; Calcitonin, B; calcium, B; calcium and vitamin D, A; Cyclic etidronate, B; hip protectors, A; HRT, B; physical exercise, B; Risedronate, A; vitamin D, B. (Cryer, 2001a)
- In the absence of any established treatment for pre-menopausal women with osteoporosis, such people should be referred to specialist centres for investigation of possible underlying causes, and on advice and management (Cryer, 2001a).
- Some agents offer effective treatment for osteoporosis in men. Consideration should be given, therefore, to a specialist centre for investigation of underlying causes and advice on further management (Cryer, 2001a).
- Biophosphates:
 - Reduce incidence of new fracture in older women with pre-existing vertebral fractures
 - Reduce bone loss and prevent fractures in postmenopausal women on corticosteroids. (Cryer, 2001a)
- There is evidence that hormone replacement therapy is associated with fewer fractures, less heart disease and more breast cancer (Cryer, 2001a).
- There is consistent evidence from observational studies that physical activity is protective against hip fracture. The association appears to present from childhood to adult age, and has been seen in many different countries in spite of their very different hip fracture rates. To be among the physically active appears to reduce the risk of later hip fracture by up to 50% (Cryer, 2001a).
- Observational study evidence suggests that thiazide diuretic users have a 20% reduction in fracture risk and that long-term use may reduce fractures by a similar amount (Cryer, 2001a).
- There is weak evidence that stopping smoking may reduce osteoporotic fractures (Cryer, 2001a).

4.3.1.2 Falls – gaps and inconsistencies

In terms of gaps and inconsistencies, there are several points.

Assessment

- Identifying people at risk before they have fallen is a key part of reducing the overall incidence of falls, and injuries following a fall (Easterbrook et al., 2001). While there are a wide variety of tools to assess those at risk of falling (Easterbrook et al., 2001), no validated multiple risk factor assessment tool/instrument

currently exists to identify people at high risk of falling, and to identify modifiable risk factors among those high-risk individuals (Cryer, 2001b).

General

- There are complex causal pathways of falls and falls-related injury among older people that have not been adequately elucidated and the evidence should be used to describe this causal network in a systematic way (Cryer, 2001b).
- More research is needed into why people fall. Associations include medication, physical functioning and performance, perceptual difficulties, medical difficulties and psychological factors, and the effects of impairment through alcohol are also relevant for older people (Ward and Christie, 2000).
- There is a need to know which subgroups of people should be targeted, and who would most benefit from falls prevention strategies (Cryer, 2001b).

Prevention measures

- Fall prevention interventions shown to be effective overseas should be evaluated in this country to investigate both their effectiveness and cost of implementation (Cryer, 2001b). Most exercise programmes without other interventions do not reduce falls in unselected community living older people (Cryer, 2001a).
- The National Service Framework for Older People (NSF-OP) will provide the opportunity for observational research to identify what factors influence effective implementation of falls prevention strategies. Research is needed to develop the NSF-OP to reduce physical and psychological outcomes of accidental injury (Ward and Christie, 2000) and to investigate the effectiveness of the NSF-OP, what effect it is having, whether the effect is the same in all parts of the country and what factors influence effectiveness (Cryer, 2001b).
- There is a need for an up to date review of the evidence for community wide interventions to prevent falls and fall injuries among older people (Cryer, 2001b).
- Randomised controlled trials are required to evaluate the effectiveness of falls prevention programmes in institutions such as nursing homes and hospitals (Cryer, 2001b). There is a need for research to examine how participation rates of falls and falls injury prevention programmes might be increased and what might be

the most effective strategies for increasing the participation of older people in multi-faceted prevention programmes and in physical activity programmes (Cryer, 2001b).

- Work is required to examine how falls can best be prevented in patients with cognitive impairment and dementia (Cryer, 2001b).
- The epidemiological evidence between vision and falls and fall injury risk is limited, and there have been no randomised controlled trials of interventions for individual visual problems. There is a need to examine whether treatment of visual problems prevents falls; whether other interventions (not aimed at the treatment of visual problems) reduce the risk of falling and falls injury in the visually impaired (Cryer, 2001b).
- There is a lack of intervention studies on footwear (Easterbrook et al., 2001). There is a need for more research in footwear design to identify types and designs of shoes that are effective in reducing the risk of falling and that are comfortable and acceptable to older men and women (Cryer, 2001b).
- More research may be needed to reach firm recommendations, concentrating on older people walking on different types of surfaces for the design and refurbishment of public places, and on the type of flooring older people use at home (Easterbrook et al., 2001).

Exercise

- Further research is required to evaluate the effectiveness of exercise interventions (Cryer, 2001b; Lavature, 2001); for example, what are the effective elements of exercise programmes (such as type, duration, intensity and frequency)? (Cryer, 2001b).
- There is no evidence that exercise programmes for nursing home residents, who are not at increased risk of falling, reduces falls (Cryer, 2001a).
- Research on effective exercise for older men is limited (Easterbrook et al., 2001).
- More research is needed into exercise among house-bound frail older people (Easterbrook et al., 2001).
- Further research is needed on the effectiveness of using walking aids outdoors; the use of sticks, and on assisting older people to step over or around obstacles. In addition there is a need to identify how to reduce the stigma associated with their use (Easterbrook et al., 2001).

Home assessment

- The evidence is uncertain regarding whether assessment and modification of the home on its own is effective in reducing falls or falls injury among older people (Cryer, 2001a). Reviews are contradictory (Cryer, 2001a) and evidence is limited (Easterbrook et al., 2001).
- There is a need to evaluate environmental modifications for the following reasons: there are a number of environmental interventions that can be made, some of which will be effective and some ineffective; the particular interventions that are effective need to be identified; the resistance among the population to the implementation of environmental modification is unknown, and there is uncertainty about the effectiveness of 'active' interventions (eg avoidance of clutter on stairs and floors) in older population groups (Cryer, 2001b).
- More research is needed on simple environmental solutions in the home that might prevent falls, scalds and poisoning (Ward and Christie, 2000).

Medications

- Withdrawal of psychotropic medication significantly reduces the risk of falling but permanent withdrawal is difficult to achieve (Cryer, 2001a).

Fractures/hip protectors

- There is weak evidence that a dietary increase in calcium and vitamin D will result in fewer fractures (Cryer, 2001a), although Easterbrook and colleagues (2001) report that there is no evidence that taking supplements will reduce the risk or incidence of falling and it is not clear that taking these supplements will significantly reduce the numbers of fractures following falls.
- The question of whether birth cohort effects make a contribution to trends in hip fracture incidence, and how this might influence long-term projections of fracture numbers and costs, should be investigated (Cryer, 2001b).
- There may be evidence that the incidence of arm fractures is higher among those wearing hip protectors and this needs further research (Easterbrook et al., 2001).
- More work is needed to examine the role of hip protectors in preventing fractures in people who have

fallen or who are at risk of falling. Research is needed that focuses both on older people living in institutions, as well as on older people living in their own homes and should include investigation of what might be the most effective and acceptable designs. Further research may be needed to develop new designs of hip protectors that are effective and acceptable (Cryer, 2001b).

4.3.2 Road traffic accidents

4.3.2.1 Road traffic accidents – key findings

A recent critical review (Cryer, 2001a) appraised evidence relating to road traffic accidents in older people. Key findings are as follows.

