

REPORT

February 2007

Accidental injury, risk-taking behaviour and the social circumstances in which young people (aged 12-24) live: a systematic review

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

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A searchable database which includes the studies reviewed in this report is available on the EPPI-Centre website (<http://eppi.ioe.ac.uk/webdatabases/Intro.aspx?ID=4>).

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TABLE OF CONTENTS

Preface	1
Scope of this report	1
How to read this report	2
Executive Summary	3
Summary	3
Background	3
Methods	3
Findings	4
Drugs	4
Alcohol	5
Transport	6
Bicycle helmets	7
Sport	8
Recommendations	9
The contribution of this review	10

Part I: Background and results of the review

1. Introduction	12
Young people and accidental injury	12
The burden of accidental injury	13
Pathways to accidental injury among young people	19
Young people and risk-taking behaviour	20
Aims of this review	22
Defining accidental injury and risk-taking behaviour	23
Review questions	24
Cautionary note: interpreting correlational studies	25
Further reading	26
2. Methods	27
3. Evidence synthesis: drugs	29
National picture	29
Illegal drugs	30
Correlational studies	32
Studies of young people's views: how do young people perceive/assess the risks of accidental injury in relation to taking drugs? What affects this perception of risk?	36
How do young people manage taking drugs in relation to accidental injury?	36
Systematic reviews of effectiveness	37
Current policy in the UK	37
Discussion and implications	39
4. Evidence synthesis: alcohol	43
National picture	43
Correlational studies	44
Studies of young people's views	45
How do young people manage their drinking in relation to potential injury?	47
Systematic reviews of effectiveness	48
Current policy in the UK	49
Discussion and implications	51
5. Evidence synthesis: transport	54
National picture	54
The role of alcohol and drugs in transport accidents	55
Correlational studies	57
Studies of young people's views: how do young people perceive/assess the risks of accidental injury in relation to unsafe road behaviours? What affects this perception of risk?	62
Pedestrians and Cyclists	63
How do young people manage dangerous driving in relation to accidental injury?	63

Systematic reviews of effectiveness	65
Current policy in the UK	69
Discussion and implications	72
6. Evidence Synthesis: Bicycle helmets	78
National picture	78
Studies of young people's views: how do young people perceive/assess the risks of accidental injury in relation to cycle helmet wearing (or non-wearing)? What affects this perception of risk?	79
How do young people manage not wearing helmets in relation to accidental injury? ..	81
Perceived Effect of Cycle Helmets on Behaviour	83
Systematic reviews of effectiveness	83
Current policy in the UK	86
Discussion and implications	87
7. Evidence synthesis: sports	90
National picture	90
Correlational studies	92
Systematic reviews of effectiveness	95
Current policy in the UK	99
Discussion and implications	99
8. The social circumstances of accidental injury among young people	102
What correlational studies tell us about accidental injury and SES	103
What reviews tell us about accidental injury and SES	104
Conclusions	108
9. Discussion and implications	109
Mapping the scope of this review onto the burden of accidental injury	109
Accidental injury and risk-taking behaviour	110
Themes arising from the 'views' studies across topic areas	113
Factors affecting risk-taking behaviour	114
Strengths and limitations of this review	114
How this review relates to other systematic reviews	116
Implications and recommendations	117

Part II: Technical description of the review

10. Methods	121
User involvement	121
Mapping exercise	122
Inclusion and exclusion criteria for mapping exercise	123
Identification of studies for the mapping exercise	124
(a) Search strategy	124
(b) Screening process	125
Classification of studies for the mapping exercise	125
In-depth review	125
Moving from broad characterisation (mapping) to in-depth review	125
Detailed description of studies in the in-depth review	127
Assessing the quality of studies, data extraction and weight of evidence	127
Evidence syntheses	129
The completed review	130
Flow of literature through the map	131
Characteristics of studies in the map	131
Correlational studies	132
Views studies	134
Systematic Reviews	135
From mapping to in-depth review	138
Characteristics of studies in the in-depth review	138
Drugs synthesis	140
Alcohol	142
Transport	144

Cycle helmets	147
Sports	149
References	153
Appendix A: Terms used in database searches	176
Search Strategy: MEDLINE via OVID 1966 to October Week 2 2004	176
Search Strategy: PsycINFO via OVID 1967 to October Week 2 2004.....	177
Search Strategy: CINAHL (Cumulative Index to Nursing and Allied Health Literature) via OVID 1982 to October Week 3 2004	178
Search Strategy: EMBASE via OVID 1980 to 2004 Week 42.....	179
Search Strategy: ASSIA (Cambridge Scientific Abstracts).....	180
Search Strategy: ERIC (Cambridge Scientific Abstracts)	180
Appendix B: Introduction to the online database	181

Preface

Scope of this report

This report describes the findings and methods of a systematic review of research relevant to accidental injury, risk-taking behaviour and the social circumstances of young people. This review was commissioned by the Department of Health (England) as part of a programme of work relating to accidental injury and will be used by the Accidental Injury Task Force (a cross-departmental body established to provide a basis for Government action) and others to develop new interventions and to identify future research needs.

The review examines the number, types and quality attributes of existing research studies. It synthesises the findings of a large sub-set of these studies to assess the relationship between accidental injury, risk-taking and social circumstances. It then sets this information into a UK national policy context and examines international evidence on the effectiveness of interventions to reduce accidental injury.

The policy and practice implications of the findings of the review are discussed and recommendations for future interventions, development and research are made.

There are many useful messages in this work for policy-makers, commissioners, practitioners and researchers who have a remit to promote or conduct research on accidental injury among young people. The key messages of this review may help particularly:

- policy-makers by highlighting where current policy relevant to reducing accidental injury among young people is supported by research evidence and where there are contradictions or gaps;
- health authorities and other services to assess the evidence-base for delivering injury prevention interventions to young people;
- researchers by highlighting areas where the evidence base is thin; also, in showing how research can be used to inform policy and practice, this review underlines the importance of detailed contextual information about study participants.

How to read this report

Because the review described in this report looks at evidence from across a broad range of topic areas, and because it is a systematic review, and so used rigorous and explicit methods to synthesise this evidence, this document is necessarily detailed. Its length and complexity have been increased by the inclusion of a range of different types of research, and other kinds of evidence. Some readers will be interested in the entirety of the report in order to get an overall picture of not only the findings of the review but also how we came to these findings. Others will want to be directed to the parts most relevant to their needs.

In order to give due prominence to the findings of the review, rather than its methods, we have divided the report into two sections: Part I focuses on the findings of the review with only very brief information given on the methods; Part II describes the review methods in detail, as well as describing the scope of research activity uncovered by our searches.

Part I is broken down into topic areas which reflect the scope of the research activity we found as well as the general causes of accidental injury (drugs, alcohol, transport and sport). Each chapter presents the findings from different types of evidence before summarising the results at the end of the chapter in a 'Discussion and implications' section.

- Readers interested in examining the detailed presentation of each type of evidence and the conclusions drawn from them will want to read Part I in its entirety.
- Those who need to gain a quick overall summary of the findings and conclusions should read the 'Discussion and implications' section of each topic area chapter together with Chapters 9 and 10.
- Those readers who are interested in how we conducted the review will need to refer to Part II for detailed methods.
- There is a section on 'further reading' at the end of Chapter 1; this points readers to other research in related areas that did not fall within the scope of this review.
- Finally, the general scope of research activity that we found is described in a 'map' in Part II and the studies in this map are also available in an online database at <http://eppi.ioe.ac.uk/webdatabases/Intro.aspx?ID=4> (see Appendix B).

Executive Summary

Summary

This report presents the findings of a systematic review of the research evidence relating to accidental injury, risk-taking behaviour and the social circumstances in which young people live. It is a broad-ranging review, covering topics as diverse as drugs, alcohol, transport and sport. It contributes a new perspective to the evidence base on risk-taking and injury by assessing explicitly the extent to which risk-taking contributes to accidental injury, and by locating this within the social circumstances in which young people find themselves. As well as examining the evidence for the above, it also contextualises its findings within current Government policy in a range of areas. It concludes that, while there is a large literature on a 'culture of risk-taking' among young people, the evidence to support the view that this translates into significant numbers of injuries is limited. Moreover, this review also challenges the idea that 'risk-taking' is a helpful umbrella term to describe the motivations underlying a range of activities. While young people undoubtedly undertake actions that result in injury, this review suggests that a move away from individual behavioural explanations towards a focus on structures and material resources is likely to be a much more productive approach to understanding overall patterns of accidental injury.

Background

The background to the review is the establishment by the UK Government of a Task Force to form the basis of cross-departmental activity to reduce accidental injuries in the population. Accidental injuries among young people, which range from sprains in sport to hospitalisation and death due to drugs or transport crashes, among young people have been identified as a particular priority and this review was commissioned to examine the relationships between young people's risk-taking and the injuries they sustain. This is because in industrialised countries such as England and Wales, accidental injury is the leading cause of death in children aged 0 to 14 years, and a major cause of death in young adults aged 15 to 24. It is also a major cause of ill health and disability in these age groups. Except where otherwise stated, the study population of this report is described as 'young people' aged 12-24. 'Children' are below this age range and 'adults' above.

Methods

Our overarching review question, which was answered in different ways by the different types of evidence in the review, was:

What are the relationships between accidental injury, risk-taking behaviour and the social circumstances in which young people live?

We sought four main sources of evidence to answer this question:

- research which tells us about the relationships between risk-taking and injury ('correlational' studies);
- UK national statistics which tell us injury rates according to different causes;
- research which has examined young people's perceptions of risk, behaviour and accidents and the factors and contexts which influence them ('views' studies); and

- systematic reviews of effectiveness to tell us 'what works' in preventing accidental injury internationally.

The inclusion of these different types of research is an important feature of this review. Its conclusions are drawn from international evaluations of injury prevention interventions, from the findings of 'qualitative' research examining the views and experiences of young people themselves conducted in the UK, and from gathering together what we know about the number and types of injuries suffered by young people.

We searched fifteen electronic databases, searched ten key journals by hand, scanned reference lists, contacted key informants and organisations, and searched websites for research to include in the review. After examining the research in detail and assessing it for relevance and quality, the review's conclusions are based on 84 studies.

Findings

The research fell into four main areas: drugs, alcohol, transport and sport. We examined the evidence in each of the areas before mapping the evidence back onto the overall burden of injury suffered by young people

Drugs

We found that the use of drugs is associated with an increased risk of accidental death among young people and that 12-24 year olds are less at risk than those immediately older. Drugs are not as an important a cause of injury among young people as, for example, transport accidents. However, since the risk of death increases with the length of drug use, this is not to say that preventative interventions should not be targeted at this younger age group. While the use of drugs overall has stabilised over recent years, the use of some drugs - such as heroin, cocaine and ecstasy - has increased. Many more young men than women die from drug overdoses, because more men take drugs, but those women who do use drugs are at higher risk. Certain other groups of young people are more at risk than others. These include young people in deprived areas and men who have recently been released from prison. Ironically, many of the correlational studies adjusted for social and economic status in order to calculate standardised rates, thereby removing the very information which might help inform policy-making to assist marginalised groups.

The included correlational studies did not contain any mention of accidents at the workplace, home or school as a result of drug impairment. This review has identified a need for research in this area focusing more exclusively on young people.

There was a clear disjunction of views between young people who used drugs and those who did not. The young people who did not take drugs regarded them as risky and stated that media images about possible negative consequences dissuaded them from trying them, while those who did tended not to believe 'official' messages about possible harms and did not perceive taking drugs as being dangerous. Cannabis in particular was singled out as possibly being good for you, with some young people believing it to be cheaper than alcohol. The recent reclassification of cannabis and the subsequent debate may have helped to reinforce this view.

The above findings relate not just to two bodies of different types research, but also two different populations of young people. The young people in the views

studies did not all take drugs, and those that did were more likely to be taking cannabis than 'hard' drugs. In contrast, the correlational studies cover deaths from opiates and other poisons. Our studies, therefore, do not contain the views of those groups of young people whose deaths are covered by the mortality statistics - either from illegal drugs, or due to volatile substance abuse (VSA). We also do not know how many, if any, young people suffer non-fatal injuries as a direct result of taking drugs. We do, however, know that the burden of the more serious injuries - as demonstrated by the mortality statistics - is carried by young people in the lower socio-economic groups.

Alcohol

Anecdotal accounts of accident and emergency departments being filled with alcohol-related casualties on a Friday and Saturday night are common, but at present, it is difficult to quantify the extent of the problem based on national statistics. Some injuries are clearly categorised in hospital episode statistics as having alcohol involvement, but since this is a supplementary code and relies on a blood test or subjective judgement, it is not clear whether these statistics are complete. We also do not know about alcohol-related injuries that do not result in hospital attendance. However, we do know how many young people are admitted to hospital from alcohol poisoning and we also know that almost everyone admitted for this reason is aged between 11 and 17. After a sharp peak among 14 and 15 year olds, hospital admissions for injuries with alcohol involvement decline slowly between the ages of 16 and 30.

Correlational studies have shown that alcohol puts the drinker at an increased risk of injury, that young people are more likely to have injuries than older people, and that young men are more at risk than young women. In the one study that examined ethnicity, minority ethnic status did not increase alcohol-related injuries, and may in fact have had a protective association.

The synthesis which examined young people's views found that young people find drinking enjoyable with the young people in the studies we found saying that they do not commonly mix alcohol and other drugs. Most young people reported that drinking places them at greater risk of injury, though some do not. The younger teenagers - 14 and 15 year olds - felt most in danger of injury when drinking. Young people felt that they learned to manage their drinking through experience and that unsupervised, outdoor drinking was the most dangerous and was more common among younger teenagers (with injuries being considered less common in licensed venues). Peers encourage both drinking and drunken pranks, but also protect one another when they have become more vulnerable as a result of drink. Young people felt that drinking reduces their perceptions of danger and some stated that injury as a result was inevitable. Most young people were cautious about getting very drunk, though being sick as a result of drinking is common and not regarded as serious. Bad experiences - whether to self or someone else - might change behaviour in the short- but not long-term.

Evidence that interventions are able to reduce alcohol-related injuries among young people is scarce and research on ways of reducing alcohol-related violence was outside the scope of this review. The one study which examined attempts to reduce alcohol-related injuries found some evidence that motivational interviews in A&E departments are more effective than information handouts.

Transport

National statistics show that 10,900 young people were killed or seriously injured on the roads in the UK in 2004. Many more young men than women are injured, although the disparity is less among car passengers than for other forms of transport. Those aged under 16 are most at risk of injury on bicycles; at age 16, more are injured on mopeds, and then at 17 and over in cars. Young people aged 17-19 years are the most likely to be involved in drink-drive related accidents. The involvement of drugs in road traffic accidents has yet to be quantified.

Research suggests that younger, as opposed to less inexperienced, motorcyclists are more likely than older motorcyclists to be killed or seriously injured while driving, but also that the factor most clearly related to severity of injury is the engine capacity of the motorcycle involved. Young drivers of cars are also more likely to be injured than older drivers.

Sixteen to twenty-four year olds in the general population in England and Wales in 1996 had a higher number of alcohol-attributable road traffic accident deaths than all other age groups. In addition, within this age group young men had over eight times as many alcohol-attributable road traffic deaths as did young women. Drugs are found in the bloodstream of more young fatal accident victims than older age groups; however, it is difficult to assess whether drugs actually contributed to the accident. A low score based on the father's occupational classification and low family affluence have both been reported as being predictive of injuries occurring on the roads, but the only independent predictor of child pedestrian injury is 'playing in the street'.

Young 'risky' drivers were more likely to think they would have an accident, but were also less worried about this than 'safe' drivers; accidents or dangerous driving were not considered to be embarrassing. Some young people expressed a fatalistic view of the chances of having an accident, and some of those that had been involved in crashes stated that it had not really affected their driving behaviour. 'Risky' driving was seen as enjoyable and not considered to be the same as driving unsafely. However, different drivers had different perceptions of what a 'good driver' was, with 'safe' drivers emphasising safety and 'unsafe' drivers emphasising driver skills.

The presence or absence of other people influenced driving behaviour. Some passengers (e.g. parents) tend to reduce risky driving, whereas others (e.g. peers) might encourage more risky driving. Young men were more likely to take risks than young women. Young people stated that they judge the degree of acceptable risk depending on the situation. Young people said they were more likely to drive riskily when driving alone or late at night when the roads are quieter than during the day or when they were responsible for others in the car. Some young people felt they 'grew out' of risky driving as they got older with more expensive cars and family responsibilities. They also said that the social expectation that they would drive riskily made it more likely that they would do so.

Young people expressed a difference in attitudes to drink-driving versus driving on cannabis. Drink-driving was generally considered dangerous and not socially acceptable, whereas driving on cannabis was more acceptable and not thought to be dangerous. Some young people stated that a lack of public transport (or alternatives, such as taxis) made it more likely that they would drink and drive.

There is a large evidence base of systematic reviews that look at interventions designed to reduce traffic injuries. Legislation on the wearing of motorcycle helmets has been found to be effective, as has legislation and enforcement on

reducing drink-driving. Raising the minimum driving age and introducing graduated licensing schemes for young people have also been shown to be effective in reducing accidents. Curfew laws, which restrict the times during which new drivers can drive, also reduce accidents. Seat belt campaigns have led to behaviour change and consequential reductions in injuries.

Interventions based on models of behaviour change to reduce drink-driving are ineffective or have a negative effect. Combining different approaches has more effect than using a single approach. Education or skills training has either negative or no effects on driver behaviour and subsequent accidents, possibly because these approaches lead to over-confidence or early licensing. The effectiveness of pedestrian education is not proven. Environmental modification and the enforcement of speed limits may be more effective at pedestrian accident prevention.

Evidence relating to community-based interventions is mixed. Some studies found that the mobilisation of social support was effective in reducing drink-driving. However, while evidence of their effectiveness is increasing, community-based interventions have not yet demonstrated a sustained impact in reducing injury.

Bicycle helmets

Despite the debate on whether or not cycle helmets should be compulsory, the balance of evidence suggests that wearing helmets reduces injury in the event of an accident.

Young people in the 'views' studies did not think cycling was very risky and did not think that accidents would happen to them. Cycling conditions (e.g. at night or in bad weather) affected their perceptions of risk and some young people believed that helmets were only needed for certain types of journey. The fact that risk perceptions differed for different types of journey did not predict the wearing of cycle helmets, only the intention to wear one, but young people who 'could never forgive themselves' if they had an injury which a helmet could have prevented were more likely to wear one.

Young people differed in their perceptions about the protection offered by helmets, with some feeling that the head was not the part of the body most likely to be injured in an accident. Beliefs about the safety offered by helmets do not necessarily predict whether a young person is likely to wear one.

'Critical incidents' - whether to the young person or to someone known to them - were reported to change behaviour, but only in the short-term. Teenagers in one study were more likely to wear a helmet if they were engaged in more risky cycling, whereas another study came to the opposite conclusion. Most young people did not feel that wearing a helmet affected the way they cycled, though some expressed concern about the possibility that motorists would think they were less vulnerable and so drive more dangerously around them.

Peers tended to be a negative influence on the wearing of cycle helmets due to concerns about being teased, particularly when first starting to wear one. Parents were often a positive influence, and some young people felt legislation would also make them more likely to wear helmets. Young people also mentioned that cheaper and more attractive helmets would be more inviting to wear.

Education interventions through a single medium were not effective at increasing the wearing of cycle helmets, but multifaceted interventions were effective. Education interventions targeting small groups had mixed effects, with some studies reporting positive results and others finding no effect.

Acknowledging that the price of helmets can be a disincentive, particularly for disadvantaged children, some interventions which provided subsidised or free helmets did increase helmet use. There was conflicting evidence about the relative effectiveness of providing free and subsidised helmets. There is some evidence to suggest that promotional campaigns have more effect in high income areas, and also that younger children were more likely than teenagers to change their behaviour (especially girls). There is also some evidence to suggest that community-based interventions are more effective than interventions based in the school.

Most primary research on helmet wearing focused on younger children, rather than young people up to the age of 24. Strategies targeted at the older age group may therefore need to be developed and tested.

The balance of evidence suggests that a combination of legislation and enforcement is the most effective means of reducing cycling injury. However, the introduction of compulsory helmet wearing can also lead to a reduction in cycling. In order to avoid this, six reviews recommend a multi-faceted approach in which legislation is preceded by education and promotional campaigns.

Sport

The greatest numbers of sports-related injuries occur to young people playing football (27%) and rugby (10%) – because these are the most widely played sports. When activity rates are taken into account, rugby is by a long way the most dangerous mass-participation sport. Stick-based sports, such as hockey, also have high injury rates, and eye injuries are more common in racquet sports. One study found that half of all injuries to young people in an accident and emergency department were sports related, and most studies which examined differential injury between sexes found that young men suffered more injuries than young women. The *Health Survey for England* found that sport/exercise accident rates peaked in young people between the ages of 13 and 15 years old.

Athletics injuries are reduced if a coach is present, and there is some evidence to suggest that adult/guard supervision can reduce injuries at swimming pools and beaches. Systematic reviews failed to find strong evidence for interventions to reduce sports injuries, and no studies in any of the reviews tackled the issue of injury in relation to social deprivation. Much of the research is focused on younger children and the question of whether or not these interventions are appropriate to a teenage audience needs to be considered.

With regard to specific sports, the use of custom-fitted mouthguards was found to reduce oral injuries in rugby and changes to the rules reduced very serious injuries in rugby and ice hockey. Similarly, the use of protective equipment reduced injuries to players of American Football, the use of belts benefited weightlifters, and eye/face protectors reduced squash injuries. For those with previous ankle sprains, ankle supports and taping were beneficial in reducing future sprains (in soccer and other sports, such as basketball). Specially designed baseball bases, which come away from the ground easily when players slide into them, were effective in lowering injury rates. Despite considerable research, there is little strong evidence to help runners avoid injury. Neither stretching nor warm up/down regimes appear to be associated with reduced rates of injury.

The environment in which sport takes place can affect injury rates. Smaller rinks are associated with more injuries in ice hockey, and the design of swimming pools can also change injury patterns. Removing monkey bars and increasing the depth of

protective bark in public playgrounds can reduce injuries significantly. Reducing potential hazards in school playgrounds has also limited rates of injury.

Recommendations

Each chapter contains specific implications and recommendations relating to the specific topic areas. Presented here are the overarching recommendations resulting from looking across the different causes of injury.

While the above topic areas cover most of the causes of accidental injury among young people, there is little evidence that consistently links individual risk-taking with accidental injury. This suggests that a move away from individual behavioural explanations towards a focus on structures and material resources is likely to be a much more productive approach to understanding patterns of accidental injury among young people.

Very few correlational studies examine possible structural causes of injury, and those that do so use different and/or unclear definitions. We need not only clearer definitions of social and economic status (SES), but better quality information on how different factors within these definitions interrelate and how they impact on accidental injury rates among young people.

There are pronounced differences between young men and young women both in rates and types of injury and in their exposure to different injury risks. Studies which examine young people's views are often eloquent on the subject of the different cultures of masculinity and femininity which contribute to shaping their behaviour, particularly with respect to transport and alcohol-related accidents where there is almost an expectation that taking risks is a normal feature of young men's lives. This is an essential context for understanding, for example, why in the 16-24 year age group young men are eight times more likely than young women to have an alcohol-related road accident. A focus on gender differences reveals some notable research gaps, for example the higher drug-related mortality risk among young women, and the greater vulnerability of young women to road accidents when travelling in groups.

Bearing in mind stated Government aims of increasing physical activity in the population as a whole, we also recommend that attention be given to ensuring that young people are not exposed to additional risk of injury as a result. In particular, if cycling is to be promoted as a healthy and environmentally friendly form of transport, we need to address the significant risks faced by cyclists sharing busy roads with much faster and heavier vehicles. The significant variations in injury rates between different sports should also be examined and the place of dangerous sport in the school curriculum should particularly be considered.

Risk-taking behaviour as an umbrella concept cannot be regarded as a useful model to explain accidental injury among young people. However, since some behaviours clearly lead to injury, we recommend a more fine-grained approach which is more sensitive to the underlying motivations, history and reasons for injury. Rather than focusing on 'risk-taking', behavioural interventions need to take account of people's different situations and recognise a striking finding across the systematic reviews - that education/information interventions alone have limited or no impact. This may not be because young people are unreceptive to the messages of such interventions, but because the influences of other factors, including the environment and social context, have an overriding importance.

The contribution of this review

This review is the first of its kind to look across risk topics and include such a wide range of research designs. It presents information not only on 'what works', but on the causes and extent of injury from a large range of sources, and it synthesises the views of the people who are the focus of interest and locates this information within current UK Government policy. It is therefore able to draw conclusions with some authority, since its broad perspective enables it to look across research activity in so many areas.

Examining research from a 'behavioural' viewpoint has enabled the review to take a critical look at the evidence base which underpins many current health promotion interventions. The conclusions about general approaches to research and the difficulty of explaining accidental injury through behaviourist approaches alone are strengthened by the broad scope of the review.

Part I: Background and results of the review

1. Introduction

Young people and accidental injury

The UK Government's Accidental Injury Task Force highlights children and young adults as priority groups for action to prevent accidental injury (Accidental Injury Task Force 2002). This is because in industrialised countries such as England and Wales, accidental injury is the leading cause of death in children aged 0 to 14 years, and a major cause of death in young adults aged 15 to 24. It is also a major cause of ill health and disability. Road traffic accidents involving pedestrians, cyclists and vehicle occupants account for a large proportion of all accidents and were the cause of nearly half of all deaths from accidental injury among children aged 0 to 14 years between 1998 and 2000. The proportion of accidental injury deaths among people aged 15 to 24 due to their presence in vehicles involved in road traffic accidents was even higher.

Within this wide age band of 0 to 24 years, two groups of young people have been particularly singled out for action: 12 to 14 year olds and 15 to 24 year olds. Within the latter age range there has been little progress in the reduction of accidental injury for a number of years (Accidental Injury Task Force 2002). It is now well established in the UK and elsewhere that rates of accidental injury are higher among the poorest children and young people, and that young men have higher rates of accidental injury than young women (Lyons et al. 2003, Roberts 2002, Roberts and Power 1996). For example, Roberts and Power (1996) found that the death rate due to injury for children from unskilled families was five times that of children from professional families between 1989 and 1992.

Because of the social class differences in rates of accidents, tackling inequalities in childhood injuries is a key part of the policy agenda. As the task force notes, 'the burden of accidental death and injury is disproportionately heavy on the most disadvantaged in society' (Department of Health 2002a). The White Paper *Saving Lives, Our Healthier Nation* set national targets to reduce the rates of death and serious injury from accidents by 2010. The Accidental Injury Task Force has set immediate and long term priority areas for action to meet these targets. Those that are relevant to young people include play and recreation (e.g. strengthening education about risk and safety in play education in schools), road accidents (e.g. local child pedestrian training schemes and travel plans), young car drivers and passengers (e.g. improve training and hazard perception skills), and injuries at work (e.g. a focus on industries most at risk of falls). The Task Force stated that, in relation to injuries to young drivers and passengers:

- There is an urgent need to update our knowledge of accidental injury in respect of 15 to 24 year olds and further studies are required in respect of 12 to 14 year olds.
- More information is needed about the possible links between alcohol and illicit drug use and accidental injury in adolescents and young adults (Accidental Injury Task Force 2002).

In 2004, as part of the work of the Department of Health to support the Task Force and implement its recommendations, the Department's Policy Research Programme commissioned a programme of research to underpin the development of new interventions to prevent injury. This systematic review is part of that programme. Systematic reviews answer a clearly formulated question using explicit methods to identify, select and assess relevant research for quality, and to draw conclusions

from their results in a transparent way. They give policymakers and other stakeholders a short-cut to the research evidence. They aim to give a transparent and unbiased picture of current knowledge in a specific area to facilitate informed decision-making.

Policy-makers suspect that the nature and motivations for risk-taking behaviour among young people (12-24 year olds) may differ from that of other age groups. Information is therefore needed to bridge this knowledge gap in order to design effective interventions to reduce risk-taking behaviour and therefore accidental injury. Policy-makers are particularly interested in finding ways to address current inequalities of social and economic status in rates of accidental injury among young people.

The burden of accidental injury

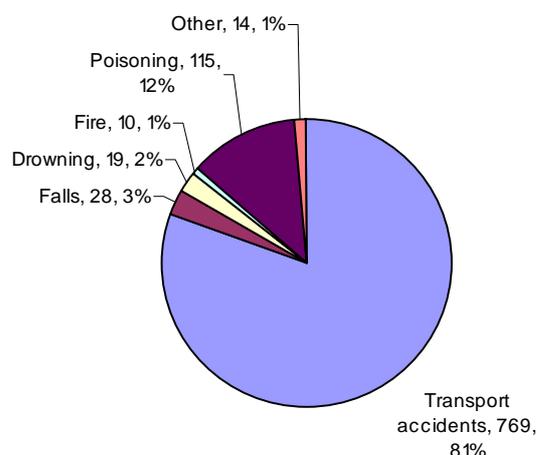
More than 10,000 people of all ages die every year because of accidental injury with over 300,000 people injured in road traffic accidents alone. Total numbers of non-fatal injuries are difficult to estimate, but approximately 5.93 million accident and emergency visits in 1999 were due to accidents in the home or leisure (Accidental Injury Task Force 2002). Treating injuries costs the NHS more than £2 billion per annum; the cost of accidental injury to the economy runs into the tens of billions of pounds and the personal costs are substantial.

The prevention of accidental injury among young people is important because it is the leading cause of death, ill health and disability in this age group. Accidents are not inevitable and injury prevention has the potential to offer significant benefits to individuals, society and the economy (Department of Health 2002a). In order to devise effective prevention strategies it is necessary to know how people are injured and why. Each chapter in this report contains details of injuries associated with specific causes; this section presents a brief overview of national injury rates.

From an international perspective, the UK has fairly low overall rates of injury. According to UNICEF, it is second to Sweden in having one of the lowest childhood mortality rates among 'rich nations' (UNICEF 2001), but at the same time has one of the highest rates of child pedestrian injuries in Europe (Department for Transport 2000b). As the Accidental Injury Task Force has observed, it is difficult to obtain precise statistics regarding the overall extent of injury among young people, since data are collected in different forms and for different reasons (Measuring and Monitoring Injury Working Group 2002). Mortality statistics, however, give some indication regarding the most serious injuries affecting young people in the UK.

Office for National Statistics (ONS) data show that, in 2004, 795 young men and 212 young women died as a result of accidents (ICD-10 codes V01-X59) (Office for National Statistics 2006a). As figure 1.1 shows, 81% of these deaths were caused by traffic accidents, 12% by poisoning, and other causes accounted for 7% in total. Mortality due to accidental injury is unevenly spread between the sexes, with 79% of the above deaths occurring to young men. Narcotics and hallucinogens caused 46 of the 115 deaths due to poisoning. A different dataset estimates that volatile substance abuse accounted for 2.2% of accidental deaths in the 10-14 age group (Department of Health et al. 2005). We should note that for the age group 25-44 this pattern changed: the proportion of people dying due to poisoning rose and the proportion of transport-related accidents fell.

Figure 1.1 Underlying causes of death: 15-24 year olds (2004)



Accurate figures for injuries which did not result in death are more difficult to obtain. The Health Survey for England (2001) (Bajekal *et al.* (eds) 2003) suggests that annual rates for serious accidents (involving visits to the hospital or doctor) were 33 per 100 among young men and 19 per 100 for young women. Rates for minor accidents were 314 and 167, respectively (Bajekal *et al.* (eds) 2003). Table 1.2 shows the rates of causes of accidents for young people in 2001. Some sampling error is apparent in the comparatively low rates of vehicle accidents, as observed by the report's authors (Bajekal *et al.* (eds) 2003, Chapter 3).

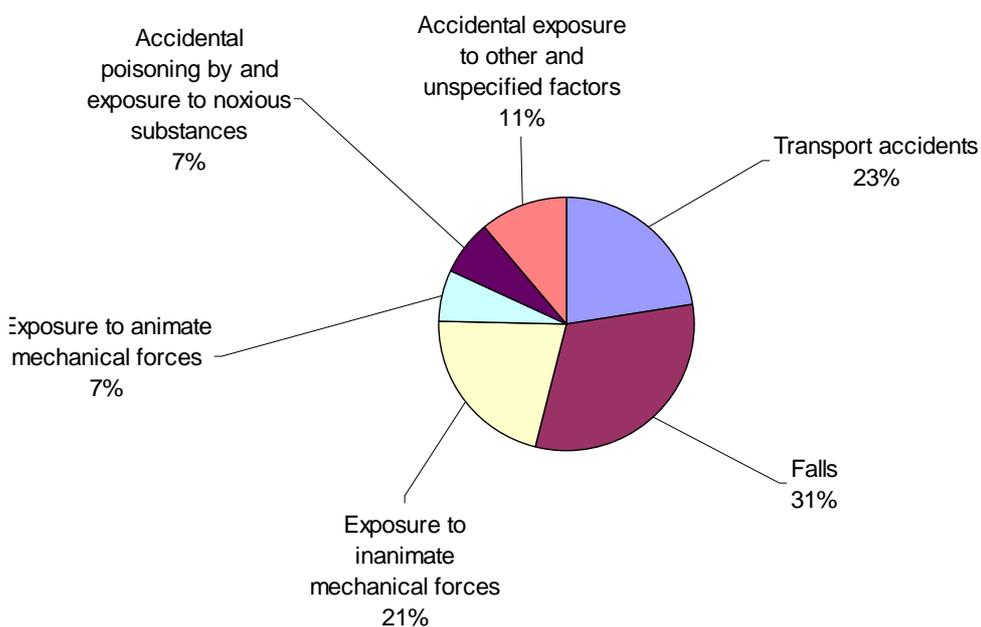
Table 1.2 Annual accident rates per 100 young people for types of major accidents. Young men (M) young women (F)

Age	12-13	14-15	16-24
Falls (excluding sport/play)	M: 14 F: 8	M: 18 F: 12	M: 7 F: 8
Sport/play	M: 20 F: 3	M: 14 F: 13	M: 11 F: 3
Tool or other implement	M: 0 F: 1	M: 1 F: 0	M: 5 F: 2
Moving vehicle	M: 0 F: 1	M: 2 F: 2	M: 4 F: 3
Bike	M: 7 F: 1	M: 1 F: 2	M: 0 F: 0
Work	n/a	n/a	M: 13 F: 7

Hospital episode statistics are another useful source of information about accidents, and they are used later in this report to provide detail about how different causes of injury vary with age. Each 'episode' represents one period 'of continuous admitted patient care under the same consultant' and they are classified according to the International Statistical Classification of Diseases and Related Health Problems, Revision 10 (ICD10) (World Health Organisation 2003). (In

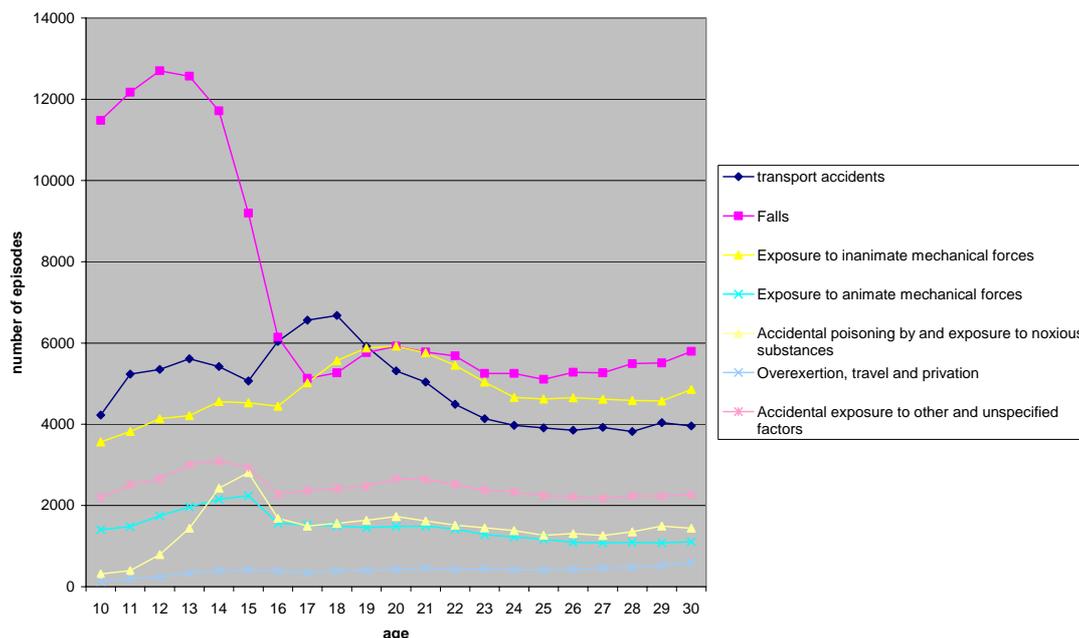
cases where a patient is transferred between consultants, they will have more than one entry in these statistics. See www.hesonline.nhs.uk for further information about hospital episode statistics.) Since comparing data by year can be problematic due to changes in organisations and classifications, we simply present gross figures in this report, presenting the total number of episodes between April 2000 and March 2004. Figure 1.3 shows the number of admissions to hospital between 2000/1 and 2003/4 due to accidental injury. Falls, transport, and 'exposure to inanimate mechanical forces' are the three largest categories of injury.