- Avoiding alcohol before driving prevents road traffic accidents (Cryer, 2001a).
- Rehabilitation courses for drink driving offenders reduces repeat offending with a probable reduction in the number of alcohol-related crashes (Cryer, 2001a).
- There is observational study evidence that a reduction in the permitted blood alcohol concentration to 50mg/100ml will lead to a reduction in injuries (Cryer, 2001a).
- The use of random breath testing, accompanied by a high level of publicity, will lead to a reduction in injuries. To be most effective, breath testing should be intensive (Cryer, 2001a).
- Strategies that use seat belts will result in less severe injuries (Cryer, 2001a).
- Stricter enforcement of speed limits will result in fewer injuries (Cryer, 2001a).
- Safer design of roads and roadside environments will result in fewer injuries (Cryer, 2001a).
- Based on a meta-analysis of observational studies, roadside guard rails and crash cushions will reduce injury severity (Cryer, 2001a).
- Observational studies found that traffic calming measures resulted in a small reduction in total casualties (Cryer, 2001a).
- Based on a meta-analysis of 17 observational studies, day running lights on cars can reduce daytime road traffic accidents (Cryer, 2001a).
- Area-wide traffic management schemes, targeted at areas with high injury rates, will reduce pedestrian injury rates. The provision of crossing patrollers, measures to redistribute traffic, and design of roads to reduce speed, are effective in reducing pedestrian injuries (Cryer, 2001a).

- There is evidence that fitting all vehicles with pedestrian protection features, as well as outlawing 'bull bars', reduces pedestrian deaths and serious injuries, as well as cyclist deaths (Cryer, 2001a).
- Reduction of risk to older pedestrians as well as disabled people can result from the following interventions (Cryer, 2001a):
 - Traffic calming
 - Low speed limits (eg 20mph zones)
 - Pedestrian areas in town and city centres
 - Priority walking routes
 - Placement of pedestrian crossings on common routes to minimise deviations for older people
 - Pedestrian crossings that are designed to meet the needs of slow walkers
 - Median refuges at crossings
 - Narrowing crossing places
 - Reduced kerb heights at crossings
 - Audible signals and stippled stones at crossings to alert the visually impaired.
- The following interventions to prevent accidental injury, which are likely to have benefits for all car occupants but all of which are relevant for older car occupants, have been suggested (Cryer, 2001a):
 - The use of seat belts
 - The use of cars with airbags, and with side impact protection
 - Improved headlight design, adjustment and cleanliness on all cars to minimise glare
 - A change to the use of automatic transmission cars to reduce the complexity of the driving task (made well in advance of any cognitive decline)
 - Junction signals, traffic signs, and road markings designed to take account of the more limited capabilities of some older drivers
 - Replacement of junctions with roundabouts where cost effective; provision of right-turn lanes, and lighting at junctions where possible
 - Improved road lighting; reduction of speed; traffic calming measures in urban areas; enforcement of speed limits
 - Roadside improvements including the removal of obstacles or replacement with 'forgiving' obstacles
 - Provision of conflict-free overtaking opportunities
 - Increasing shoulder width and lane width
 - Identification and correction of health and physical functioning problems (for drivers) including vision, review of medicines and adjustment where appropriate, and identification of joint stiffness and exercise to increase range of movement

- Encouragement for older drivers to have eyesight tests at least every two years
- Provision of advice to drivers about the particular problems of alcohol and tiredness for the older person, the dangers of some medications and/or their interactions, avoidance of difficult driving situations, and planning for the time when they would need to give up driving.

4.3.2.2 Road traffic accidents – gaps and inconsistencies

In terms of gaps and inconsistencies, there are a number of general points.

A recent OECD report (OECD, 1998, in Cryer, 2001b) has highlighted a need to:

- Identify means by which the crash survivability of older people involved in accidents as vehicle occupants or pedestrians could be improved (OECD, 1998, in Cryer, 2001b)
- Develop and implement means of improving the assessment and rehabilitation of older drivers and develop training programmes to enable them to continue driving safely (OECD, 1998, in Cryer, 2001b)
- Conduct analyses and report on costs and benefits to society of providing older people with continued mobility, for at least the following strategies:
 - Public transport improvements
 - Other alternative transport options
 - Infrastructure enhancement
 - Vehicle enhancements
 - Improved land use, particularly to enable aging-in-place (OECD, 1998, in Cryer, 2001b)
- Coordinate research and demonstration projects with government, medical and academic institutions, planners and stakeholders to:
 - Explore means to reduce functional limitations that adversely affect older people's transport use
 - Investigate strategies to improve land use planning to foster aging-in-place
 - Conduct comprehensive cohort studies to travel patterns across countries, to better understand older people's future travel needs
 - Better understand current and emerging preferences for retirement housing (OECD, 1998, in Cryer, 2001b)
- Foster multinational cooperation in the development of data and information sources to increase

understanding of older people's safety and mobility needs. Specific examples include:

- Design and conduct a personal transport survey that can be used across OECD member countries to identify changes in travel patterns over time and permit cross-national comparisons
- Design and implement a system to record annual driver licensing numbers and crash and injury statistics for all transport modes, consistent across all member countries
- Monitor changes in older people's health and wellbeing across OECD member countries to provide insight to policy requirements that meet the safety and mobility needs of aging populations (OECD, 1998, in Cryer, 2001b).

4.3.3 Domestic fires

4.3.3.1 Domestic fires – key findings

Key findings relating to domestic fire accidents, as appraised by Cryer (2001a).

- There is strong evidence that the use of smoke alarms will reduce burn injuries. There is only weak evidence that the free distribution of smoke alarms will reduce fire deaths (Cryer, 2001a).
- Effective smoke alarms for older people are most viable when they are hard wired or include a battery with at least a 10-year lifetime (Cryer, 2001a).
- There is evidence from a non-randomised trial that a reduction in smoking prevalence would reduce deaths from fire (Cryer, 2001a).
- Evaluation of a number of small-scale initiatives, using before and after methods and surveys, provides evidence that community based interventions can be effective in reducing fire-related injury (Cryer, 2001a).

4.3.3.2 Domestic fires – gaps and inconsistencies

There are a number of areas where the evidence has been identified as weak.

- There is only weak evidence that the free distribution of smoke alarms will reduce fire deaths (Cryer, 2001a).
- There is weak evidence that the replacement of electric blankets that are over 10 years old would prevent many electric blanket fires (Cryer, 2001a).
- There is weak evidence that clothing fires among older people can be reduced through the use of electric rather than gas hobs, and use of an electric kettle to make hot drinks rather than the hob (Cryer, 2001a).

4.3.4 Further conclusions about accidental injury in older people

There are a number of other observations in addition to those made above.

General

- Trends in age-standardised mortality rates should be investigated to identify why, unlike other age-groups, these rates have not continued their previous historical decline (Cryer, 2001b).

Inequalities

- A systematic review that targets inequalities as the primary focus of inquiry is required to examine the effectiveness of interventions across social groups. This will also more clearly identify gaps in primary research involving a range of social groups.
- Research is required to investigate the association (if any) between accidents and poverty/deprivation and ethnicity among older people. Further work is also required to describe and explain geographic variations in accidental injury rates among older people (Cryer, 2001b).