Figure 1.3 Hospital episode statistics 2000/1-2003/4: accidents to 12-24 year olds (more than 10,000 episodes)



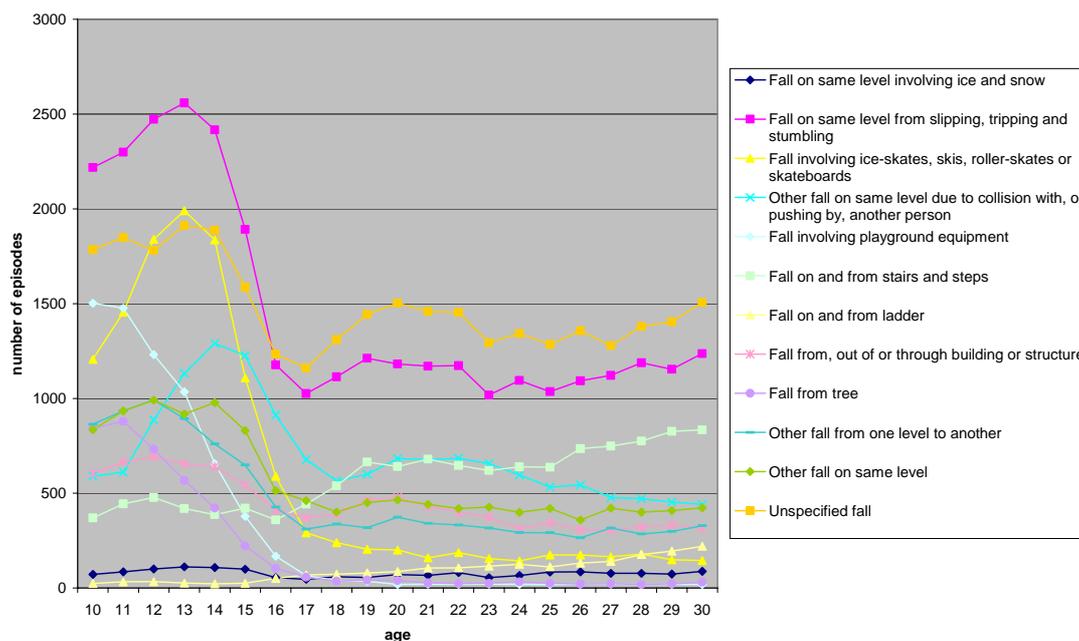
Hospital episode statistics can be broken down according to age. Figure 1.4 shows the same data as above according to the age of the person admitted. As can be seen, the reason that falls occupy such a large proportion of accidents in figure 1.4 the large number of falls suffered by people in the lower age groups. Among those aged in their late teens and older, the number of falls resulting in hospital admissions falls sharply.

Figure 1.4 External causes of morbidity and mortality: hospital episode statistics 2000/1-2003/4



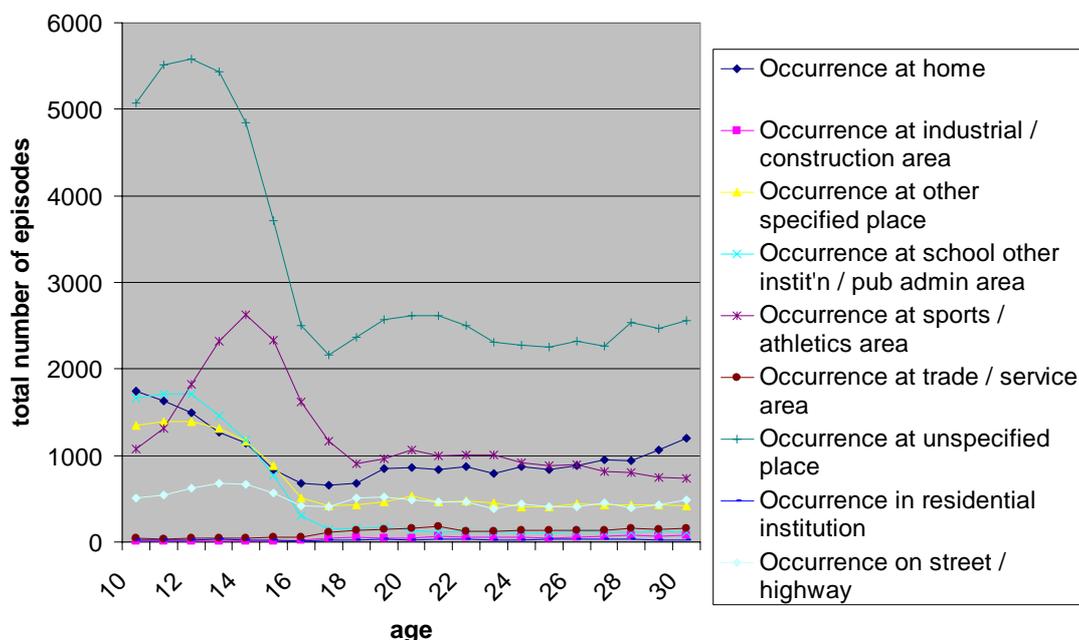
The statistics also sub-classify falls, and figure 1.5 shows a breakdown of the main classifications by age and type of fall. As can be seen, the relatively high number of admissions among the younger age group is due to falls involving: ice-skates, skis, roller-blades or skateboards; playground equipment; collision with, or pushing by, another person; falling out of trees; and a greater number of unspecified types of falls.

Figure 1.5 Subcategories within falls: hospital episode statistics 2000/1-2003/4



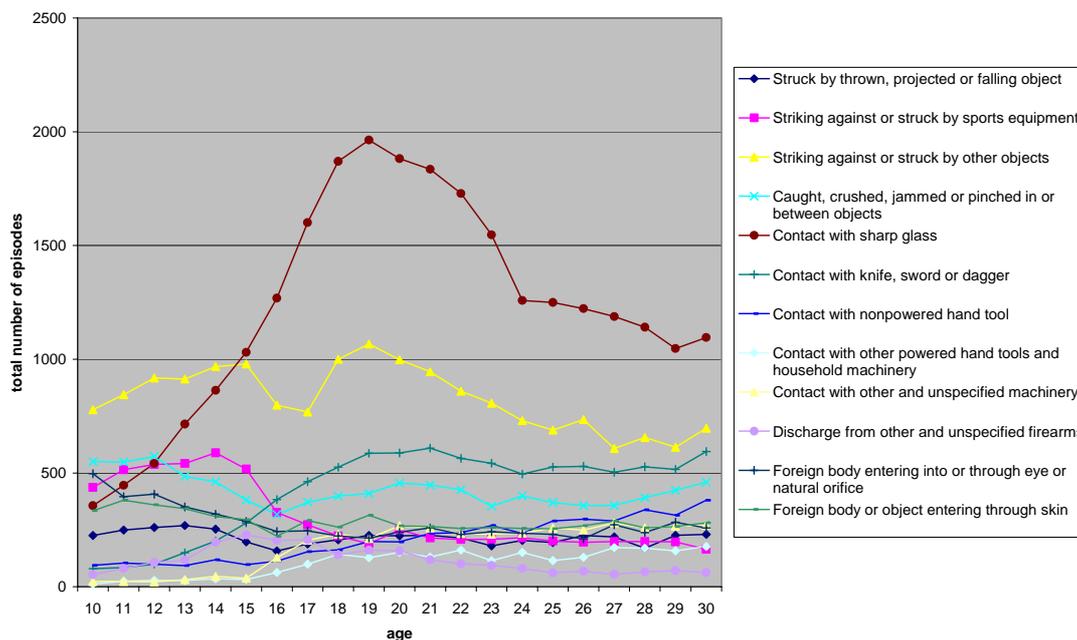
A different view of falls can be seen by examining the location coding. Figure 1.6 shows that most falls are coded 'unspecified' in this area, but the second highest categorisation is 'occurrence at sports/athletics area' telling us that a high proportion of these injuries were probably sustained playing sport.

Figure 1.6 Hospital episode statistics: locations of falls 2000/1-2003/4



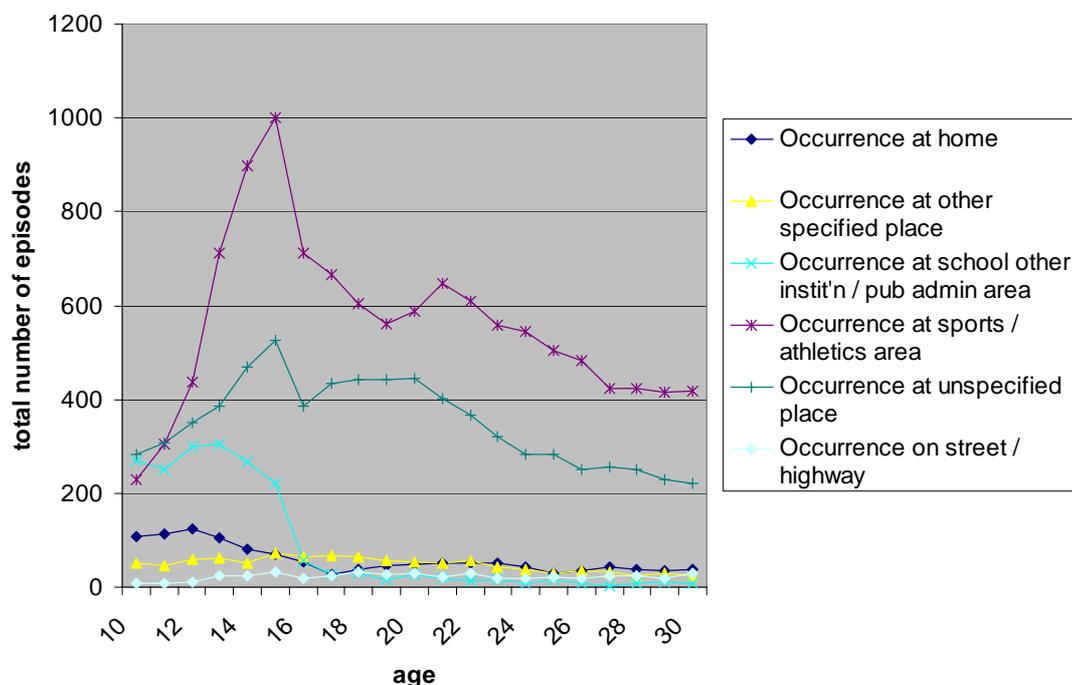
The detailed breakdown of transport injuries can be found in Chapter 5. Classifications within 'exposure to inanimate mechanical forces' are shown in figure 1.7. Injuries due to animate mechanical forces were mostly caused by hitting, being hit by, or otherwise colliding with other people and being bitten or struck by dogs. If we look at this category in more detail and examine only those injuries which were due to being 'hit, struck, kicked, twisted, bitten or scratched by another person' or 'striking against or [being] bumped into by another person' we can see that this category also contains a large number of sports injuries (see figure 1.7).

Figure 1.7 Hospital episode statistics 2000/1-2003/4: types of exposure to inanimate mechanical forces



Contact with sharp glass is the reason for most admissions in this category with injuries due to sports equipment peaking at age 14 and then falling back.

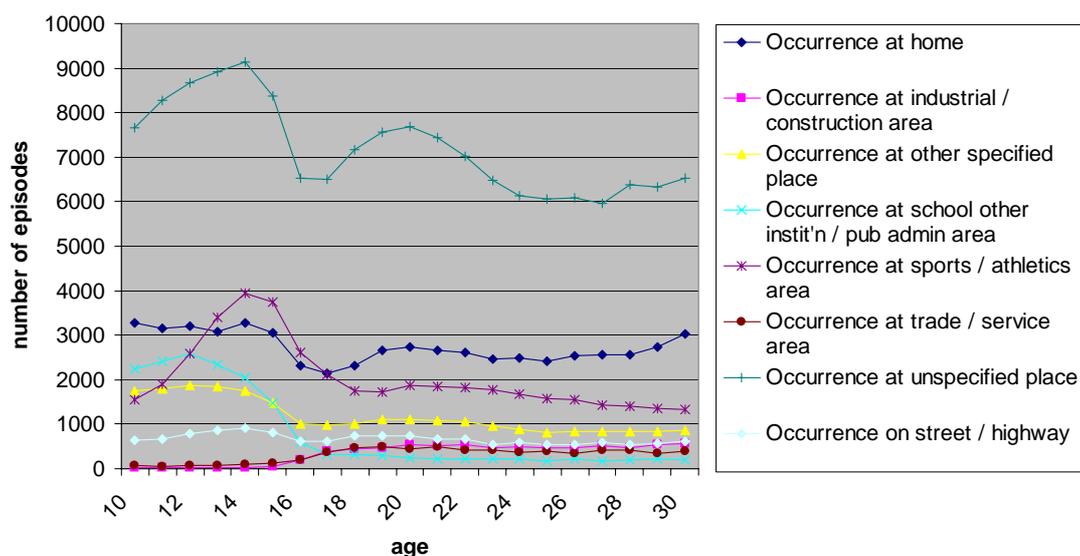
Figure 1.8 Hospital episode statistics 2000/1-2003/4: locations of injuries involving other people



The locations of non-transport injuries are shown in figure 1.9. As would be expected, injuries at school reduce and injuries in sports areas rise and then fall in

early to mid teenage years. It is difficult to obtain anything more than rough estimates of the numbers of sports injuries which resulted in hospital admissions – even though, from the ‘location’ categories, there are a significant number. The high number of ‘unspecified’ places also suggests that the ICD codes may be missing some important classifications.

Figure 1.9 Location of non-transport injuries: hospital episode statistics 2000/1-2003/4



Hospital episode statistics therefore contain a wealth of information relating to accidental injury and can tell us a great deal about the types and locations of (mostly) non-fatal accidents. The importance of accident severity is clear when comparing hospital episodes with the mortality statistics. Only 23% of hospital episodes were due to transport accidents, but 81% of accidental deaths were in this category. The difficulty of quantifying the number of sports injuries is also apparent, with no single ICD category available to classify these injuries. One might also conclude from these figures that the attention given to drugs is disproportionate compared with the number of injuries and deaths. However, it should be noted that we are only looking at *accidental* poisoning in an age group which is less at risk than others. There were 2598 deaths among people of all ages in 2004 where the underlying cause was attributed to drug-related poisoning.

Pathways to accidental injury among young people

These accidental injury rates raise some important questions. Among the UK population aged 0-65 years, young people (aged 15-24) have the highest rates of accidental injury. Why are young people more likely to suffer accidental injury in comparison to other groups? Why do some groups of young people suffer more accidental injury than others? Accidental injuries in this group, especially road traffic accidents, have been linked to behaviours such as drinking, drug taking and involvement in crime (Fergusson and Horwood 2001, Morrison et al. 2002, Roberts et al. 1995). Increases in the numbers of young people drinking alcohol and taking illegal drugs have occurred over recent years in the UK (e.g. Aldridge et al. 1999,

Goddard and Higgins 1999). It is clear that the relationship between taking risks and accidental injury in this age group needs to be explored. In addition, changes in the *distribution* of accidental injuries according to age may reflect differing patterns of, and attitudes towards, risk-taking behaviour.

However, the tendency to see accidental injury solely in terms of the outcome of engaging in unsafe or 'risky' behaviours ignores the wider social context (and any previous history of other contexts) in which accidental injury occurs. A recent study (Haynes et al. 2003) found that living in a deprived neighbourhood was associated with an increased rate of accidental injury independent of individual or household factors. The occurrence of 'risky' behaviour is itself associated with indicators of inequality (e.g. Sweeting and West 2000). Also previous experience, such as traumatic experiences in childhood, can lead to increased risk of accidental injury in later life. The pathways to accidental injury among young people are therefore complex, involving the interaction between individual behaviours, perceptions of risk, and young people's social and material circumstances.

An understanding of people's perceptions of the causes of accidental injury is important for prevention. For example (Roberts et al. 1995) found that parents saw accidents in terms of the risks built into their living space and had extensive prevention strategies. In contrast, professionals saw accidents as caused by carelessness and believed that parents had a lack of knowledge about risk. As a consequence, parents felt that professional interventions could be misguided and patronising. The parental view of 'risks' as influenced more by the environment than by 'behaviour' is supported by data which suggest that a decline in deaths from road traffic accidents involving child pedestrians aged 0-14 years is linked to the increase in the use of cars for travelling rather than walking or cycling (DiGuseppi et al. 1997). Similarly, a recent meta-analysis by Elvik (2001) found that traffic calming schemes can reduce childhood injuries from road accidents by up to 15 per cent.

Like the parents described in the study by Roberts and colleagues (1995), young people are already likely to possess their own knowledge and skills relevant to accident prevention. Most young people do not have accidents; they are therefore successfully assessing and managing the risk of accidental injury on a daily basis. Prevention strategies need to be informed by young people's own perspectives and experiences of accidental injury. The knowledge held by young people may be very different from that held by professionals, and offer great insights for policy and practice. The perspectives of young people are likely to be important for the implementation of prevention strategies too. In looking at participants' experiences of interventions to promote the use of smoke alarms to reduce fire-related injuries among children and young people, Arai and colleagues (2002) revealed a range of barriers to implementation in the experiences of the target group. For example, many of those in rented accommodation felt anxious about being held responsible by landlords for any damage caused during the installation of an alarm.

Young people and risk-taking behaviour

Risk-taking behaviours can be defined objectively (for example, epidemiological data may show certain behaviours to be more likely to result in injury than others) or subjectively (i.e. an individual's own perception of whether, or to what extent, a behaviour is risk taking) (Trimpop 1994). When participating in an objectively defined risk-taking behaviour, a person may be unaware of the risks involved and, therefore, may not be 'choosing' to take them. Subjective definitions of what is

considered a risk-taking behaviour will vary depending on the context as well as personal and social values (for example, a person may become more aware of a risk shortly after experiencing or witnessing an accident or injury resulting from that behaviour). Objective definitions of risk-taking are useful in pinpointing the behaviours (and circumstances) that are most 'risky'; research into subjective perceptions of risk-taking provides an understanding of how and why people choose to participate in risk-taking behaviours.

On a simplistic level, a decision to participate in a risk-taking behaviour may be based on weighing up the perceived benefits and costs of participating (Lloyd and Forest 2001, Trimpop 1994, Tursz 1997). Many factors will affect how these benefits and costs are perceived. Perceived costs will be influenced by the level of understanding of risk (both perceived likelihood of an adverse outcome happening and the perceived severity of this outcome), while perceived benefits may be affected by the degree of sensation-seeking desired or peer pressure felt (Tonkin 1987).

There is a substantial body of international literature on the subject of young people and risk-taking. 'Adolescents', in particular, are identified as a population that is highly likely to take risks because risk-taking is held to be part of human development and is part of shaping one's identity (Lightfoot 1997, Miller 1989). The motivations and rationale for this are regarded in different ways by different parts of the literature. They break down into three main areas: 'dispositional traits', which are attempts to identify individual differences between people which cause them to take risks; biological models, which attribute risk-taking to genetic and biological factors; and cultural factors, which situate risk-taking within behaviours adopted by specific peer groups.

Research examining dispositional factors has a long history with many papers citing Marvin Zuckerman's work on sensation-seeking and using his Sensation Seeking Scale (Zuckerman 1994). Zuckerman suggests that the sensation-seeking trait is made up of four parts: 'Thrill and adventure seeking', which expresses the desire to take physical risks especially with regard to high-risk sports; 'Experience seeking', which relates to liking new experiences with unconventional friends and through travel; 'Disinhibition', which describes people who are willing to take social and health risks; and 'Boredom susceptibility' which describes an aversion to monotonous experiences. A scale made up of 40 questions which assess an individual's position with regard to each of the above traits is used in a wide range of research. Often people's scores on one or more of the sensation-seeking scales are compared with rates of accidents or injuries to examine whether sensation seeking is a factor in accidental injury. However, recent research casts doubt on the notion that an individual's risk-taking propensity can be summarised simply by looking at sensation seeking, and it is suggested that the psychological profiles of people who take health risks, such as using drugs, are very different to those who participate in other risky activities, such as high-risk sports (Llewellyn 2003).

A comparatively new body of research questions whether risk-based models are appropriate for adolescents, given that self-regulatory functioning in the brain is not thought to develop fully until someone is in their mid-20s (Steinberg 2004). This research is looking in particular at prefrontal and related corticolimbic activity and investigating models of adolescence in animal mammals as a way to understanding human development (Keating 2004, Kelley et al. 2004). Evidence from research on animals (less so from research on humans) also suggests that the brains of young people require a higher level of stimulation to achieve the same amount of pleasure as other age groups (Spear 2000). Thus it is hypothesised that 'risk taking

during adolescence is the product of an interaction between heightened stimulation seeking and an immature self-regulatory system that is not yet able to modulate reward-seeking impulses' (Steinberg 2004, p 54).

However, as well as possible physiological reasons for risk-taking, research has also shown the importance of culture in young people's behaviour (e.g. Gardner and Steinberg 2005, Lightfoot 1997, Simons-Morton et al. 2005). For example, in a study of 306 young people aged between 13 and 22, Gardner and Steinberg (2005) found that the younger participants were more likely to take risks, that they took more risks when among their peers than alone, and that the effect of peer groups was stronger on the younger age groups than among adults. Moreover, Lightfoot (1997) suggests that risk-taking has an important position in the interactions between young people long after the risks themselves are over:

Teenagers tell and retell their adventures, and this is significant action, both socially and personally. Like the hunting, fishing, and war stories analyzed by anthropologists, adolescents' risks can be seen to promote a sense of shared history and a means by which to mediate ingroup-outgroup relations. Risks provide material for stories. They become part of the collective biography of group experience. Magnified by the symbolic meanings of the group, they can, and sometimes do, assume nearly mythical proportions. (Lightfoot 1997, p 2-3)

Finally, research has also examined the sense of invulnerability that some young people appear to possess when they assess potential risk-taking. This strand of research has a long history (for example, Elkind 1967, Jack 1989) and tends to characterise young people as assuming that 'it will never happen to me'. More recent research has cast doubt on this traditionally-held view and has found that young people aged 11-15 were less likely than those aged 20-30 to see themselves as invulnerable (Millstein and Halpern-Felsher 2002). Other research in this area has assessed whether young people's apparent attraction to risk-taking might be due to their lack of exposure to injury, death or other threats to their health and has focused on the role of 'critical incidents' in influencing young people's decisions (Denscombe 1999, Denscombe and Drucquer 1999). There is some evidence that 'critical incidents' impact on young people's attitudes towards risk-taking; this is discussed further in Chapters 3 and 4.

Aims of this review

The overall purpose of this systematic review is to gain an understanding of the relationships between accidental injury occurrence, risk-taking behaviour among young people (aged 12-24), and the social circumstances in which they live. In order to achieve this, we have used five main sources of evidence:

1. data from national statistics;
2. research which tells us about the relationships between risk-taking and injury ('correlational' studies);
3. research which has examined young people's perceptions of risk, behaviour and accidents and the factors and contexts which influence them ('views' studies);
4. information from existing systematic reviews about which interventions work;
5. papers outlining current Government policy.

Bringing together these five sources of evidence has enabled us to describe the burden of accidental injury in four main areas (drugs, alcohol, transport and sport), and how young people perceive and manage risk in these areas, and to place this information in the context of current national policy.

Defining accidental injury and risk-taking behaviour

We have used the same definitions of accidental injury that were used by the Accidental Injury Task Force (Measuring and Monitoring Injury Working Group 2002, p 2-3). Accidental injury is an injury occurring as a result of an unplanned and unexpected event at a specific time from an external cause. The following definitions and groupings are those used by the ONS based on the 9th revision of the International Classification of Diseases (ICD-9) (World Health Organisation 1979). Included are studies dealing with accidental death or injury due to:

‘transport - rail, road, air, water;
poisoning;
falls;
fire, flames and smoke;
natural and environmental factors;
submersion, suffocation and foreign bodies.’

In addition, intentional injuries are excluded from our review (as defined by the Accidental Injury Task Force). These are:

‘self inflicted injury and confirmed suicide;
homicide and injury purposely inflicted by other persons;
injury undetermined whether accidentally or purposely inflicted;
other accidental and violent deaths and injuries.’

Also excluded are chronic exposure-based injuries.

Defining risk-taking behaviour is more problematic. The term is used in different ways in different literatures and, as discussed above, there is considerable debate as to its causes and whether or not it can be regarded as a homogenous concept. An uncritical adoption of the concept might well fail to take account of the role that social and environmental factors play in accidental injury. Risk itself has been defined as ‘the probability that an event will occur, e.g., that an individual will become ill or die within a stated period of time or age’ (Tursz 1997). In turn, clinical and public health research has tended to define behaviours which can lead to ‘unfavourable outcomes’ as risk-taking behaviours, and there is evidence to suggest that young people aged between 12 and 24 are more likely than other age groups to engage in these activities (Tursz 2000).

As well as these individual factors affecting the decision-making process, it is important not to neglect wider issues that may affect this process indirectly, such as gender and social and economic status (Barss et al. 1998, Li et al. 1995). For example, being male, adolescent, of low social and economic status, and belonging to certain ethnic groups or Travellers have all been associated with higher levels of risk-taking behaviour (Barss et al. 1998, Li et al. 1995, Morris and Clements 2001, Trimpop 1994, Tursz 2000). It is therefore important to recognise that risk-taking behaviour is a contested term, and what one person views as risk-taking may be viewed very differently by someone else. This review has been carried out within

the current paradigm for defining risk behaviour. Concepts and definitions of risk change over time and vary between countries and cultures (Douglas 1994, Luhmann 2005, Ritter and Beck 1992); we do not consider this variation in our review.

We have taken a broad definition of risk-taking and have included the following behaviours/actions as risk-taking behaviours:

- impulsive or thrill-seeking behaviour;
- unsafe road behaviours (e.g. speeding or not wearing cycle helmets)
- sports activity
- drinking alcohol or taking drugs

The following fall outside the remit of the Accidental Injury Task Force and are therefore excluded from this review:

- suicide/self-harm/para-suicide
- violent behaviour
- related to sexual behaviour

These definitions mark the scope of the review and cover the major areas of accidental injury among young people. Because defining injury in terms of 'risk-taking' implies a particular model which assumes young people make a conscious decision to do something risky, we also discuss other research which assumes a different model. In particular, since the (sometimes steep) social gradients for accidental injury are well documented, we have brought other studies, which deal with socio-economic, environmental and 'neighbourhood' causes of injury, into the relevant discussions.

For each area of accidental injury, we look at the evidence relating to gender, class and ethnic differences as major axes of social division helping to explain the cultural context in which people sustain injuries.

Review questions

Our overarching review question, which will be answered in different ways by the different sources of evidence in the review, is:

What are the relationships between accidental injury, risk-taking behaviour and the social circumstances in which young people live?

In order to answer this, more specific questions were derived, which determined the types of studies to be looked at:

Which factors or behaviours are associated statistically with injury among young people?

Do the above factors and behaviours vary in their prevalence and strength of association according to:

- the age of the sample;*
- social class;*
- other subgroups.*

What is the evidence relating the use of alcohol, illicit drugs and volatile substance abuse to accidental injury among young people?

We used 'quantitative' studies which explore statistical relationships between variables and national statistics to answer these questions and have termed these studies 'correlational' studies.

How do young people define, perceive, assess and manage risk-taking behaviour in relation to accidental injury?

Do the above definitions, perceptions and behaviours vary according to:

the age of the sample;

social class;

other subgroups.

Do young people discuss accidental injury in relation to the use of alcohol, illicit drugs and volatile substance abuse? What types of accidents do they discuss in relation to these?

We used 'qualitative' studies of young people's views to answer these questions and have termed these studies 'views' studies.

Which strategies for intervention can be recommended based on the results of effectiveness studies?

Do the interventions provide evidence on differential effects according to age, class or other sub-groups?

What are the national injury rates which might be affected by the above interventions?

We used systematic reviews, correlational studies and national statistics to answer this question.

Cautionary note: interpreting correlational studies

This review makes extensive use of correlational studies in order to understand more about the relationships between accidental injury and risk-taking. However, the results of these studies need to be interpreted carefully since they usually do not justify the inference of a causal link between a given behaviour and injury, particularly when there is no other evidence to support a link.

For example, the fact that young people are more likely to be involved in a serious car crash if they have high levels of alcohol in their blood does not, in itself, lead to the conclusion that alcohol causes crashes. There is background evidence showing that alcohol impairs good driving, and that, therefore, one might be justified in claiming a causal link between alcohol and crashes. But it is very difficult to determine in any individual case, whether alcohol *actually* caused a crash, or was a contributory factor.

Interpretation is even more difficult in other correlational studies. For example, one study found that young people who take drugs are more likely to be injured than those who do not (Balding 2002). There could be many possible explanations of the association - such as an individual's increased willingness to take other risks, or increased exposure to environmental risks - and since we do not even know the type of injuries concerned, the study must therefore not be over-interpreted. In this case, as we have very little evidence to support a causal link we should not interpret the relationship as meaning that taking drugs *causes* injury.

Further reading

Though this is an exceptionally wide-ranging systematic review, there are areas of interest with regard to injury and risk-taking that were not within its scope. The following is not an exhaustive list of further reading, but contains references to other systematic reviews in related areas.

In relation to childhood injury prevention, a recent report examines current prevention activities including partnerships across the NHS and local government (Audit Commission and Health Commission 2007). This report, and a systematic review by Towner and colleagues (2005), also examines the issue of inequalities in unintentional injury rates among children. Towner and colleagues have conducted a number of systematic reviews of what works in preventing childhood unintentional injury (Towner et al 2001a, 2001b, Towner 2002).

Risk taking in relation to sexual health was outside the scope of this review. However, seven systematic reviews about pregnancy prevention have been published in recent years (Bennett and Assefi 2005, Dennison 2004, DiCenso et al. 2002, Harden et al. 2006, Health Development Agency 2001, Swann et al. 2003), as have a number of systematic reviews on the prevention of HIV and other sexually transmitted infections in young people (Magnussen et al. 2004, Morrison-Beedy and Nelson 2004, Mullen et al. 2002, Pedlow and Carey 2003, Robin et al. 2004, Yamada et al. 1999).

Violence, either as a cause of injury, or as risk taking behaviour, was not within the scope of this review. We know of one systematic review of school-based violence prevention initiatives (Mytton et al. 2006), and recently Wilson and Lipsey (2006a, 2006b) have published two systematic reviews of school-based social information processing interventions on aggressive behaviour. A systematic review by Chan and colleagues (2004) focused on preventing violence and related health-risking social behaviours in adolescents.

The long-term health impact of risk behaviours such as drinking and drug taking are not discussed in the review as these were considered to be chronic exposure-based injuries. While there are a number of recent systematic reviews focused on a range of drug prevention interventions for young people (Cuijpers 2002, Gates et al. 2006, Faggiano et al. 2005, Skara and Sussman 2003, Tait and Hulse 2003), there is a paucity of review level evidence about reducing alcohol misuse. A recent HDA review of reviews (Health Development Agency 2005) identified only one systematic review relating to young people (Foxcroft et al. 2002).

Accidents in the home are a cause of many injuries to children and young people, but were not within the scope of this review. Systematic reviews of home-based accident prevention strategies include those directly related to fire prevention (DiGuseppi and Higgins 2001, Warda et al. 1999) and others of interventions involving education and, or modifications to, the home (Close 2002, Kendrick et al. 2007, Lyons et al. 2006, Thompson and Rivara 1998).

In July 2006 the HDA published an evidence briefing of interventions to prevent accidental injury to young people (Errington et al. 2006). This report was not available at the time of conducting this review, and did not explicitly consider risk-taking behaviour. However it is a thorough exploration of the review level evidence on injury prevention and we recommend it as a useful and timely resource.

2. Methods

This report describes the results of a systematic review of research relating to young people and accidental injury. It contains:

- 'correlational' studies and UK national statistics which tell us injury rates according to different causes;
- studies which tell us about young people's views and experiences in the UK; and
- systematic reviews of effectiveness to tell us 'what works' in preventing accidental injury internationally.

The review answers the questions outlined in the previous chapter in a structured and systematic way, aiming to avoid drawing wrong or misleading conclusions by attempting to ensure that all relevant reliable is included. Detailed methods are presented in Part II of this report.

We searched 15 electronic databases, searched ten key journals by hand, scanned reference lists, contacted key informants and organizations, and searched websites for research to include in the review. Databases included major databases such as PsycINFO and MEDLINE and specialist databases including SIGLE and the National Research Register. The journals we handsearched ranged from general sources relating to injury, such as Injury Prevention, to topic-specific journals including Addiction and the British Journal of Sports Medicine. Studies needed to have been published between 1985 and 2005, with the majority of their data also being collected during this time period. Our searches found 4981 potentially relevant studies of which, on closer inspection and after the retrieval of 1495 paper reports, 168 reports contained information about 143 separate studies which were relevant to answering our review questions. After examining the research in detail and assessing it for relevance and quality, the review's conclusions are based on 84 studies. Since the potential scope of this review was very large, we concentrated on research and policy in the UK, with an international perspective being obtained from previous systematic reviews.

We used standardised frameworks to describe key aspects of each study (for example, population, topic area, research method, and conclusions) and entered these data onto an online database. All studies were assessed for methodological quality and relevance before being included in the review. We used different quality assessment tools for assessing the reliability and validity of different types of study and also assessed the ability of each study to answer our review questions. A judgement about the overall 'weight of evidence' was reached by consensus. This was based on how useful the study was in helping to answer the review question and how reliable its findings were. Studies judged to have a low overall weight of evidence were not included in the synthesis. The database of studies used in this review is available for online searching at:

<http://eppi.ioe.ac.uk/webdatabases/Intro.aspx?ID=4> (see Appendix B for further information).

Since the review contains different types of research, we used different methods to bring the research together into 'evidence syntheses'. The topic area focus for each synthesis was selected based on the studies found in the review. These specific topic areas are looked at in individual chapters. To make sure that these chapters are useful for the reader interested in a specific area, relevant national statistics on accidental injury (where available) and other background information are provided. A detailed 'map' of research activity from which we derived our

topic-based divisions can be found in Part II of this report. The 'qualitative' studies examining young people's views were synthesised thematically using methods which are commonly employed when primary research is analysed. The findings of the statistical correlational studies were entered into more than 100 pages of tables, organised according to the five prioritised areas of risk-taking behaviour, type of accidental injury, particular variable, and numerical data. Reviewers working in pairs then confirmed the direction of the association that any particular variable of risk-taking behaviour was thought to have with accidental injury. The tables allowed reviewers to bring the findings of the studies together in a uniform way which allowed the numerical findings and the textual data to be combined in a narrative conceptual synthesis.