Cost effectiveness

- A systematic review that targets cost effectiveness as the primary focus of inquiry is required to examine the cost effectiveness of interventions across the range of injuries incurred by older people. This will also more clearly identify gaps in primary research involving the cost effectiveness of a range of interventions.
- The cost effectiveness of guidelines and strategies (including the National Service Framework for Older People, NSF-OP) should be investigated (Cryer, 2001b).
- Few studies on exercise regimes have considered cost (Easterbrook et al., 2001).
- There is no evidence on the costs of walking aids (Easterbrook et al., 2001).
- There is no cost-benefit analysis on different kinds of flooring (Easterbrook et al., 2001).
- No data are provided for costs of home assessment visits, nor the period of time over which these should take place (Easterbrook et al., 2001).
- No studies in a recent systematic review included a cost analysis of hip protectors, or were able to demonstrate that these were cost effective, although

two ongoing studies include an economic evaluation (Parker et al., 2001).

- The cost effectiveness of interventions such as cataract operations needs further investigation (Easterbrook et al., 2001).
- There is little evidence on the cost effectiveness of calcium and vitamin D (Easterbrook et al., 2001).

5 Inequalities

Analyses of one year's (1998) data from the DTI's Home Accident Surveillance System (HASS) has revealed that: *'Residential areas with higher proportions of lower socio-economic groups have higher overall accident rates [and that] this statistical relationship is most marked for overall accident rates for children under 16, and particularly the under fives'* (Raine et al., 2000). Despite these differences, *'there have been relatively few injury prevention initiatives that have been designed to meet the needs of the most deprived communities'* (BMA, 2001).

The preceding sections have highlighted ways in which inequalities relating to accidental injury might be prevented or reduced, relative to the specific populations and topic areas previously discussed. There are, however, a number of gaps in the evidence base relating to inequalities. Details of these follow.

5.1 Inequalities – gaps in the evidence base

- There is a need to know where social gradients are steepest, where they are shallow, and where they can be reversed and to identify how the inequalities are different for various accident types, geographical regions and ethnic groups (Ward and Christie, 2000).
- Injury research lacks explanatory models to inform how both contextual and individual factors, together and separately, contribute to injury causation. Such models would:
 - Assist understanding of the social patterning of hazard exposure
 - Help ensure that prevention strategies are equitable in targeting those most in need (Laflamme and Diderichsen, 2000).
- Not enough is known about the mechanisms for changing behaviour and more research is needed to

provide a greater understanding of links between social deviancy, social deprivation, at risk groups and injury (Ward and Christie, 2000).

- More information is required about inequalities in access to treatment and care following accidents (Ward and Christie, 2000).
- More research is needed on exposure to risk in the population (Ward and Christie, 2000) and on understanding and reversing social inequality in injury risk (BMA, 2001).
- More information is required about causal links between ischaemic heart disease, deprivation, injury occurrence and outcome (Ward and Christie, 2000).
- More research is needed to increase understanding of how deprivation affects and complicates the response to injury and its subsequent treatment (Ward and Christie, 2000).

6 Cost effectiveness

Previous sections have addressed the cost effectiveness of interventions in relation to children and older people. There are, however, a number of broader gaps in the evidence base relating to cost effectiveness. Details of these follow.

6.1 Cost effectiveness – gaps in the evidence base

- Ward and Christie (2000) have identified a need for further research to develop a common framework for quantifying the costs of injuries. Of note is that:
 - Accidents of different types result in injuries of different types and severities, affect different age groups and may have different long-term consequences in terms of disability. For example, the types, durations and costs of treatment associated with burns, are different to those associated with injuries resulting from falls and road traffic accidents
 - Methodologies for assessment of costs of interventions also need more development (Ward and Christie, 2000).
- The BMA (2001) has identified a need to extend the evidence base for effective injury prevention to include details of cost effectiveness, including an urgent need for research into effectiveness and cost effectiveness of rehabilitation interventions to ensure that victims receive the best possible chances of recovery.

7 Rural areas

There are specific gaps in the evidence in relation to sports injuries, drowning, falls, and rural areas (Ward and Christie, 2001). Gaps relating to sports injuries, drowning and falls are incorporated in Sections 3.3.3.2 and 4.3.1.2. Gaps relating to rural areas follow.

7.1 Rural areas – gaps in the evidence base

Ward and Christie (2000) have identified a need to know more about:

- Differences in accidental injury patterns between rural and urban communities
- Whether rural populations manage injury prevention differently from urban populations in respect of their remoteness from emergency/care/treatment facilities
- Reducing risks to adults and children on farms and in rural areas
- Speed management on rural roads, especially where it can contribute to a reduction in the number of injuries sustained by young males. (Ward and Christie, 2000)

8 Staying healthy, protecting health and reducing risk

Staying healthy, protecting health and reducing risk are also identified as actions to reduce accidental injury in *Saving Lives: Our Healthier Nation* (Department of Health, 1999). To meet these criteria Ward and Christie (2000) have identified a need for more research, as follows.

8.1 Staying healthy – gaps in the evidence base

More research is required about:

- Individual differences in behaviour, including propensity to multiple risk
- The effects of stress on injury liability
- The links between social deviance, at-risk populations and injury
- The impact of safety training on groups in various settings (eg home carers, road users, people in sports/leisure environments, workforces in work environments)
- The ways in which children are supervised in the home and elsewhere and the effect on accidental injury (eg poisoning, drowning, traffic accidents, farm accidents)
- The effects of impairment resulting from illicit drugs
- The effects of impairment through alcohol in all settings and for adults of all ages, including older people
- How to enhance take-up of secondary safety devices (eg cycle helmets, sports protectors). (Ward and Christie, 2000)

8.2 Protecting health – gaps in the evidence base

More work is needed on:

- Developing/improving protective devices (eg hip protectors)

- Improving car secondary safety and pedestrian protection
- Improving domestic product design
- Improving smoke alarm/sprinkler design and uptake in high-risk premises
- Improving provision of safety use information to both the public and manufacturers to ensure well-designed products are used in a safe manner
- Developing better sports protection equipment for general public use to reduce the severity of sports injuries. (Ward and Christie, 2000)

8.3 Reducing risk – gaps in the evidence base

More work is needed on:

- Exposure in the population by injury type and population group
- Exposure in the environment to enable targeted changes to be made
- Safety techniques and risk management and their cross-sectional relevance throughout injury prevention
- Risks in remote/extreme workplaces (deep water, mines)
- Risks to pedestrians in the industrial workforce (eg construction/industrial environments)
- The effect of speed modification on rural and urban roads
- Risks to adults and children in rural areas and farms
- Reducing environmental risks in schools, sports and leisure environments
- Home environment solutions in relation to falls, scalds, poisoning (eg enhanced lighting, hot water temperatures and safety containers, respectively)
- Ergonomic design factors of stairs, to make them safer for all age groups. (Ward and Christie, 2000)

9 Improving outcomes

More needs to be known about the delivery of more effective treatment services for recovery, rehabilitation and care, and how cooperation between these services can improve outcomes (Ward and Christie, 2000).