3. Evidence synthesis: drugs

This chapter focuses on injury (including fatal injury) due to accidental poisoning from drugs - although discussion of alcohol has been placed separately in the next chapter. It is important to note that, while not a focus of this review, the use of drugs is also associated with increased rates of suicide and self-harm, psychiatric morbidity, and diseases which can be transmitted through sharing needles such as hepatitis B and C and HIV/AIDS (e.g. Goulden and Sondhi 2001, Office for National Statistics 2000, Office for National Statistics 2002b). Much of the research presented in this chapter concerns the use of illegal drugs. However, before examining this subject in detail, we will look at the overall burden of injury from poisoning.

National picture

ONS figures show that in 2001 there were 2898 deaths in England and Wales due to 'drug-related poisonings' in all age groups, a figure which has remained relatively stable since 1997 (Office for National Statistics 2003). As stated in the introduction, poisoning accounted for approximately 12% of deaths among 15-24 year olds in 2003 and 2004 (115 deaths in 2004). Of these, 46 young men and 11 young women died from poisoning due to narcotics and hallucinogens (including cannabis, cocaine and heroin).

Hospital episode statistics, which include people formally admitted to hospital, either for day case procedures or as inpatients, show the ages at which young people are affected by poisoning.

Figure 3.1 Poisoning: hospital episode statistics 2000/1-2003/4

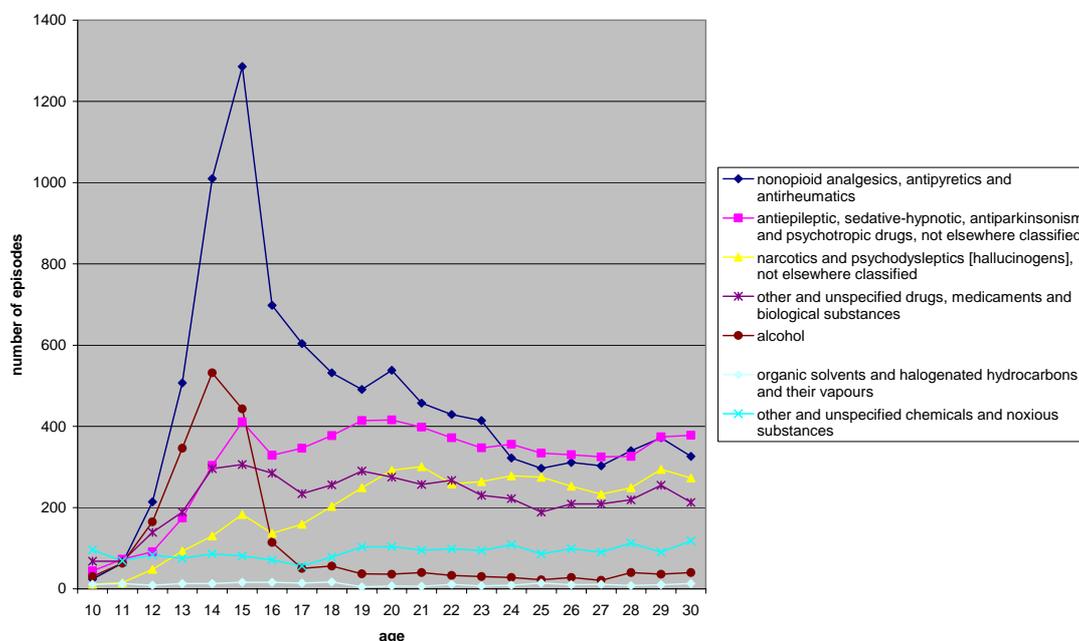


Figure 3.1 shows that poisoning is relatively rare in 10 and 11 year olds, but as young people reach their teens they are admitted to hospital for a range of poisonings. The drugs with the highest number of cases are nonopioid analgesics, antipyretics and antirheumatics which include paracetamol and ibuprofen.

Admissions due to alcohol poisoning were ten times higher among those aged 14 compared to 17 year olds. The series marked 'narcotics and psychodysleptics' contains the illegal drugs which are the focus of much research activity.

Illegal drugs

The Misuse of Drugs Act 1971 established three categories of classification for certain drugs with different penalties for possession and supplying. The classification system places drugs in a scale of categories (A to C) depending on the likelihood of effects being harmful enough to cause a 'social problem' with the potentially most harmful drugs being categorised as 'Class A'. Table 3.1 shows the UK classification system in 2005. A useful history and overview of the evidence base for the UK system has been written by Levitt and colleagues (2006).

Table 3.1 UK classification of drugs, 2005 (Levitt et al. 2006)

Classification	Drugs
Class A	heroin, LSD, ecstasy, amphetamines (prepared for injection), cocaine, crack, magic mushrooms, crystal meth
Class B	amphetamines, barbiturates
Class C	cannabis, Tamazepam, anabolic steroids, Valium, Ketamine, methylphenidate (Ritalin), Pholcodine, GHB, mild amphetamines (such as slimming tablets)
Medicines Act	Poppers (Amyl nitrate)

In this chapter the following drugs are discussed:

- opiates (heroin, morphine, codeine)
- cocaine (including crack cocaine),
- amphetamines (speed)
- ecstasy
- methadone (a synthetic painkiller used to wean addicts off heroin)
- cannabis
- benzodiazepines (drugs used for the treatment of anxiety)
- antidepressants (drugs used for the treatment of depression)
- paracetamol

While not classified as an illegal drug, volatile substance abuse (VSA) (gas, aerosol propellants, solvents in glue, and other solvents) is also discussed.

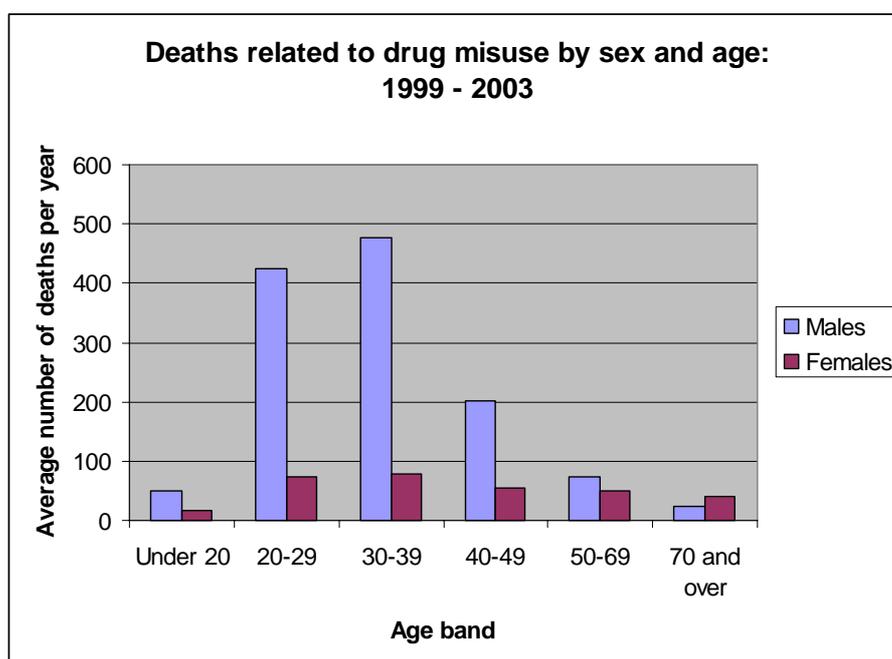
In 2001, ONS reported that deaths due to poisoning by heroin or morphine, cocaine (including crack cocaine), and ecstasy had increased, while those due to paracetamol had decreased. In a report on deaths related to drug poisoning in the Spring 2002 edition of *Health Statistics Quarterly* (Office for National Statistics 2002a), the ONS stated that

both sexes had low proportions of deaths in the under 20 age group, increasing to a peak in the 20 to 29 age group and then declining

subsequently with age. The peak and subsequent decline were more marked in males than females. For females, the peak was much lower (just under 25 per cent of all female deaths occurred in 20 to 29 year olds compared to nearly 40 per cent for males in the same age group) and the decline with age stopped at the 40 to 49 age group. Following this, the proportion of deaths due to misuse remained steady at about 15 per cent. (p 81)

Using the more recent figures from the Spring 2005 report (Office for National Statistics 2005b), Figure 3.2 shows this age distribution in graphical form. The hospital episode statistics (above) reflect this in a gradual rise in admissions between the ages of 12 and 20.

Figure 3.2 Deaths related to drug misuse by sex and age (1999-2003)



The General Registrar Office for Scotland prepares similar statistics which are available online (General Register Office for Scotland 2005).

The mortality statistics reported above are mirrored in terms of estimated rates of drug use and in the ages of those receiving treatment. The ONS reports that rates of Class A drug use among young people have remained stable and the use of other illegal drugs has fallen when comparing 2005 with 1998 (Home Office 2005a). According to statistics from regional drug misuse databases, about a third of those in treatment programmes in 2000/1 were under the age of 25 (Department of Health 2001).

The Community Health Sciences Department at St George's, University of London, has been collecting data on deaths in the UK from volatile substance abuse for about 20 years. Its latest report deals with the years 1971-2003 (Field-Smith et al. 2005). Key findings from the report are:

- there were 51 deaths associated with VSA in 2003, the lowest annual total recorded since data collection methods were stabilised in 1983;
- the majority of deaths (40 of the 51) were associated with gas fuels;

- between 1971 and 2003, half of all VSA deaths occurred in the under-18 age group
- the practice of VSA is nearly equal between the sexes;
- there is no statistically significant regional variation, though the areas with the highest rates are the North East of England and Scotland;
- it is too early to assess the impact of legislation passed in 1999 which bans the sale of cigarette lighter refills to under-18 year olds.

More young people aged 10-16 die from VSA than illegal drugs. For example, in England and Wales in 2002, there were 18 deaths from VSA among young people, compared to 6 drug-related deaths (Department of Health et al. 2005).

There is a growing body of international literature on the factors associated with young people's drug misuse and other risky health behaviours. A wide range of social variables have been identified as risk factors for drug misuse: single parent families (Miller 1997, Smith and Nutbeam 1992); problematic family relationships (Stoker and Swadi 1990); low parental education (Miller 1997); social and economic disadvantage (Furr-Holden and Anthony 2003); and lack of social support (Miller 1997). Longitudinal studies in the USA suggest that school experiences can have an independent effect on risky health behaviours, including drug misuse, over and above these risk factors (Resnick et al. 1997), with 'school bonding' (measured by strength of relationships at school and commitment to school) shown to be related to lower levels of drug use (Catalano et al. 2004). Studies conducted in the UK on the link between school experiences and risky health behaviours have tended to focus on teenage pregnancy, smoking, and drinking (Bonell et al. 2005, Harden et al. 2006, Nutbeam et al. 1993). For example, Bonell and colleagues (2005) found dislike of school to be an independent risk factor for teenage pregnancy. Although none of these UK studies investigate the link between school experiences and drug taking, these risky health behaviours share a number of common 'distal' causes with drug misuse (Jessor et al. 1991).

Correlational studies

After two studies were excluded on the basis of their low weight of evidence (Hammersley et al. 1992, Measham et al. 2000), a total of 13 correlational studies were identified for this synthesis. All but one (Balding 2002) examined mortality relating to drug use. Balding's study was a large annual survey which considered accidental injury among school children aged 10-15.

Mortality among young people (in these cases aged 15-19) who took drugs was the specific focus of only two studies.

Five studies analysed data from England and Wales (Oyefeso et al. 1999, Roberts et al. 1997, Schifano et al. 2003, Shah et al. 2001, Uren 2001), five took place in Scotland (Bird et al. 2003, Bird and Hutchinson 2003, Frischer et al. 1993, Frischer et al. 1997, Obafunwa and Busuttill 1994), two in England (Gossop et al. 2002, Hickman et al. 2003) and one in the UK as a whole (Balding 2002).

Three focused specifically on mortality among people who injected drugs (Bird et al. 2003, Frischer et al. 1993, Frischer et al. 1997); one study (Schifano 2003) examined deaths related to taking ecstasy (alone or with other drugs); two studies focused on a range of mostly Class A drugs (Uren 2001, Roberts et al. 1997); one included only individuals whose main drug of choice was heroin (Hickman et al. 2003); and five studies considered prescription and/or 'over the counter' drugs as well as illegal drugs (Bird and Hutchinson 2003, Gossop et al. 2002, Obafunwa and

Busuttil 1994, Oyefeso et al. 1999, Shah et al. 2001). The final study looked at drug-related mortality among men recently released from prison (Bird and Hutchinson 2003).

Drug use is associated with an increased risk of accidental injury

Evidence from the correlational studies is unequivocal: young people who take drugs are more likely to have accidental injuries than those who do not. In *Young people in 2001*, Balding (2002) states that young people who report ever having used illegal drugs or having smoked or consumed alcohol in the last week were more likely to have had an accident. The example given, year 10 males (14-15 years), showed that those who had ever used drugs were 43% more likely to have had an accident involving treatment by a doctor or hospital in the previous year than those who had not. (The relative risk was derived by the reviewers of this paper to be 1.43.)

The four studies which compared mortality among people who took drugs with that of the general population all found significantly higher mortality among those who took drugs (Frischer et al. 1993, Frischer et al. 1997, Gossop et al. 2002, Oyefeso et al. 1999).

Oyefeso, for example, found that 'Overall, teenage addicts are about 12 times more likely to die as teenagers in the general population of the same age'. The evidence also suggests that drug-related mortality is rising (Oyefeso et al. 1999, p 440). Roberts and colleagues (1997, p 40) found that 'from 1985-1995 the death rate from accidental poisoning increased by 8% per year (95% CI 5-17%); the death rate from poisoning by opiates and related narcotics increased by 27% per year (17-36%). Death rates from poisoning by other psychotropic agents increased by 23% per year.'

Two studies reported that among 15-24 year olds opiates were the drug most commonly associated with mortality (Roberts et al. 1997, Shah et al. 2001). Shah found that they were responsible for considerably more deaths in this age group than benzodiazepines and antidepressants and Roberts and colleagues reported that opiates and other narcotics accounted for 21% of the deaths in their study of 15-19 year olds.

Under 25 year olds had a lower risk of drug-related mortality compared to older people

A consistent picture also emerges when the relative risk of dying from accidental poisoning is examined across age groups, with under 25s at a lower risk than older age groups - in particular compared to those aged 25-34 years (Bird et al. 2003, Frischer et al. 1993, Gossop et al. 2002, Hickman et al. 2003, Obafunwa and Busuttil 1994, Schifano et al. 2003, Uren 2001). This finding gives a true picture of which age groups are most at risk because the majority of these studies conducted some form of age-standardisation. (One study of people who injected drugs in Glasgow found that 15-19 year olds may be at a higher risk than any other age group (Frischer et al. 1997). This discrepancy could be explained by the fact that this study was of a cohort of individuals who took drugs identified from the records of one treatment centre, and therefore may not be representative of Glaswegians of this age group who use drugs.)

Mortality risk increases with length of drug use

In the study by Frischer and colleagues (1997), length of drug use (from 0-14 years) was associated with the probability of fatality. After 10 years of injecting drugs,

the risk of dying was about 1 in 10. However, a person's age at first drug use was not a predictor of fatality.

Drug-related deaths are more likely in deprived areas

Among our included correlational studies we located very limited research on socio-economic inequalities (either at an individual or area level) and drug-related injury. In the two correlational studies we did find, the results were given for 'all ages' (Gossop et al. 2002, Shah et al. 2001). The study by Shah and colleagues (2001) concluded:

Our results indicate that drug poisoning deaths are substantially higher in areas of greatest deprivation; this may be due to a number of factors, in particular, higher prevalence of mental illness and illicit drug use... The results of our study indicate that there are clear demographic and socio-economic differences in mortality from drug poisoning... and this emphasizes the importance of addressing social deprivation and inequalities as a means of decreasing mortality rates from drug poisoning. (Shah et al. 2001, p 246)

Gossop and colleagues (2002) reported that the risk of fatal drug overdose was associated with homelessness.

While we located very limited research on socio-economic inequalities and drug-related injury, we did find some studies which examined the association between social and economic status (SES) and drug-taking, of which the most relevant are reported in the discussion section below.

Men are at higher risk of drug-related death in the two weeks after release from prison than in the ten subsequent weeks

The final group to emerge in the correlational studies as more at risk than others was males released after 14 or more days in prisons or young offenders' institutions in Scotland. One study (Bird et al. 2003) found that young men were particularly vulnerable in the first two weeks after release compared to the subsequent ten weeks. Mortality was five times higher in the 15-20 age group and nearly nine times higher for those aged 21-25. (The age group with the highest risk was 26-30 year olds.) We found no studies which looked at similar risks for young women.

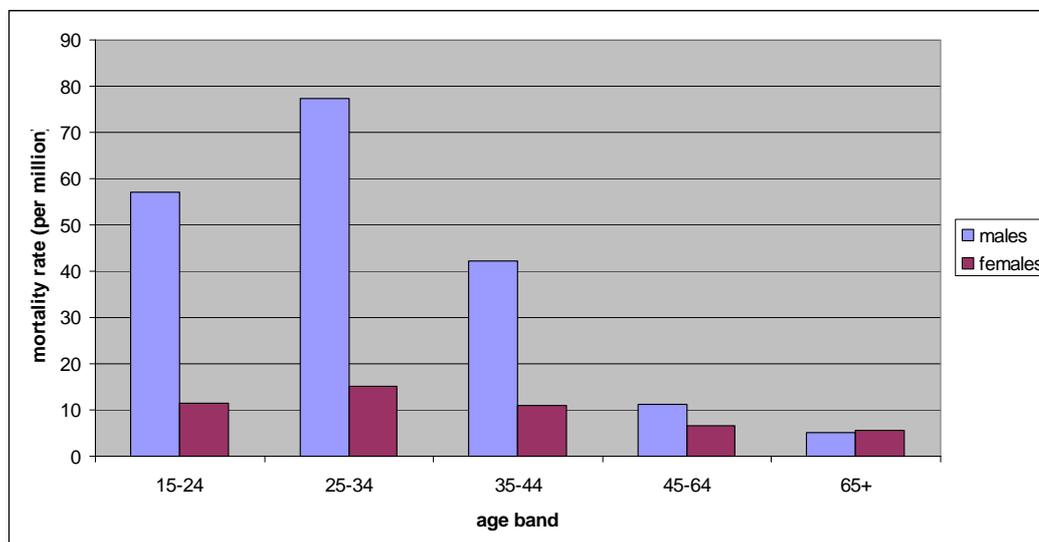
More men die from drugs than women, but more men use drugs. Among drug users, women are more at risk of drug-related death than men

Seven studies explored the differences in mortality among men and women who used drugs (Frischer et al. 1993, Frischer et al. 1997, Obafunwa and Busuttil 1994, Oyefeso et al. 1999, Roberts et al. 1997, Shah et al. 2001, Uren 2001).