9.1 Improving outcomes – gaps in the evidence base

Gaps in the evidence base relate to pre-hospital treatment, more effective treatment and rehabilitation and care (Ward and Christie, 2000), as follows.

Pre-hospital treatment

More research is needed to:

- Assess the extent to which the ambulance service contributes to injury reduction and to identify extra gains that could be made from better training and more widespread use of telemedicine
- Identify how call prioritisation can be better used to offer alternative responses to minor injuries
- Facilitate rapid diagnosis of the critically injured, especially children, and swift transfer to appropriate centres accompanied by specially trained staff. (Ward and Christie, 2000)

More effective treatment

More research is needed to:

- Inform A&E location, provision and organisation and to inform future choices (eg potential substitutes for traditional forms of service structure)
- Improve understanding of the role and location of trauma services and trauma care to improve health outcomes of injury

- Identify how to reach people to be trained in first aid and to assess how long this will take and by how much it will impact on A&E resources
- Assess the success of minor injuries units and how well the public take to care and treatment by nurses. Who decides where the boundary lies between serious and slight injury and who decides who should treat the injured person?
- Assess NHS Direct and its ability to provide advice on treating minor injuries, so as to develop support to the community and give people confidence to access the service for advice on treating minor injuries. There is also a need to establish whether a dedicated poisons help-line should be set up for NHS staff and others, and to what extent this would aid the speed of first action in the case of ingestion of household substances and therapeutic drugs. (Ward and Christie, 2000)

Rehabilitation and care

More research and development is needed to:

- Improve disability scoring techniques to aid assessment of post-traumatic disability to enable the delivery of better care
- Help develop care plans for people with head injuries to aid treatment and rehabilitation
- Develop policies for effective rehabilitation and care to maximise recovery. (Ward and Christie, 2000)

10 The information infrastructure, multi-disciplinary working and the research infrastructure

10.1 The information infrastructure

There is a need to ensure that evidence is collected, collated and disseminated in a manner that is usable and accessible to all agencies and parties involved in accidental injury research. The ways in which this might be achieved are impeded by a number of gaps in the evidence base. Details of these follow.

10.1.1 The information infrastructure – gaps in the evidence base

Gaps in the information infrastructure evidence base relate to data collection, definitions, measures, databases, cost effectiveness and dissemination (Ward and Christie, 2000), as follows.

Data collection

- In the UK there are no routinely collected data that provide a picture of the magnitude or the nature of disablement resulting from injury and this is a major deficiency (BMA, 2001).
- Research is needed to identify ways of accurately and consistently collecting severity data (Ward and Christie, 2000) and to identify routine methods of data collection that are feasible, reliable and that will produce valid and relevant indicator information (Cryer, 2001b).
- Deficiencies in data collection procedures also need to be addressed to examine the relationship between disadvantage and injury morbidity for a range of injury mechanisms and injury severity, and to examine the relationship between injury related disability and social group (Kendrick, 2001).

Definitions

- Work is needed to develop and agree consistent definitions across agencies collecting data relevant to

accidental injury (Ward and Christie, 2000). Definitions should take account of the severity of injury and a case should only be counted if it exceeds a given threshold of severity (Cryer et al., 1999, in BMA, 2001).

Measures

- There is an urgent need to develop good quality measures of non-fatal injury (Towner et al., 2001). While a consensus is emerging about the quality criteria required for injury surveillance (BMA, 2001), research is needed to identify stable and unbiased methods of measuring the occurrence of accidental injury from routinely collected data sources, for surveillance monitoring and evaluation (Cryer, 2001b).
- More work is required in the area of risk calculations, the identification and management of risk factors and on public perceptions of risk (Ward and Christie, 2000).
- Research is also required to develop more meaningful measures of exposure to risk in relation to childhood home injuries; these should utilise both quantitative and qualitative methodology and include the views of parents and children (Kendrick, 2001).

Databases

- Ward and Christie (2000) report that new research is necessary to develop databases and improve existing ones. This work should add to the available epidemiological evidence about which population groups are most at risk in relation to which types of injury; extend research on behavioural factors that increase risk; examine the effects of alcohol consumption on accident occurrence – who is affected by alcohol consumption and in which types of accident; and more consistently map environments that expose individuals to risk (Ward and Christie, 2000).

- Roberts and colleagues (2001) report that traffic crash prevention work is impeded by database quality (eg TRANSPORT) and that this needs to be addressed. Research output reporting controlled trials of interventions to prevent traffic crashes needs to be identifiable, so 're-tagging' of this output is required (Roberts et al., 2001).

Cost effectiveness

- Ward and Christie (2000) have identified a need for developmental research in the following areas: to develop nationally agreed consistency of costing standards and conventions, in relation to costs over time in preventing accidents, injury treatment, rehabilitation and care; to develop an agreed range of costing values for prevention of death and injury; to develop robust procedures for evaluating analyses to aid priority decision making; and to develop robust procedures for cost effectiveness assessment of implemented interventions.

Dissemination

- Randomised controlled trials should be a preferred research design for investigating injury interventions, and specific standards for reporting non-randomised controlled trial intervention designs should be developed. This will assist quality evaluation and assist efforts to synthesise results (MacKay, 1999). Dissemination strategies need to be developed and supported at local, regional and national levels (Ward and Christie, 2000).

10.2 Multi-disciplinary working

Multi-disciplinary working is currently impeded by a range of gaps in the evidence base. Details of these follow.

10.2.1 Multi-disciplinary working – gaps in the evidence base

To enhance multi-disciplinary working, research is needed:

- To develop a national plan for multi-disciplinary injury prevention research including research councils, government departments and other major research funders (BMA, 2001)

- To develop information, knowledge and skills to enhance multi-disciplinary and multi-agency working to bring about changes to the environment and people's behaviour to reduce risks (Ward and Christie, 2000)
- To develop priorities for collaboration in a range of research, particularly regarding the development and testing of a range of interventions. (Ward and Christie, 2000)

10.3 The research infrastructure

To redress the balance of small amounts of injury research aimed at a large injury problem, Ward and Christie (2000) suggest that multi-disciplinary units and sustainable collaborations are needed. The authors highlight that these would:

- Develop the R&D workforce capacity to ensure that there is a sufficient supply of senior researchers who can work with complex methods, who can work across boundaries, and who can conduct difficult R&D designs
- Foster better understanding of the variety of valid methodological approaches to answering different research questions between researchers and across disciplines
- Provide mechanisms for breaking down barriers to effective working by encouraging the building of multi-disciplinary teams who can share and develop research methods as well as share data and research findings. (Ward and Christie, 2000)

10.3.1 The research infrastructure – gaps in the evidence base

- There is a research role to provide training and guidance to the research community on how to disseminate its research findings so they can be translated into practice. There is also a role to train local professional people in research methods and encourage bids for funds (Ward and Christie, 2000).

11 Key points and recommendations

Using the evidence outlined in the preceding sections and the documents prepared by experts in the fields of concern (eg Cryer, 2001a, 2001b; Hayes and Towner, 1998; Kendrick, 2001; Towner, 2001; Towner et al., 2001; Ward and Christie, 2000), this section outlines key points and recommendations. The recommendations refer to a number of areas where further research needs to be conducted to strengthen the accidental injury evidence base. In certain cases recommendations are not mutually exclusive to one area (eg routine collection of data relating to accidental injury is paramount to preventive work in respect of children, older people, building the information infrastructure and multi-disciplinary working).

11.1 Accidental injury in children

11.1.1 General areas

'Injury is the main cause of death and a major cause of ill health and disability in childhood' (Towner and Dowswell, 2001). A wide range of reviews has been conducted in this area in the last decade (Towner, 2001). A recent systematic review of 155 studies (Towner et al., 2001) revealed that research tends to be organised around accidental injury incurred on the road (including pedestrians, cyclists and passengers), in the home (including suffocation and foreign bodies*, fire and flames, drowning and submersion, falls and poisoning), the leisure environment, community prevention programmes, and mass media and training.

Gaps are evident in relation to inequalities and cost effectiveness work (see Sections 11.1.2 and 11.1.3 below) and in the areas of sports and leisure injuries, drownings, falls, child agricultural injuries, community

first aid and 12 to 14 year olds (Towner, 2001; Towner et al., 2001). There is also an urgent need to update our knowledge of accidental injury in respect of 15 to 24 year olds.

11.1.2 Inequalities

Despite clear evidence that social gradients exist in childhood injury mortality, particularly for fire and flames, falls, poisoning, submersion, suffocation and foreign bodies (Kendrick, 2001), of 155 studies identified by Towner and colleagues (2001), just 32 addressed social deprivation (Dowswell and Towner, 2002). Furthermore, these studies did not necessarily focus on areas where inequalities are known to be associated with accidents. For example, while there is a strong social gradient in child pedestrian deaths, only one study in this area specifically targeted socially deprived groups (Dowswell and Towner, 2002). This point is not exclusive to childhood accidental injury. Scrutiny of the National Research Register has revealed very few studies that explicitly investigated accidental injury in relation to inequalities (Ward and Christie, 2000).

Despite very strong links between injury mortality in children and social deprivation, much less is known about inequalities in relation to injury morbidity. This is an important point because, as Kendrick remarks (2001):

'If we cannot adequately describe the size and nature of inequalities in injury morbidity and injury related disability, we cannot understand the burden of ill health caused by injury, identify possible causal mechanisms and design interventions to reduce inequalities.'

Several factors impede work in this area: data on injuries are not routinely collected and coding of injury

* The term 'foreign bodies' refers to the ingestion or aspiration of objects or substances which are categorised as food, non-foods, toys, or parts of toys, and other 'unknown' substances (see DTI, 1999a).

attendances and admissions remains incomplete; there is a lack of a routinely used standard measure of severity of injury; there is a lack of a standardised system to collect data, and there is a lack of data available on social groups (Kendrick, 2001).

Previous studies have focused on populations (eg school children) or topic areas (eg pedestrian injury) as a primary focus of inquiry. There is an urgent need for more research that targets inequalities as the primary research focus.

11.1.3 Cost effectiveness

There is very little data relating to cost effectiveness of interventions in financial terms, with the exception of road traffic accidents where there is evidence that area-wide engineering schemes are cost effective in reducing childhood injuries (Towner et al., 2001). Notably, the former DETR, collaboratively with the HSE and HO, have produced values for the prevention of a road traffic accident fatality (Ward and Christie, 2000).

The cost effectiveness of other interventions, however, needs to be examined (Towner et al., 2001). There is currently no work examining the cost effectiveness of reducing inequalities in childhood home injuries (Kendrick, 2001). There is some evidence to suggest that public access poisons information services are cost effective (Miller, 1995, in Hayes and Towner, 1998).

The difficulties of establishing the cost effectiveness of interventions have been highlighted by Roberts (2001), who argues that in some areas it is difficult to evaluate effectiveness information because valid data do not exist, or where they do, data collection and indexing techniques are often inadequate and impede access to the kinds of information necessary.

11.1.4 Research recommendations

General areas. As a result of extensive work concerned with childhood accidental injury, Towner (2001) and Towner et al. (2001) propose research in the following areas:

- There is an urgent need to update our knowledge of accidental injury in respect of 15 to 24 year olds
- Further studies are also required on 12 to 14 year olds
- More studies are needed in the areas of sports and leisure injuries, drownings, falls, child agricultural injuries and community first aid

- Community based injury prevention programmes need to be evaluated
- Different approaches need to be included: child-to-child, use of incentives to change behaviour, tailored health education materials, benefits of programmes
- Research is required to inform how evidence can best be turned into practice
- Comparative designs are necessary that employ the same research design in different countries.

Inequalities. Dowswell and Towner (2002) report that although there are strong links between accidental childhood injury and social deprivation, of 155 studies focusing on accidental childhood injury, just 32 (21%) targeted social deprivation. Specifically, Dowswell and Towner (2002) noted that:

- For injuries in the road environment there is a striking paucity of evidence
- There is limited evidence concerning the effects of cycle helmet programmes on different population subgroups
- There have been no evaluated interventions where environmental changes (eg cycle paths) have been used to reduce the exposure of socially deprived children to injury risk
- There is little information about the differential effect of in-car restraint use campaigns with families in different economic and social circumstances
- There is little evidence that the presence of safety devices (eg electric socket covers, cupboard locks) have any effect on injury risk
- There is very little evidence relating to the effectiveness of interventions to:
 - Increase access to services
 - Achieve broader economic change
- There is also little information on the reach/penetration of different programmes
- Much more evidence is needed in respect of the impact of community wide campaigns, broader policy change and strategies to increase the reach of health promotion campaigns on deprived groups.

In respect of home injuries, Kendrick (2001) identifies research needs in relation to the following areas:

Monitoring inequalities over time

- To examine trends in injury morbidity by social group over time (Kendrick, 2001).

Explaining inequalities

- To examine the relationship between exposure to risk, especially for home injuries and social disadvantage.
- To examine the relationship between exposure to hazards and injury occurrence.
- To examine the response to risk of childhood injury and post-injury survival by social group.
- To define area-level variables that may explain the range in injury inequalities; there is an associated need to confirm and quantify the contribution of these area-level variables, to examine the effect of varying the definition of neighbourhoods/communities, and also to examine the relationship between individual and area-level factors and exposure to risk of injury. (Kendrick, 2001)

Access to and effectiveness of injury prevention

- To explore access to childhood injury prevention by social group; to examine reasons for differential access and how inequalities might be reduced; to examine effectiveness of interventions across social groups; to examine the effectiveness of existing prevention activity (eg advice in child health surveillance programmes) and access to such activity by social group. (Kendrick, 2001)

Cost effectiveness

- The cost and benefits of injury prevention interventions should be evaluated (Towner, 2001). With the exception of road traffic accidents, there is a lack of cost effectiveness work.
- There is a need to examine the cost effectiveness of interventions to reduce inequalities in childhood home injuries (Kendrick, 2001).
- A systematic review that targets cost effectiveness as the primary focus of inquiry is required to examine the cost effectiveness of interventions. This will also more clearly identify gaps in primary research involving the cost effectiveness of a range of interventions.