Three studies which collected data as crude rates or frequencies (Obafunwa and Busuttil 1994, Roberts et al. 1997, Shah et al. 2001) found a higher number of young men were dying of drug related causes than women. For example, Roberts and colleagues (1997) analysed routine data from 1985-1995 and found that 70% of 15-19 year olds who died from accidental drug poisoning were male. A typical graph showing the age distribution of deaths due to opiates is shown in figure 3.3 (Shah et al. 2001). Between 1993 and 1998, out of every million people aged between 15 and 24, 57 men and 11 women died as a result of opiate poisoning. These findings are consistent with the fact that fewer women take illegal drugs (Bates et al. 2005, Department of Health 2004d, National Centre for Social

Research and National Foundation for Educational Research 2006). However they conceal the true risk of drug-related death among women.

Figure 3.3 Age-specific mortality rates (per million) (Shah et al. 2001, Table 5)



Four studies took account of the differences in demographic characteristics and mortality differences between males and females in the general population. Two studies of people who were registered addicts and/or injected drugs examined gender differences in mortality by comparing the study population mortality rates with men and women of the same age in the general population (Frischer et al. 1993, Frischer et al. 1997). They both found that young females had a much higher mortality rate. For example Frisher and colleagues (1997) found the excess mortality ratio among 15-19 year old registered addicts and/or injecting drug users was 58.5% for men and 94.3% for women, and 20.6% for men and 46.5% for women aged 20-24 years. These findings are consistent with the fact that the general population of young women have a lower rate of mortality than men of the same age.

The remaining two studies compared age-standardised mortality rates for men and women (Uren 2001, Oyefesso et al. 1999). Uren found similar mortality rates for men and women aged less than 25 years whose deaths were as a result of heroin/morphine misuse. Oyefeso and colleagues (1999) analysed drug-related deaths among young people (aged 15-19) for all drugs. Unlike males, excess mortality in females was never in decline during the 20 year study period, and female excess mortality was twice as high.

These studies show that while more young men than women die from causes related to drug-taking, those young women who take drugs are at greater risk of dying.

Drug-related death rates vary by region

The geographical distribution of drug-related deaths supports the importance of social and economic circumstances. In a study examining geographical variations in England and Wales between 1993 and 1999, Uren (2001) found that the regions with the highest heroin and/or morphine use mortality rates for males aged under 25 were Yorkshire and the Humber, followed by the North West. (There were too few female deaths in this age group to reach statistical significance in any region.)

This study also found that mortality from methadone use for those aged under 25 was significantly higher in the North West than in other regions of England and Wales, and significantly lower in the West Midlands and the South East.

A further study examined geographical variations in drug-related mortality within Scotland, but analysed data for the whole age group (15-54 years) only (Bird et al. 2003).

Studies of young people's views: how do young people perceive/assess the risks of accidental injury in relation to taking drugs? What affects this perception of risk?

Seven studies reported young people's views of drug taking and accidental injury (Bendelow et al. 1998, Boreham and Shaw 2002, Danton et al. 2003, Deehan and Saville 2003, Denscombe 1999, Engineer et al. 2003, Gillen et al. 2004). One of these (Boreham and Shaw 2002) was judged to be of low weight of evidence in terms of answering the review question, and so was excluded from the review.

Young people who did not use drugs perceived drug-taking as risky, but those who took drugs thought they were not dangerous

The perceived risk associated with taking drugs varied widely between young people who had taken drugs and those who had not. Those who did not use drugs tended to perceive drug-taking as being risky while those who took drugs thought it was not very risky or not at all dangerous (Bendelow et al. 1998, Denscombe 1999, Gillen et al. 2004). Young people who used cannabis but not other drugs perceived cannabis as being less risky; indeed other drugs were considered 'dangerous' by these young people (Bendelow et al. 1998). Many cannabis users thought that smoking cannabis was safer than drinking as they were less likely to lose control or 'do stupid things' (Bendelow et al. 1998, Engineer et al. 2003). However, a study of young clubbers found that they were generally aware of the risks and adopted strategies to lessen these risks (Deehan and Saville 2003). For example, you 'never buy drugs from a dealer in a club' because the quality may be poor and could be dangerous (Deehan and Saville 2003). However, for most there was a sense that 'it won't happen to me' (Deehan and Saville 2003).

Some young people thought that taking cannabis before driving did not increase their risk of accidents, although drinking alcohol before driving was considered dangerous (Danton et al. 2003). Mixing alcohol and cannabis was not perceived as dangerous per se by those who did it, although it was often avoided because it was felt that it could make the user feel sick (Engineer et al. 2003). Some young people who used other drugs such as speed or ecstasy viewed mixing them with alcohol as dangerous or pointless (Engineer et al. 2003).

Those who were younger (11-12 year olds compared to 14-15 year olds) were less likely to have taken drugs and less likely to have information about drugs; the younger age group tended to perceive drugs as being more dangerous than the older age group (Bendelow et al. 1998).

How do young people manage taking drugs in relation to accidental injury?

The factors that affect young people's drug-taking behaviour can broadly be categorised into individual factors, influences from other people, and social and environmental factors.

The individual factors which young people identified as shaping their behaviour fall into two main categories: critical incidents, and the perceived pleasure obtained from taking drugs.

Media images of the negative consequences of drug-taking dissuaded those who had never taken drugs from trying them

For those who had not previously taken drugs, seeing negative consequences in films and documentaries (for example, the Leah Betts video (*Sorted*), or the films *Pulp Fiction* or *Trainspotting*) put them off trying them (Bendelow et al. 1998, Denscombe 1999). In particular, they said that the vivid images and realistic nature of these films had the greatest impact on them, as they were able to identify with those portrayed.

Cannabis was used for pleasure and some thought it was good for them

Those who used cannabis (aged 14-15 years) did so for pleasure. Among those who had taken it, there was a perception that cannabis was 'safe'; some also thought it was good for their health, both physically and emotionally (Bendelow et al. 1998).

Official messages about drugs were not believed by those taking cannabis

Those aged 14-15 years who smoked cannabis felt that official messages about the dangers were wrong (Bendelow et al. 1998). Several young clubbers thought that the media overreacted to drugs and that it 'blows out of proportion' the bad reaction experienced by the few (Deehan and Saville 2003). The fact that drugs are illegal was a risk that was considered, on top of risks to health (Bendelow et al. 1998, Deehan and Saville 2003). Pop stars were seen as examples of the dangers of drugs.

Some thought cannabis was cheaper than alcohol

Some young people who used cannabis stated that economics influenced their decision; cannabis was regarded as cheaper than other types of risk-taking such as drinking alcohol (Bendelow et al. 1998).

Systematic reviews of effectiveness

Our search did not identify any systematic reviews of interventions designed to reduce the accidental injuries associated with drug use among young people. (There are, of course, a great many systematic reviews which deal with interventions to reduce drug use, but since they do not deal with accidental injury, we did not include them.)

Current policy in the UK

The UK Government's current drug strategy was launched in 1998 with *Tackling Drugs to Build a Better Britain* (Cabinet Office 1998), which was updated in 2002 (Home Office 2002). The most recent report which details Government strategy in this area is *Tackling Drugs. Changing Lives: Delivering the difference*, published in November 2005 (Home Office 2005b). The strategy has four main aims:

- reducing the supply of illegal drugs;
- preventing young people from becoming drug misusers;

- reducing drug-related crime;
- reducing the use of drugs through increased participation in treatment programmes.

At a regional and local level in England and Scotland, Drug Action Teams (DATs) are working in partnership with local agencies to implement the strategy. DATs are teams which partner representatives from different organisations (local authorities, NHS, probation service, the prison service and the voluntary sector) to co-ordinate cross-agency work. Since 2001, DATs in England have been aligned with local authority boundaries. In Wales and Northern Ireland, this function is being performed by Regional Advisory Teams and Drug Co-ordination Teams respectively. Currently, ten Drug Action Teams (DATs) are testing child- and youth-centred interventions as part of the Drug Interventions Programme (DIP) in England. DIP was introduced in 2003 and aims to move people in the criminal justice system into treatment.

As part of the *Every Child Matters* strategy, a Young People and Drugs Delivery Plan is now being implemented by the Home Office, with the Department for Education and Skills and the Department of Health, which aims to develop and target specialist drug services for children and young people (Department for Education and Skills et al. 2005). The main areas of activity are in: awarding funding through the *Young People's Substance Misuse Partnership Grant*; the *FRANK* national drug awareness campaign (www.talktofrank.com); encouraging social inclusion through participation in sport and leisure activities through the *Positive Futures* initiative; and investigating the effectiveness of drug education through the *Blueprint* research programme.

The National Treatment Agency for Substance Misuse, a special health authority, was created in 2001 'to improve the availability, capacity and effectiveness of treatment for drug misuse in England' (www.nta.nhs.uk). The Agency has released guidance to helpline providers who provide advice to prevent overdose and reduce fatalities (McLean and Derricott 2004). The advice contains information about the effects of different drugs and their associated risks, situations in which taking drugs is more or less risky, and factors relating to the circumstances of the person taking the drug. Some of the advice offered in this guidance has clear resonances with the views and correlational studies. For example, it points out that people who return to drugs after a period of abstinence (such as those recently released from prison) are at greater risk of overdose and suggests ways of reducing risks which are similar to some of those adopted by clubbers (Deehan and Saville 2003).

A review of drug treatment services for young people in Scotland was undertaken by the Effective Interventions Unit, and the report is available online (Burniston et al. 2002). They found that there was a 'limited but significant base of existing provision' (Burniston et al. 2002, p 2), but that service provision was unevenly distributed and that coverage in areas with services was usually incomplete. However, many services were relatively new (1-2 years old) and plans exist to establish new or expand existing services. A key issue identified was isolation of services, with few opportunities to exchange ideas or disseminate good practice.

The Audit Commission recently reviewed current practice including drug misuse programmes among local agencies (Audit Commission 2004). It found that there had been 'impressive progress' since its previous review in 2002 with 'local commitment backed by national strategies, programmes and funding... having an impact' (Audit Commission 2004, p 2). However, it expressed concern at the high rate of dropout from programmes (34% leaving within the first 12 weeks of

treatment) and recommended that 'a supportive infrastructure of key services should be in place to sustain users on the tough road back to recovery' and that 'policy makers and local practitioners should use the insight of users and carers to shape the services to meet individual needs' (Audit Commission 2004, p 3).

There has been much recent debate and press interest in the classification of cannabis. The Misuse of Drugs Act (1971) originally classified cannabis as a Class B drug but expert opinion often stated that it was less harmful than other drugs in that category, such as amphetamines. In January 2004 it was reclassified as being Class C but since then, debate has continued regarding its safety, particularly with regard to possible mental health problems. After examining the issue, in December 2005 the Government's Advisory Council on the Misuse of Drugs recommended that the Government should not change classification for the time being but that further research should be carried out into the relationship between cannabis use and mental health problems (Advisory Council on the Misuse of Drugs 2005).

Organisations and websites involved in drug information and policy include: Drugscope (www.drugscope.org.uk), the Drug Education Forum (www.drugeducationforum.com), the Society for the Prevention of Solvent and Volatile Substance Abuse (www.re-solv.org), Lifebytes (www.lifebytes.gov.uk), Mind Body and Soul (www.mindbodysoul.gov.uk), Release (www.release.org.uk), TheSite.org (www.thesite.org.uk), Drug Misuse Information Scotland (www.drugmisuse.isdscotland.org), Scotland Against Drugs (www.sad.org.uk).

Discussion and implications

Summary of findings

The evidence presented above shows that the use of drugs is associated with an increased risk of accidental death among young people and that 12-24 year olds are less at risk than those immediately older. However, since the risk of death increases with the length of drug use, this is not to say that preventative interventions should not be targeted at this younger age group. It is clear that drugs are not as an important a cause of injury among young people as, for example, transport accidents are - a fact which might not be apparent from media coverage of these issues. While the use of drugs overall has stabilised over recent years, the use of some drugs - such as heroin, cocaine and ecstasy - has increased. Many more young men than women die from drug overdoses, because more men take drugs, but those women who do use drugs are at higher risk. Certain other groups of young people are more at risk than others. Those found by the correlational studies include young people in deprived areas and men who have recently been released from prison. Ironically, many of the correlational studies adjusted for social and economic status in order to calculate standardised rates, thereby removing the very information which might help inform policy-making to assist marginalised groups.

The included correlational studies did not contain any mention of accidents at the workplace, home or school as a result of drug impairment. This review has identified a need for research in this area focusing more exclusively on young people. One study which did address this issue, but which was outside the scope of this review (the mean age of participants was too high), was conducted by Cardiff University for the Health and Safety Executive. This found that although 29% of those under 30 surveyed had used drugs in the previous year, there was 'no association between drug use and workplace accidents' when other socio-demographic factors were taken into account (Smith et al. 2004, p 85). The socio-

economic factors which may have been responsible are not further explored, again revealing a need for research on inequalities and drug-related workplace and home accidents.

There was a clear disjunction of views between young people who used drugs and those who did not. Those who did tended not to believe 'official' messages about possible harms and did not perceive taking drugs as being dangerous. The young people who did not take drugs regarded them as risky and stated that media images about possible negative consequences dissuaded them from trying them. Cannabis in particular was singled out as possibly being good for you, with some young people believing it to be cheaper than alcohol. The recent reclassification of cannabis and the subsequent debate may have helped to reinforce this view.

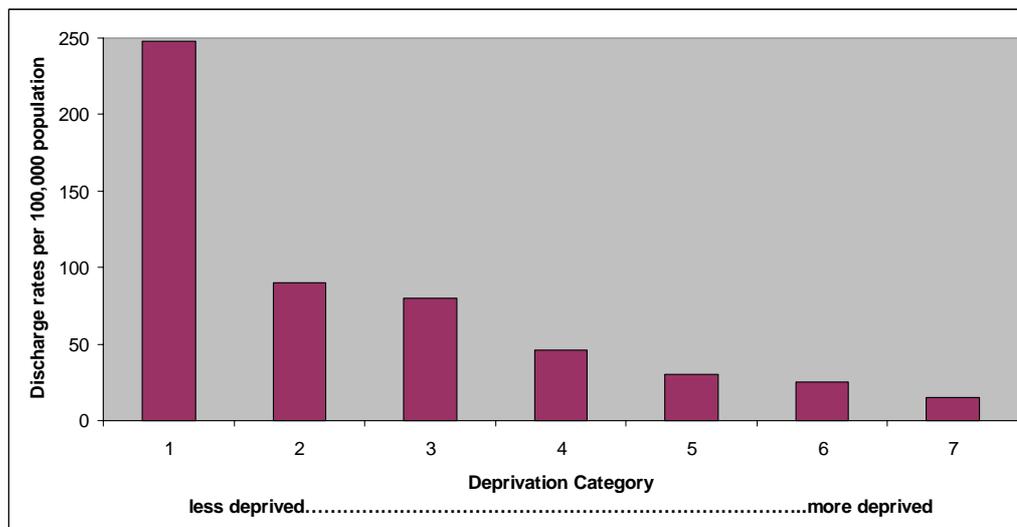
Of particular interest to those concerned with young people's views will be a study which is currently being carried out by the National Treatment Agency for Substance Misuse which will detail the views of clients of the Agency's services. Another study that covers a similar topic is *Service User Views of Drug Treatment: Research conducted for the Audit Commission* which was published in June 2004 (European Association for the Treatment of Addiction 2004). The average age of the sample, at 25, was slightly too old for inclusion in this review.

The above findings relate not just to two bodies of different types research (correlational studies and views studies), but also two different populations of young people. The young people in the views studies did not all take drugs, and those that did were more likely to be taking cannabis than 'hard' drugs. In contrast, the correlational studies cover deaths from opiates and other poisons. Our studies, therefore, do not contain the views of those groups of young people whose deaths are covered by the mortality statistics - either from illegal drugs, or due to volatile substance abuse (VSA). We also do not know how many, if any, young people suffer non-fatal injuries as a direct result of taking drugs. We do, however, know that the burden of the more serious injuries - as demonstrated by the mortality statistics - is carried by young people in the lower socio-economic groups.

Social and economic circumstances

Inequalities play a major role in determining those most at risk of taking drugs, and those most at risk for fatal drug poisoning. Boys and colleagues (2003, p 513) found that 'children from lone parent families were almost twice as likely to have used cannabis than children from families where the parents were married'. The study by Miller (1997) reported similar findings for any illegal drug, and for VSA. Furr- Holden and Anthony (2003, p 170) found that 'the lower the SES, the greater the prevalence of drug dependence' (even when age, sex and ethnicity were taken into account). In the Boys and colleagues (2002, p 1554) study 'white prisoners were more likely to report ever using heroin and/or cocaine than those categorized as "black"'. These findings echo those of a Home Office report, *At the Margins: Drug use by vulnerable young people in the 1998/99 Youth Lifestyles Survey* (Goulden and Sondhi 2001), which reported that drug use among vulnerable young people (serious and persistent offenders, rough sleepers, serial runaways, and school truants and excludées) was significantly higher than that in the general population (Goulden and Sondhi 2001). As figure 3.4 shows, data from the Scottish Drug Misuse Database shows a strong correlation between deprivation and admission to hospital for certain types of drug misuse.