11.2 Accidental injury in older people

11.2.1 General areas

'Over 50% of accidental injury deaths, and over 60% of serious accidental injury, occur in people aged 65 and over' (Cryer, 2001a). Rates of accidental injury that result in hospitalisation or fatality are higher for older people,

compared to all other age groups (Cryer, 2001a). Almost half of fatalities from accidental injuries (and the majority of non-fatal injuries) occur in the home; a quarter occur on the street/highway and nearly a fifth occur in residential institutions (Cryer, 2001a). A recent critical review (Cryer, 2001a) has revealed that research relating to older people tends to be organised around the topics of falls (including protective physical activity, home and residential assessment, hip protectors and osteoporosis prevention/treatment), road traffic accidents (including seat belt use, speed limits, road designs, traffic management and car designs) and domestic fires (including smoke alarms, electric blanket replacement, gas cooking appliance replacement and smoking prevalence). Mortality ratios for these three areas are 62%, 13% and 3%, respectively (Cryer, 2001a).

11.2.2 Inequalities

While there is a geographic variation in falls, and in prevention activity, rates of falling for older people do not appear to increase with deprivation (Cryer, 2001a). Survey data reveals that fires are more likely to occur in lower income and rented households (Cryer, 2001a). It should be acknowledged that social class gradients relating to accidental injury in older people are not necessarily the same as in other sectors of the population. It is an empirical question. There is very little research relating to inequalities in accidental injury among older people and in respect of preventive activity.

11.2.3 Cost effectiveness

There is little evidence on the cost effectiveness of exercise regimens or of calcium and vitamin D supplements (Easterbrook et al., 2001). There is no evidence on the costs of walking aids, of different types of flooring and of home assessment visits (Easterbrook et al., 2001). No studies in a recent systematic review (Parker et al., 2001) included a cost analysis of hip protectors, or were able to demonstrate that these were cost effective. The cost effectiveness of strategies for prevention recommended in the NSF-OP needs to be evaluated.

11.2.4 Research recommendations

General. As a result of extensive work in the area of accidental injury in older people, Cryer (2001b) proposes research in the following areas:

- There is a complex network of falls and falls-related injury among older people that has not been

adequately elucidated and the evidence should be used to describe this causal network in a systematic way

- Trends in age-standardised mortality rates should be investigated to identify why, unlike other age-groups, these rates have not continued their previous historical decline
- Interventions shown to be effective overseas should be evaluated in the UK to investigate their effectiveness and to estimate the cost of implementation
- There is a need for validated risk factor assessment tools/instruments to identify people at high risk of falling, and to identify modifiable risk factors among those high-risk individuals
- There is a need to know which subgroups of older people should be targeted for (and who would benefit most from) falls prevention strategies
- There is a need for an up to date review of the evidence for community wide interventions to reduce falls and fall injuries among older people
- Randomised controlled trials are required to evaluate the effectiveness of falls prevention programmes in institutions such as nursing homes and hospitals
- There is a need to investigate what should be the components of a falls prevention programme; which risk factors are modifiable; whether modification of risk factors results in a reduction in fall rate, and what is the most effective and feasible method for modifying these risk factors
- There is a need to investigate what the effective elements of exercise programmes (eg type, duration, intensity, frequency) might be
- Research is needed to ascertain what might be the most effective strategies for increasing the participation of older people in multi-faceted prevention programmes and in physical activity programmes
- There is a need to evaluate environmental modifications to highlight which ones may be effective and whether there might be population resistance to some modifications
- There is a need to know how falls can best be prevented in patients with cognitive impairment and dementia
- Research is needed to establish whether treatment of visual problems prevents falls and whether other interventions (not aimed at the treatment of vision problems) reduce the risk of falling and falls injury in the visually impaired
- There is a need to research the role of hip protectors in preventing fractures in persons who have fallen or who are at risk of falling; this must focus on older people in

their homes and those living in institutions, and should investigate what might be the most effective and acceptable designs. Further research may be needed to develop new designs of hip protectors that are effective and acceptable

- Whether birth cohorts make a contribution to trends in hip fracture, and how this might influence long-term projections of fracture numbers and costs, should be investigated
- Research is needed to investigate the effectiveness of the NSF-OP; what effect it is having; whether the effect is the same in all parts of the country, and what factors influence effectiveness
- A range of research needs are required in the area of road traffic accidents, as identified in a recent OECD report (see Section 4.3.2.2).

In addition, in the area of falls, Easterbrook and colleagues (2001) recommend:

- More research into exercise among house-bound frail older people
- Further intervention studies investigating the role of footwear
- More research on the effectiveness of using walking aids outdoors; the use of sticks, and in assisting older people to step over or around obstacles; there is an associated need to investigate the stigma associated with their use
- More research is needed on older people walking on different types of flooring surfaces in public places and in the home.

Inequalities

- A systematic review that targets inequalities as the primary focus of inquiry is required to examine the effectiveness of interventions in different social groups. This will also more clearly identify gaps in primary research involving a range of social groups.
- Research is required to investigate the association (if any) between accidents and poverty/deprivation and ethnicity among older people. Further work is also required to describe and explain geographic variations in accidental injury rates among older people (Cryer, 2001b).

Cost effectiveness

- A systematic review that targets cost effectiveness as the primary focus of inquiry is required to examine the

cost effectiveness of interventions across the range of injuries incurred by older people. This will also more clearly identify gaps in primary research involving the cost effectiveness of a range of interventions.

- The cost effectiveness of guidelines and strategies (including the NSF-OP) should be investigated (Cryer, 2001b).
- Few studies on exercise regimes have considered cost (Easterbrook et al., 2001).
- There is no evidence on the costs of walking aids (Easterbrook et al., 2001).
- There is no cost-benefit analysis on different kinds of flooring (Easterbrook et al., 2001).
- No data are provided for costs of home assessment visits, nor the period of time over which these should take place (Easterbrook et al., 2001).
- No studies in a recent systematic review included a cost analysis of hip protectors, or were able to demonstrate that these were cost effective, although two ongoing studies include an economic evaluation (Parker et al., 2001).
- Further research is needed to investigate potentially higher incidences of arm fractures among those wearing hip protectors (Easterbrook et al., 2001).
- The cost effectiveness of interventions such as cataract operations needs further investigation (Easterbrook et al., 2001).
- There is little evidence on the cost effectiveness of calcium and vitamin D (Easterbrook et al., 2001).

11.3 Inequalities

11.3.1 General points

Evidence suggests that residential areas with higher ratios of lower socio-economic groups have higher accident rates, especially among children (Raine et al., 2000).

However, very few injury prevention strategies have been designed to meet the needs of the most disadvantaged communities (BMA, 2001).

11.3.2 Research recommendations

In addition to the recommendations relating to inequalities and children (Section 3 and 11.1), and inequalities and older people (Sections 4 and 11.2), a number of broader needs follow.

- There is a need to know where social gradients are steepest, where they are shallow, and where they can be reversed and to identify how the inequalities vary

for different accident types, geographical regions and ethnic groups (Ward and Christie, 2000).

- Injury research lacks explanatory models to inform how both contextual and individual factors, together and separately, contribute to injury causation, yet such models would:
 - Assist understanding of the social patterning of hazard exposure
 - Help ensure that prevention strategies are equitable in targeting those most in need (Laflamme and Diderichsen, 2000).
- Not enough is known about the mechanisms for changing behaviour and more research is needed to provide a greater understanding of links between social deviancy, social deprivation, at risk groups and injury (Ward and Christie, 2000).
- More information is required regarding inequalities in access to treatment and care following accidents (Ward and Christie, 2000).
- More research is needed on exposure to risk in the population (Ward and Christie, 2000) and on understanding and reversing social inequality in injury risk (BMA, 2001).
- More information is required about causal links between ischaemic heart disease, deprivation, injury occurrence and outcome (Ward and Christie, 2000).
- More research is needed to increase understanding of how deprivation affects and complicates the response to injury and its subsequent treatment (Ward and Christie, 2000).

11.4 Cost effectiveness

11.4.1 General points

In addition to appraising the cost effectiveness of interventions relating to children (Sections 3 and 11.1) and older people (Sections 4 and 11.2), there are a number of broader gaps in the evidence base.

11.4.2 Research recommendations

- There is a need to develop a common framework for quantifying the costs of injuries. Of note is that:
 - Accidents of different types result in injuries of different types and severities, affect different age groups and may have different long-term consequences in terms of disability. For example, the types, durations and costs of treatment associated

with burns are different to those associated with injuries resulting from falls and road traffic accidents – Methodologies for assessment of costs of interventions also need more development (Ward and Christie, 2000).

- There is a need to extend the evidence base for effective injury prevention to include details of cost effectiveness, including an urgent need for research into effectiveness and cost effectiveness of rehabilitation interventions to ensure that victims receive the best possible chances of recovery (BMA, 2001).

11.5 Rural areas

11.5.1 General points

There are gaps in the evidence base relating to accidental injury in rural areas (Ward and Christie, 2000).

11.5.2 Research recommendations

More needs to be known about:

- Injury on farms to both children and the workforce
- Differences in accidental injury between rural and urban communities
- Reducing risks to adults and children on farms and in rural areas
- Speed management on rural roads, especially where it can contribute to a reduction in injuries sustained by young males
- Whether rural populations manage injury prevention differently from urban populations in respect of their remoteness from emergency/care/treatment facilities.

11.6 Staying healthy, protecting health and reducing risk

11.6.1 General points

Staying healthy, protecting health and reducing risk are identified as actions to reduce accidental injury in *Saving Lives: Our Healthier Nation* (Department of Health, 1999). To meet these criteria more research is needed (see Ward and Christie, 2000), as follows.

11.6.2 Research recommendations

More research is required about:

- Individual differences in behaviour, including propensity to multiple risk

- The effects of stress on injury liability
- The links between social deviance, at risk populations and injury
- The impact of safety training on various groups in various settings (eg home carers, road users, people in sports/leisure environments, workforces within work environments)
- The ways in which children are supervised in the home and elsewhere and the effect of this on accidental injury (eg poisoning, drowning, traffic accidents, farm accidents)
- The effects of impairment resulting from illicit drugs
- The effects of impairment through alcohol in all settings and for adults of all ages, including older people
- How to enhance take up of secondary safety devices (eg cycle helmets, sports protectors)
- Developing and improving protective devices (eg hip protectors)
- Improving car secondary safety and pedestrian protection
- Improving domestic product design
- Improving smoke alarm/sprinkler design and uptake in high-risk premises
- Improving provision of safety use information to both the public and manufacturers to ensure well-designed products are used in a safe manner
- Developing better sports protection equipment for general public use to reduce the severity of sports injuries
- Exposure in the population by injury type and population group
- Exposure in the environment to enable targeted changes to be made
- Safety techniques and risk management and their cross-sectional relevance throughout injury prevention
- Risks in the remote/extreme workplaces (deep water, offshore, mines)
- Risks to pedestrians in the industrial workforce (eg construction/industrial environments)
- The effect of speed modification changes on rural and urban roads
- Risk to adults and children in rural areas and farms
- Reducing environmental risks in schools, sports and leisure environments
- Home environment solutions in relation to falls, scalds, poisoning (eg enhanced lighting, hot water temperatures and safety containers, respectively)
- Ergonomic design factors of stairs, to make them safer for all age groups.

11.7 Improving outcomes

11.7.1 General points

More needs to be known about the ways in which both the delivery of more effective treatment services for recovery, rehabilitation and care, and the ways in which cooperation among these services can improve outcomes.

11.7.2 Research recommendations

The following research recommendations have been highlighted (Ward and Christie, 2000).

Pre-hospital treatment. More research is needed to:

- Assess the extent to which the ambulance service contributes to injury reduction and to identify extra gains that could be made from better training and more widespread use of telemedicine
- Identify how call prioritisation can be better used to offer alternative responses to minor injuries
- Facilitate rapid diagnosis of the critically injured, especially children, and swift transfer to appropriate centres accompanied by specially trained staff.

More effective treatment. More research is needed to:

- Inform A&E location, provision and organisation and to inform future choices (eg potential substitutes for traditional forms of service structure)
- Improve understanding of the role and location of trauma services and trauma care to improve health outcomes of injury
- Identify how to reach people to be trained in first aid and to assess how long this will take and by how much it will impact on A&E resources
- Assess the success of minor injuries units and how well the public have taken to care and treatment by nurses; determine who decides where the boundary lies between serious and slight injury; and determine who decides who should treat the injured person
- Assess NHS Direct and its ability to provide advice on treating minor injuries, so as to develop support to the community and give people confidence to access the service for advice on treating minor injuries. There is also a need to establish whether a dedicated poisons help-line needs to be set up for NHS staff and others, and to what extent this would aid the speed of first action in the case of ingestion of household substances and therapeutic drugs.

Rehabilitation and care. More research and development is needed to:

- Improve disability scoring techniques to aid assessment of post-traumatic disability to enable the delivery of better care
- Help develop care plans for people with head injuries to aid treatment and rehabilitation
- Develop policies for effective rehabilitation and care to maximise recovery.

11.8 The information infrastructure

11.8.1 General points

Overseas work has highlighted the need to have an adequate information infrastructure to monitor and respond to the incidence of accidental injury (Ward and Christie, 2000; Mulder, 2001). There is a need to ensure that evidence is collected, collated and disseminated in a manner that is usable and accessible to all agencies and parties involved in accidental injury research (Ward and Christie, 2000).

11.8.2 Research recommendations

- **Data collection.** In the UK there are no routinely collected data that provide a picture of the magnitude or the nature of disablement resulting from injury and this is a major deficiency (BMA, 2001). Research is needed to identify ways of accurately and consistently collecting severity data (Ward and Christie, 2000) and to identify routine methods of data collection that are feasible, reliable and that will produce valid and relevant indicator information (Cryer, 2001b). Deficiencies in data collection procedures also need to be addressed to examine the relationship between disadvantage and injury morbidity for a range of injury mechanisms and injury severity, and to examine the relationship between injury related disability and social group (Kendrick, 2001).
- **Definitions.** Work is needed to develop and agree consistent definitions across agencies collecting data relevant to accidental injury (Ward and Christie, 2000). Definitions should take account of the severity of injury and a case should only be counted if it exceeds a given threshold of severity (Cryer et al., 1999, in BMA, 2001).
- **Measures.** There is an urgent need to develop good quality measures of non-fatal injury (Towner et al., 2001). While a consensus is emerging about the quality

criteria required for injury surveillance (BMA, 2001), research is needed to identify stable and unbiased methods of measuring the occurrence of accidental injury from routinely collected data sources, for surveillance monitoring and evaluation (Cryer, 2001b). More work is required in the area of risk calculations, the identification and management of risk factors and on public perceptions of risk (Ward and Christie, 2000). Research is also required to develop more meaningful measures of exposure to risk in relation to childhood home injuries; these should utilise both quantitative and qualitative methodology and include the views of parents and children (Kendrick, 2001).