Figure 3.4 Drug Misuse: Non-psychiatric hospital admissions, 1997/98 (The Scottish Office 1999, Part 1)



There is also growing recognition that inequalities are a factor in VSA. Melrose (2000) suggests that young offenders, school excludees and looked after young people are most at risk of becoming involved in substance abuse. A recent Home Office study (Cusick et al. 2003) which examined the relationship between drug use and sex work concluded that 'Sex work and drug use may be mutually reinforcing such that "exiting" becomes more difficult' (Cusick et al. 2003, p v). Among the 'trapping factors' associated with increased difficulty in leaving sex work and drugs is 'involvement in prostitution and/or "hard drug" use before age 18' (Cusick et al. 2003, p v).

These studies show that individual risk-taking behaviour in relation to drugs is socially patterned. Some young people are more likely than others to participate in drug-related risk-taking behaviour and, as the Advisory Council on the Misuse of Drugs concluded, 'drug-related deaths are often causally embedded in a complicated and as yet not fully understood nexus of adverse social context' (Advisory Council on the Misuse of Drugs 2000, p 11). Therefore, interventions should be targeted at the structural factors which put specific communities and groups at risk. This recommendation supports the Government's stated commitment in its current drug strategy which states:

The Government's Drug Strategy focuses on the most dangerous drugs, the most damaged communities and problematic drug users, who cause the most harm to themselves and to their families and communities... (Drugs Strategy Directorate 2005)

The findings of this review reinforce the importance of this part of the strategy.

Implications for interventions

We need to bear in mind the gaps identified in the evidence when making recommendations for interventions to reduce drug-taking and the risks associated with it among young people. The correlational studies contained less information on the social circumstances of the young people than we had hoped for, the views studies did not contain the views of those most at risk from poisoning, and the focus of nearly all the research activity is on illegal drugs and VSA. As the national mortality statistics show, these drugs account for just less than half of all deaths due to poisoning, and the hospital episode statistics also reveal a more complex

picture of age-related poisoning. In particular, the sharp spike at the ages of 14 and 15 in hospital admissions due to poisoning by commonly available drugs such as paracetamol and ibuprofen is cause for concern.

The main aims of current policy are to reduce the supply of illegal drugs, reduce drug-related crime, reduce the supply of illegal drugs, and prevent young people from becoming 'drug misusers'. Advice about safer ways to take drugs is also given to reduce injuries among drug users. While the research we have found does not contain implications for methods to reduce the supply of drugs, there are clear implications regarding the type of information that will be useful and acceptable to young people. These include:

- giving young people accurate information about the health and other risks of different types of drugs;
- ensuring health messages are credible and can stand up to personal experience;
- if utilising critical incidents to prevent young people from trying drugs, ensuring these are realistic and that young people can identify with them.

Implications for research

- Since 12-14 year olds consider drugs as being more risky than 15-24 year olds do, the way in which young people's views change is worth further research.
- Research into the role played by inequalities in determining those most at risk from suffering a drug overdose needs to focus on young people, and include schools as contexts which can have an important influence on risk-taking behaviour. Moreover, greater depth of detail is needed in studies which do collect information on inequalities.
- We do not know how many, if any, injuries are caused as a result of drug impairment. We also know very little about the locations in which such injuries may occur. Further research in this area is needed.
- Many young people regard cannabis as being safe to use. More research on their views in relation to the latest reliable scientific evidence about the effects of cannabis would be useful.
- While we know that more young men than women die from overdoses because more men are taking drugs, and that the risk for those women who do take drugs is higher, we do not know *why* the risk is higher for women. Further research into this issue is needed.
- There is possibly a need for research into the sudden, high rates of poisoning due to commonly available drugs such as paracetamol and ibuprofen at the ages of 14-15, and the way that the classification system is operating: for example, how are decisions made in practice to classify some poisonings as 'accidental' and some as 'self-harm'?

4. Evidence synthesis: alcohol

The focus of this chapter is fatal and non-fatal *injury* resulting from alcohol consumption. Other harms are also well-documented, such as chronic health conditions, violence and regretted sexual experiences. Information about drinking and driving has been placed in Chapter 5.

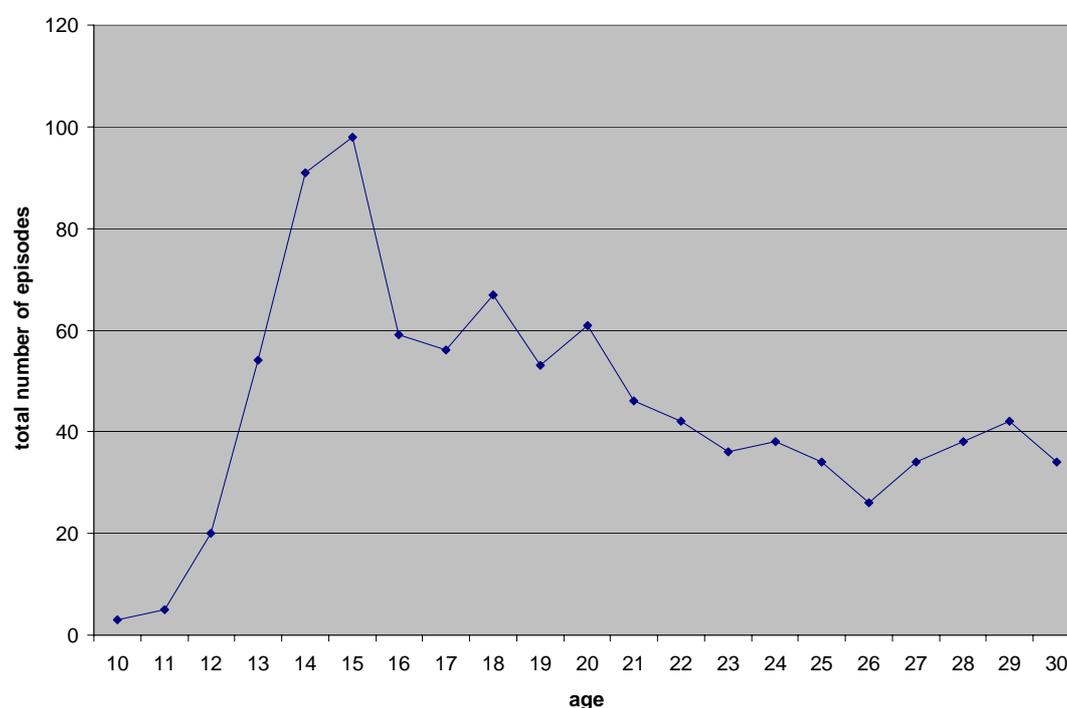
National picture

The Office for National Statistics has recently reported that alcohol-related deaths are continuing to rise (Office for National Statistics 2005a). However, the figures reported under this heading exclude traffic and other accidents, and, apart from accidental alcohol poisoning, all the causes of death covered are the result of chronic exposure. We therefore need to look elsewhere for statistics on injuries caused by alcohol. However, despite frequent media discussion regarding the impact of alcohol on accidental injury, it is difficult to obtain exact estimates of the number of accidental injuries which are directly related to alcohol and the risk of injury related drinking alcohol (Office for National Statistics 2006b). As the Department of Health acknowledges, 'there are also a number of other possible consequences of excessive alcohol consumption, including injuries leading to attendance at an accident and emergency centre, but these are difficult to measure reliably' (Department of Health 2004c). The Cabinet Office Strategy Unit reports that the consumption of alcohol has led to increased numbers of accidents and injuries, but does not quantify them and cites international research in support (Strategy Unit 2003). Data from the Whitehall II study, published by the Health and Safety Executive, suggest that moderate levels of drinking can result in sickness absence from work due to injury (Head et al. 2002).

The Department of Health, in conjunction with the Office for National Statistics, produces bulletins on alcohol use and misuse. The latest bulletin is for 2004 and the best estimate of the number of people suffering an accidental injury requiring hospital treatment as a result of alcohol was approximately 23,500 in 2002-3 (Department of Health 2004c). (This figure was calculated using the Hospital Episode Statistics and so only includes patients who were admitted to hospital and not those seen and discharged from accident and emergency departments.) The bulletin does not break this down according to age, however, so it is not clear what proportion of the 23,500 were young people. The bulletin also states that, in 2003, 'a quarter...of pupils in England aged 11-15 had drunk alcohol in the previous week' and that this was the same level as had been the case since the mid 1990s.

The hospital episode statistics reported in the previous chapter show that poisoning due to alcohol rises quickly between the ages of 11 and 14 and then reduces again by the age of 17. Indeed, almost all hospital admissions for this reason appear to be young people. Figure 4.1 shows the age distribution of hospital admissions according to additional ICD codes Y90 and Y91 ('Evidence of alcohol involvement determined by blood alcohol level' and 'Evidence of alcohol involvement determined by level of intoxication'). These categories are used in addition to other categories for injury, for example a fall, but we do not know which injuries lay behind these numbers. (The two categories are mutually exclusive, so if an admission was categorised by blood alcohol level it would not also be coded according to level of intoxication.) When both categories are combined, a peak in admissions with alcohol involvement is clear at ages 14-15, followed by a decline to a plateau between the ages of 20 and 30. While these statistics can tell us something about injuries due to alcohol, we don't know what kind of injuries they were or how many are unclassified.

Figure 4.1 Hospital episode statistics: alcohol involvement (Y90 and Y91 combined)



Statistics using these 'optional' codes need to be treated with some care. One depends upon a blood test being carried out and the other on subjective judgement. The guidance given invites the person coding to classify alcohol involvement on a scale ranging from *mild alcohol intoxication* ('smell of alcohol on breath, slight behavioural disturbance in functions and responses, or slight difficulty in coordination') to *very severe alcohol intoxication* ('very severe disturbance in functions and responses, very severe difficulty in coordination, or loss of ability to cooperate'). (See www3.who.int/icd/vol1htm2003/fr-icd.htm for an online list of the WHO ICD10 categories.) It is not clear why some people are given blood tests and others not.

Correlational studies

Six studies considered the relationship between alcohol consumption and accidental injury; all were surveys published between 1988 and 2002 (Bagnall 1988, Balding 2002, Hutchison et al. 1998, Brannen et al. 1994, Pickett et al. 2002, Williams and Shams 1998). Of these five studies, one was a large annual survey of 10-15 year old school children in the United Kingdom (Balding 2002); one examined health risk behaviours and youth injury among English school children aged 11, 13 and 15 as part of a World Health Organization cross-national study (Pickett et al. 2002); one focused on alcohol-related facial injuries (Hutchison et al. 1998); two reported on gender (Bagnall 1998; Williams and Shams 1998); one reported on age (Hutchinson et al. 1998); and Williams and Shams (1998) looked at the role of minority ethnic group status as a variable in alcohol-related accidental injuries.

Alcohol consumption among young people is associated with an increase in the incidence of both fatal and non-fatal accidental injury

A hospital-based study by Hutchison and colleagues (1998) found that, of those male patients presenting with facial injuries to the participating accident and emergency (A&E) departments, the majority had consumed alcohol. Two large surveys of self-reported alcohol use among school pupils (Pickett et al. 2002, Balding 2002) also found a link between drinking and injury. The evidence from Pickett and colleagues' examination of a number of health risk behaviours simultaneously (including excess drinking) indicated that young people were 57% more likely to have a medically-treated injury if they had ever been 'really drunk' (Pickett et al. 2002). Balding reported that those young people who had drunk alcohol in the past week were 53% more likely to have had an accident involving treatment by a doctor or hospital in the previous year than those who had not. Williams and Shams (1998) reported that the 'odds of an accident are 2.6 times greater for those who drink once a month or more compared with non-drinkers' (Williams and Shams 1998, p 560).

Young men are more likely to have an alcohol-related accidental injury than young women

Bagnall's study of a group of 12-13 year olds in the UK population reported that males were significantly more likely to have 'experienced an alcohol-related accident or injury' than females (Bagnall 1988, p 248). After adjustment for alcohol consumption, Williams's study of ethnic differences in health status in Glasgow among 14-15 year olds found that, in the last three years, males were 2.3 times more likely to have had an accident than females (OR = 2.3 (95% C.I. 1.5-3.3) $p < 0.001$). While young men have more alcohol-related accidents than young women, it is not known whether alcohol consumption alone can explain such differences in accident rates. The above studies do not examine other factors which may be partly or fully responsible for the differences between the sexes.

Young people have a higher risk of alcohol-related accidental injuries than older age groups

The one study which looked at age showed the 15-25 year old population to be more at risk than other age groups (Hutchison et al. 1998). The findings from Hutchison's study indicated that a greater number of over 15-25 year old patients presented to the 163 participating A&E departments with alcohol-related facial injuries than did patients in other age groups.

Ethnicity and alcohol-related accidental injury

Patterns of alcohol consumption among young people vary by ethnicity with those self-classified as 'white' having higher rates than those of other ethnicities, especially Asian young people (Brannen et al. 1994, p 113, Williams and Shams 1998). Alcohol consumption may therefore help to explain why non-Asian people have a higher rate of accidental injuries than those from an Asian background.

Studies of young people's views

We located six studies which asked young people about their views of drinking and accidental injury (Bendelow et al. 1998, Boreham and Shaw 2002, Coleman and Cater 2005, Denscombe 1999, Engineer et al. 2003, Honess et al. 2000). One of these studies was excluded on the grounds of low overall weight of evidence (Boreham and Shaw 2002).

Most young people felt that drinking was risky

In general, there was an acceptance among most young people that drinking alcohol placed them at risk of accidental injury (Coleman and Cater 2005, Engineer et al. 2003). Injury was the second most commonly reported 'health outcome' (out of four identified by young people); these were mostly minor injuries, although a few were more serious (Coleman and Cater 2005). Most young people said they were worried about these accidents; however, they were often reported with bravado (Engineer et al. 2003). Many placed their personal safety at risk (for example, through drunken pranks or riding with a drunk driver) because they were too drunk to recognise potentially risky situations, because the alcohol had increased their confidence so they felt able to ignore the risks or because their mental and physical reactions were impaired (Coleman and Cater 2005, Engineer et al. 2003).

Being sick from drinking was common and was not considered serious

Nausea, vomiting or being hung-over were commonplace experiences that resulted from young people drinking; some perceived these as being inevitable and there was a lack of concern about the health risks. Vomiting in public was considered degrading (especially for girls) and something to be avoided; these outcomes were more common among the younger teenagers (Coleman and Cater 2005, Honess et al. 2000). Severe intoxication, passing out or alcohol poisoning were also reported but were understood to be more serious outcomes (Bendelow et al. 1998, Coleman and Cater 2005, Engineer et al. 2003).

Drinking reduced young people's perception of danger; getting injured was considered inevitable

Despite recognising when they were sober the risks of drinking, most young people accepted that they may feel invulnerable while intoxicated (Engineer et al. 2003). Some felt that injuries were an inevitable consequence of drinking, although were not serious enough to deter future behaviour (Coleman and Cater 2005). Some young people did not accept that getting drunk increased their risks of accidental injury, and many did not consider their actions or situations to be risky unless a negative outcome had actually occurred - these risky situations were accepted as standard when drinking (Engineer et al. 2003).

Mixing drink and drugs was not generally done

Mixing alcohol and cannabis was not perceived as dangerous per se by those who did it, although it was often avoided because it was felt that it can make the user feel sick. Some young people who used other drugs, such as speed or ecstasy, viewed mixing them with alcohol as dangerous or pointless (Engineer et al. 2003).

Those in their mid-teens were most at risk of injury

14-15 year olds felt themselves to be more at risk of injuries, vomiting and severe intoxication than older teenagers (e.g. 16-17 year olds). They were more likely to report daring behaviour, drinking in unsupervised outdoor locations and lacking the ability to 'know their limits' as they were relatively inexperienced with alcohol (Coleman and Cater 2005, Honess et al. 2000).

Many 12-13 year olds lacked the opportunity to drink to excess or outside of (supervised) family events. However they were still able to recount tales of getting drunk and vomiting, although these were rare occurrences with fewer in this age group drinking to excess in this manner (Honess et al. 2000). Those 12-13 year olds

living in semi-rural areas reported more drinking and vomiting than those in urban areas (Honest et al. 2000).

Boys and girls reported similar rates of minor injury associated with alcohol, although boys were more likely to get into fights and report daring behaviour such as pranks. Girls were more likely than boys to report being sick or passing out (Coleman and Cater 2005, Engineer et al. 2003).

Most young people were cautious about getting very drunk

Most young people in these studies felt some degree of caution about getting very drunk; one reason for this was because they did not want to spoil their night out by making themselves ill (Engineer et al. 2003). Those aged 14-15 years acknowledged the potential dangers associated with lowered inhibitions (that are both caused by, and reason for, drinking) (Honest et al. 2000).

How do young people manage their drinking in relation to potential injury?

The factors that affect 'dangerous' drinking can broadly be categorised into three types: individual factors, influences from other people, and environmental factors.

Individual factors included the ability of young people to manage their own drinking coupled with the inherent benefits of drinking and occasional 'critical incidents'.

Young people felt they learnt to manage their drinking through experience

It was felt that the ability to manage drinking limits was gained with experience (which correlated with age). This reflects the fact that the youngest (and most inexperienced) age groups were most likely to report harmful outcomes (Coleman and Cater 2005). However those aged 18-24 years still had difficulties in judging their limits: for example, few were able to specify the alcohol content of different drinks (Engineer et al. 2003, Honest et al. 2000). A common view among older teenagers was that the amount that could be tolerated varied from person to person, so any guidance provided was irrelevant (Honest et al. 2000). Older teenagers reported that they had 'calmed down' with age (Coleman and Cater 2005, Engineer et al. 2003). Avoiding vomiting in public (particularly for girls) was one reason to monitor the quantity and also the mix of drinks consumed (Honest et al. 2000).

Drinking was an enjoyable activity

Young people generally enjoyed drinking and getting drunk. Reasons for drinking were to feel happy, to have a laugh, to enjoy the buzz, to increase confidence in a social group, and to lower personal inhibitions or barriers between people (Bendelow et al. 1998, Coleman and Cater 2005, Engineer et al. 2003, Honest et al. 2000). A minority enjoyed losing control when drunk and accepted being sick or forgetting events as part of the fun (Engineer et al. 2003). Being able to brag and recount stories of drunken pranks and mishaps (such as injuries or alcohol poisoning) were also enjoyed by some young people (Engineer et al. 2003). Some also thought that drinking was part of being a teenager (Honest et al. 2000). Young people most likely to report harm from drinking were those whose main reason for drinking was 'for the buzz' or to forget about their problems. Those least likely to

report harmful outcomes were those who drank to increase their confidence in a social group (Coleman and Cater 2005).