- **Databases.** Ward and Christie (2000) report that new research is necessary to develop databases and improve existing ones. This work should add to the available epidemiological evidence in respect of which population groups are most at risk in relation to which types of injury; extend research on behavioural factors that increase risk; examine the effects of alcohol consumption on accident occurrence, who is affected by alcohol consumption and in which types of accident, and more consistently map environments that expose individuals to risk. Roberts and colleagues (2001) report that traffic crash prevention work is impeded by database quality (eg TRANSPORT) and that this needs to be addressed. Research output reporting controlled trials of interventions to prevent traffic crashes needs to be identifiable, thus 're-tagging' of this output is required.
- **Cost effectiveness.** Ward and Christie (2000) have identified a need for developmental research in the following areas: to develop nationally agreed consistency of costing standards and conventions, in relation to costs over time in preventing accidents, injury treatment, rehabilitation and care; to develop an agreed range of costing values for prevention of death and injury; to develop robust procedures for evaluating analyses to aid priority decision making; and to develop robust procedures for cost effectiveness assessment of implemented interventions.
- **Dissemination.** Randomised controlled trials should be a preferred research design for investigating injury interventions and specific standards for reporting non-randomised controlled trial intervention designs should be developed. This will assist quality evaluation and assist efforts to synthesise results (MacKay, 1999). Dissemination strategies need to be developed and supported at local, regional and national levels (Ward and Christie, 2000).

11.9 Multi-disciplinary working

11.9.1 General points

Multi-disciplinary working is currently impeded. Research is needed to develop enhanced ways of working.

11.9.2 Research recommendations

- To develop a national plan for multi-disciplinary injury prevention research including research councils, government departments and other major research funders (BMA, 2001).
- To develop information, knowledge and skills to enhance multi-disciplinary and multi-agency working to bring about changes to the environment and people's behaviour to reduce risks (Ward and Christie, 2000).
- To develop priorities for collaboration in a range of research, particularly regarding the development and testing of a range of interventions (Ward and Christie, 2000).

11.10 The research infrastructure

11.10.1 General points

To redress the balance of small amounts of injury research aimed at a large injury problem, multi-disciplinary units and sustainable collaborations are needed (Ward and Christie, 2000). Ward and Christie (2000) highlight that these would:

- Develop the R&D workforce capacity to ensure that there is a sufficient supply of senior researchers who can grapple with complex methods, work across boundaries and conduct difficult R&D designs
- Foster better understanding of the valid methodological approaches to answering different research questions among researchers and across disciplines
- Provide mechanisms for breaking down barriers to effective working by encouraging the building of multi-disciplinary teams who can share and develop research methods as well as share data and research findings.

11.10.2 Research recommendations

- There is a research role to provide training and guidance to the research community on how to disseminate its research findings so they can be translated into practice, and to train local professional people in research methods and encourage bids for funds (Ward and Christie, 2000).

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Appendixes

Appendix A: Primary evidence-based sources

BMA (British Medical Association) (2001). *Injury prevention*. British Medical Association Board of Science and Education.

Cryer, C. (2001a). *What works to prevent accidental injury amongst older people*. Report to the Health Development Agency (HDA), London. Centre for Health Services Studies, University of Kent.

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Appendix B: Selected further reading

This list identifies a selection of systematic reviews, guidance documents and strategic documents that relate to accidental injury.

Acheson, D. (1998). *Independent inquiry into inequalities in health report*, chaired by Sir Donald Acheson. London: The Stationery Office.

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Dowswell, T., Towner, E., Cryer, C., Jarvis, S., Edwards, P. and Lowe, P. (1999). *Accidental falls: Fatalities and injuries – an examination of the data sources and review of the literature on preventive strategies*. A report prepared for the Department of Trade and Industry. University of Newcastle and South East Institute of Public Health, University of London.

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The Royal College of Surgeons of England (2000). *Better care for the severely injured*. A joint report from the Royal College of Surgeons of England and the British Orthopaedic Association. Hampshire: The Royal College of Surgeons of England.

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van Haastregt, J. C. M., Diederiks, J. P. M., van Rossum, E., et al. (2000). Effects of preventive home visits to elderly people living in the community: Systematic review. *British Medical Journal* 320: 754-758.

World Health Organization (WHO) (1994). Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. *Technical Report Series* 843. Geneva: WHO.

Appendix C: Websites containing other relevant information

Child Accident Prevention Trust
www.capt.org.uk

Choking risks to children under four years from toys and other objects (DTI, 1999)
www.dti.gov.uk/homesafetynetwork/pdf/choke.pdf

DTI Home Safety Network
www.dti.gov.uk/homesafetynetwork

DTLR Fire Safety
www.safety.odpm.gov.uk/fire/firesafety.htm

DTLR Road Safety
www.roads.dft.gov.uk/roadsafety/index.htm

National Research Register (NRR)
www.update-software.com/National

Public Health electronic Library
www.phel.gov.uk

Royal Society for the Prevention of Accidents
www.rospa.com/CMS/index.asp

Saving Lives: Our Healthier Nation
www.archive.official-documents.co.uk/document/cm43/4386/4386.htm

What works in neighbourhood renewal
www.renewal.net

Glossary

A&E – Accident and Emergency Department.

Child Resistant Packaging – Includes non-reclosable containers (ie strip and blister packs).

CRASH – Corticosteroid randomisation after significant head injury trial (supported by the MRC).

DALYs – Disability Adjusted Life Years; a composite health measure that combines mortality and morbidity to quantify health effects.

DCMS – Department for Culture, Media and Sport.

DETR – Department of Environment, Transport and the Regions.

DfEE – Department for Education and Employment.

DH – Department of Health.

DTI – Department of Trade and Industry.

EHLASS – European Home and Leisure Accident Surveillance System.

EPPI-Centre – EPPI-Centre is an acronym for The Evidence for Policy and Practice Information and Co-ordinating Centre. It is part of the Social Science Research Unit (SSR), Institute of Education, University of London.

ESRC – Economic and Social Research Council.

HDA – Health Development Agency.

HEA – Health Education Authority.

HO – Home Office.

HSE – Health and Safety Executive.

HTA – Health Technology Assessment.

MRC – Medical Research Council.

NCFSC – National Community Fire Safety Centre.

NHS – National Health Service.

NRR – National Research Register.

NSF-OP – National Service Framework for Older People.

ODPM – Office of the Deputy Prime Minister

OECD – Organisation for Economic Co-operation and Development.

OT – Occupational Therapy.

PUFFIN – Pedestrian User Friendly Intelligent (Types of infrared road crossings).

R&D – Research and Development.

RCT – Randomised Controlled Trial.

SES – Socio-economic Status.

TRANSPORT – TRANSPORT is a road traffic related database. It is not an acronym.