Having or knowing someone who has had a bad experience affected drinking in the short-term only

Critical incidents, such as the experience of alcohol poisoning or accidental injuries (either personal experiences, or that of friends or family), did have an effect on drinking but these tended to exert a temporary effect only (Coleman and Cater 2005, Denscombe 1999, Engineer et al. 2003, Honess et al. 2000).

Peers encouraged drinking and drunken pranks, but also looked after each other

Peer influence had both a negative and a positive influence on drinking. Older teenagers felt that when they were younger, drinking outdoors was expected of them and young people could encourage others to drink (Coleman and Cater 2005, Honess et al. 2000). Drunken pranks were encouraged by friends and were enjoyed as a means of showing off to friends (particularly, though not exclusively, for boys) (Engineer et al. 2003). Vomiting in public was not something that was encouraged or bragged about and was particularly bad in licensed establishments (Coleman and Cater 2005).

A more positive influence was the help and support that was experienced, and expected, from friends, when drinking or engaging in related dangerous behaviour (Engineer et al. 2003; Honess et al. 2000).

Unsupervised, outdoor drinking was more dangerous (and more common among younger teenagers)

Coleman reported that 'Younger people were significantly more likely to get very drunk in unsupervised, including outdoor, locations, compared to older groups who were more likely to frequent bars and clubs' (Coleman and Cater 2005, p 11). Most injuries also occurred outdoors, and 14-15 year olds were at more risk of drinking-related injuries.

Injuries were less likely when drinking in licensed venues

Licensed establishments were protective in that young people were more restricted in terms of their behaviour, and vomiting would be a greater negative outcome (as they could be removed and barred from the premises). Older teenagers preferred drinking in licensed establishments and girls could access these at a younger age than boys, since they often looked older than boys of a similar age. The same rate of injuries occurred in rural and urban areas, but the nature of the injuries (and the potential hazards that may have caused them) were different (Coleman and Cater 2005).

Systematic reviews of effectiveness

One relevant effectiveness review (i.e. one which focused on alcohol-related accidental injury prevention) was located (Dinh-Zarr et al. 2004). The authors of this Cochrane review stated that although their data were not conclusive, interventions to reduce problem drinking may be effective in reducing the incidence of fatal and non-fatal injuries. There is some evidence that this applies to young people (see below).

The authors found 23 eligible trials, 17 of which provided results on injury outcomes. Between them, the studies evaluated a number of different interventions, patient populations and injury outcomes, the most common intervention being brief counselling for problem drinking, which was evaluated in nine trials. Others included telephone aftercare contacts, interventions in the emergency department, community-based day-centre treatment, motivational interviews (with or without booster sessions), education (in class or at home), and the use of disulfiram (a drug which produces an unpleasant sensitivity to alcohol).

The relevance of this review to our report was limited by a number of different factors. Firstly, some trials looked at intentional injury (e.g. suicide, domestic assault). Secondly, as noted by the review itself, few trials were sufficiently large to assess precise effects on injuries (some reductions may have been due to chance). Thirdly, the review did not routinely report the sex or the age of the study participants. Only two studies examined by Dinh-Zarr et al. (2004) were reported to include young people aged 18 and over, and one other study evaluated an intervention which was explicitly undertaken with young people (Monti et al. 1999). This study was one of only two which were large enough to demonstrate statistically significant reductions in injuries. Monti et al. (1999) found a significantly reduced risk of self-reported alcohol-related non-fatal injury at 6-month follow-up among 18-19 year olds who received a brief intervention in the emergency department (consisting of either a brief motivational interview and a drunk-driving handout, or a handout only: the former produced a more positive effect) (alcohol-related injuries: 21% versus 50% , adjusted OR = 0.25; 95% CI 0.09-0.69).

Current policy in the UK

The Alcohol Harm Reduction Strategy for England was published in March 2004. The report describes the Government's approach to 'tackling the harms and costs of alcohol misuse in England' (Cabinet Office 2004). It outlines the social and economic cost of alcohol misuse in terms of an increase in violent crime and the fear of crime, the cost of alcohol treatment programmes, the number of hospital admissions and premature deaths, the number of working days lost through alcohol-related absence, and the impact of alcohol misuse on families. The strategy targets two drinking patterns which are most likely to increase the risk of harm, binge-drinking and chronic drinking. Binge drinkers are usually under 25, whereas chronic drinkers are more likely to be older than 30. Both categories of drinkers are described as being more likely to be men than women.

In order to reduce alcohol-related harm, the strategy outlines four main areas for intervention:

1. education and communication;
2. health and treatment;
3. combating alcohol-related crime; and
4. working with the alcohol industry.

The strategy for education and communication aims to provide better information to consumers in order to improve understanding of 'sensible drinking' messages and to change behaviour. These messages are to be targeted at binge-drinkers and chronic drinkers. The strategy also seeks a review TV advertising of alcohol to avoid targeting young people promoting irresponsible behaviour.

With regard to health treatment services, the strategy aims to improve the early identification and treatment of alcohol-related problems. In particular, it aims to provide better help for vulnerable groups: 'homeless people, drug addicts, the mentally ill, and young people'. The Department of Health publishes lists of local initiatives which involve working with the alcohol industry (<http://www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCareTopics/AlcoholMisuse/fs/en>). Recent policy changes have also included the Licensing Act 2003 which allows for flexible opening hours and the possibility for some premises to be open for 24 hours a day. It is too early to tell whether this change will result in a continental-style 'café culture', increased alcohol related disorder and injury, or have no effect at all.

Crime reduction toolkits

Alcohol related crime is the subject of one of the Home Office's *Crime Reduction Toolkits* (Home Office [2003]). It focuses on supporting the development of strategies aimed at reducing a range of alcohol-related crime, from anti-social behaviour to drink-driving and violence. It notes that 'alcohol-related crime featured...in over 70% of Crime and Disorder' and suggests that crime reduction strategies should focus on young people in either reducing the availability of alcohol or delivering educational messages.

Guidance from the Department of Health

The Department of Health has also recently released guidance on developing local alcohol misuse interventions (Department of Health 2006). The document aims to provide 'guidance on developing and implementing programmes that can improve the care of hazardous, harmful and dependent drinkers' (Department of Health 2006, p 4). It forms part of the programme which builds on the *Alcohol Harm Reduction Strategy for England* (Cabinet Office 2004) and the *Choosing Health* white paper (Department of Health 2004a).

The Department also publishes guidance for young people which focuses on information about the effects of alcohol and 'what to do when things go wrong' (Department of Health 2002b). The latter advice deals with basic first aid on how to handle an unconscious patient, emphasising the importance of staying with them rather than leaving for fear of getting into trouble. A regional publicity campaign entitled 'Don't walk away and let a friend die!', which was developed by the Merseyside Regional Ambulance Service, has been used in many parts of the country to convey this message.

'Brief interventions' have been recommended in some sectors as a means of addressing potential alcohol problems opportunistically (Cabinet Office 2004). These often target people whose alcohol use is not diagnosed as abuse or dependence (Moyer and Finney 2004/5). Typically, such interventions can take place after the individual concerned has visited, for example, an accident and emergency department and has been identified as being suitable for the intervention. There is no set form of 'brief intervention', though common elements include information, advice and an intention to intervene early with an emphasis on a reduction in binge drinking, rather than complete abstinence.

In September 2002, Alcohol Concern published a *Report on the Mapping of Alcohol Services in England* for the Department of Health which describes the work of more than 450 alcohol agencies (Alcohol Concern 2002). These services focused more on chronic or severe alcohol misuse rather than accidental injury. However Alcohol Concern did find that 2% of clients were aged 17 years or younger and state that,

'...the fact that very young people were accessing adult-orientated, specialist alcohol agencies at all may be a source of interest and concern' (Alcohol Concern 2002, p 16).

The Health and Safety Executive has also produced guidance on reducing harm from alcohol. Its strategy aims to guide employers in ways of reducing losses in productivity and accidental injury as a result of alcohol (Health and Safety Executive 1998).

There are numerous organisations and websites involved in reducing alcohol-related harms, such as Alcoholics Anonymous (www.alcoholics-anonymous.org.uk), Alcohol Concern (www.alcoholconcern.org.uk), Drink and Drugs.net (www.drinkanddrugs.net), the Portman Group (www.portman-group.org.uk), Alateen (www.al-anon.org/alateen.html), Wired for Health (www.wiredforhealth.gov.uk), Wrecked (www.wrecked.co.uk), the National Youth Agency (www.youthinformation.com), and the Institute of Alcohol Studies (www.ias.org.uk).

Discussion and implications

Summary of findings

Anecdotal accounts of accident and emergency departments being filled with alcohol-related casualties on a Friday and Saturday night are common, but at present, it is difficult to quantify the extent of the problem based on national statistics. Some injuries are clearly categorised in hospital episode statistics as having alcohol involvement, but since this is a supplementary code and relies on a blood test or subjective judgement, it is not clear whether these statistics are complete. We also do not know about alcohol-related injuries that do not result in hospital attendance. However, we do know how many young people are admitted to hospital from alcohol poisoning and we also know that almost everyone admitted for this reason is aged between 11 and 17. After a sharp peak among 14 and 15 year olds, hospital admissions for injuries with alcohol involvement decline slowly between the ages of 16 and 30. Correlational studies have shown that alcohol puts the drinker at an increased risk of injury, that young people are more likely to have injuries than older people, and that young men are more at risk than young women. In the one study that examined ethnicity, minority ethnic status did not increase alcohol-related injuries, and may in fact have had a protective association.

The synthesis which examined young people's views found that young people find drinking enjoyable with the young people in the studies we found saying that they do not commonly mix alcohol and other drugs. Most young people reported that drinking places them at greater risk of injury, though some do not. The younger teenagers - 14 and 15 year olds - felt most in danger of injury when drinking. Young people felt that they learned to manage their drinking through experience and that unsupervised, outdoor drinking was the most dangerous and was more common among younger teenagers (with injuries being considered less common in licensed venues). Peers both encourage drinking and drunken pranks, but also protect one another when they have become more vulnerable as a result of drink. Young people felt that drinking reduces their perceptions of danger and some stated that injury as a result was inevitable. Most young people were cautious about getting very drunk, though being sick as a result of drinking is common and not regarded as serious. Bad experiences - whether to self or someone else - might change behaviour in the short- but not long-term.

Evidence that interventions are able to reduce alcohol-related injuries among young people is scarce and research on ways of reducing alcohol-related violence was outside the scope of this review. The one study which examined reducing alcohol-related injuries found some evidence that motivational interviews in A&E departments are more effective than information handouts. Alcohol-related crime and disorder is mentioned frequently in current Government policy documents, as is health information about alcohol and guidance on what to do 'when things go wrong'. In particular, the Government is targeting two drinking patterns - binge drinking and chronic drinking - while also attempting to assist vulnerable groups.

Social and economic circumstances

We identified no studies which examined the role of social and economic circumstances in alcohol related accidental injuries, and only one which examined the relationship with minority ethnic group status.

Both alcohol-related morbidity and mortality are higher for men in manual rather than non-manual occupations in Britain (Harrison and Gardiner 1999), but the role that social and economic status has to play in alcohol related morbidity and mortality is unclear. International research findings are contradictory, and mostly examine deaths due to chronic diseases associated with alcohol (e.g. cirrhosis of the liver) (Harrison and Gardiner 1999). A range of variables have been identified as risk factors for alcohol misuse in young people: single parent families (Miller 1997); psychiatric disorder (Boys et al. 2003); parental alcoholism (Chalder et al. 2006) and low parental education (Miller 1997). Despite the fact that alcohol consumption among young people is increasingly seen as a social problem, there is surprisingly little research on the social context of problem drinking by young people in the UK.

Implications for interventions

Again, gaps in the evidence base make drawing implications for interventions problematic. In particular, we do not know precisely who is being injured as a result of alcohol and why. It is clear, however, that younger teenagers are at particular risk of alcohol poisoning. This is something they know themselves and they are aware that drinking outside in unsupervised locations places them at greater risk. Interventions to reduce this risk include detached youth workers and the provision of spaces and activities more appealing than drinking - particularly targeting semi-rural areas. Many of the following recommendations are based on the findings from the views studies.

Interventions to reduce young people's vulnerability to injury when drinking should be based on:

- raising young people's awareness of risky situations and developing skills so they are better able to recognise risky situations when drunk;
- raising their awareness of risks of drinking and tackling feelings of invulnerability (especially that young people may have while drunk);
- developing young people's skills so that they can better handle situations and find it easier to 'know their limits';
- challenging perceptions that drinking is a normal part of teenage life and the perception that getting into risky situations when drunk is a standard, acceptable event;

- recognising that drinking can be an enjoyable activity, possibly emphasising harm reduction methods, rather than abstinence-only approaches;
- encouraging positive peer influences and the reduction of negative peer influences;
- building on the belief that vomiting in public is degrading and encouraging young people to consider the harmful and embarrassing aspects of drunkenness;
- the recognition that any use of critical incidents in interventions may only produce temporary changes in behaviour;
- highlighting the fact that drinking is not an effective long-term solution to resolving problems.

Implications for research

The most important implication for research is the development of strategies to help us to quantify the extent of accidental injury as a result of alcohol. Obtaining national statistics of returns from accident and emergency departments will help in this regard, but equally important will be ensuring that 'optional' ICD categories are completed accurately and consistently.

Some of the above implications for interventions build on young people's views of helping people to recognise risky situations when drunk. Research on how to do this effectively is probably required.

We did not find as many studies in this topic area as in the others in this review. This may be partly because alcohol is not responsible for the same level of accidental death as, for example, drugs; also, long-term harm and alcohol-related violence fall outside the scope of this review. Even though there is other research available relating to different types of alcohol-related harm, the evidence base regarding alcohol-related injury looks rather thin. New research is required to elucidate the above issues.

5. Evidence synthesis: transport

This chapter is concerned with the largest burden of accidental injury among young people, accidental injuries on the road - whether as pedestrians or vehicle occupants. At present the wearing of cycle helmets is not compulsory in the UK, though it is in other countries. Since there is a large body of research about cycle helmets, this issue is discussed in the next chapter.

National picture

The Department for Transport issues yearly statistical bulletins detailing casualties on Britain's roads and the latest figures relate to 2004 (Department for Transport 2005). During that year, there were 207,000 accidents which resulted in injury, including 10,900 young people aged 12-24 who were killed or seriously injured (Department for Transport 2005, p 59). Table 5.1 gives a breakdown of the type of road user. More than twice as many young men as women were killed or seriously injured during 2004. The excess male rate was greatest for motorcycle and moped rider casualties (95% and 91% males) and least among pedestrian casualties (62%).

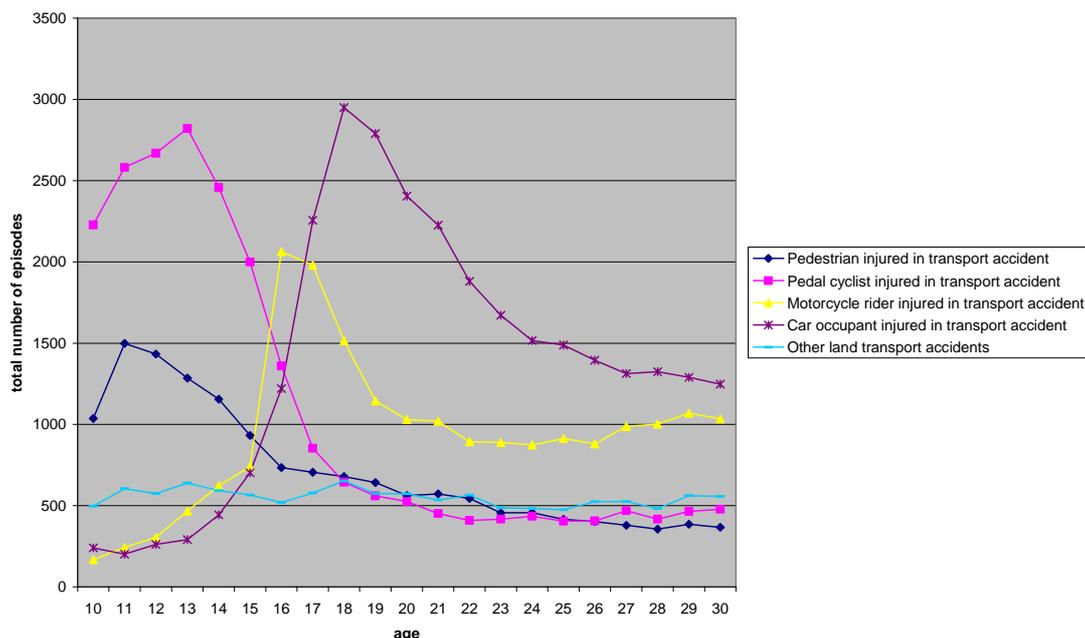
Table 5.1 2004 road casualties by sex and type (source: Tables 6a and 6b)

	Male	Female	Combined
Pedestrians (12-24)	1383	851	2234
Pedal cyclists (12-24)	608	94	702
Moped riders (under 16-24)	532	50	582
Motorcycle riders (under 16-24)	1365	75	1440
Car drivers (under 17-24)	2128	767	2895
Car passengers (under 17-24)	1813	1234	3047
Total	7829	3071	10900

Overall, there has been a reduction in the number of people who have been killed or seriously injured on UK roads in recent years, and Great Britain had the second lowest road death rate in the EU in 2003. However, the UK's record on pedestrian deaths is less favourable - in the middle of the rankings of EU states - and it performs even worse with regard to the number of child pedestrians killed. The picture is also more mixed regarding the direction in which the casualty figures are heading: many such as cycle and pedestrian injuries are reducing, but others such as those among moped and motorcycle drivers are increasing.

An examination of hospital episode statistics gives an even more detailed picture of the causes of transport injuries to young people. As figure 5.1 shows, the number of injuries to car occupants peaks at 18 and, with a slightly lower legal age, motorcycle injury accidents peak at 16.

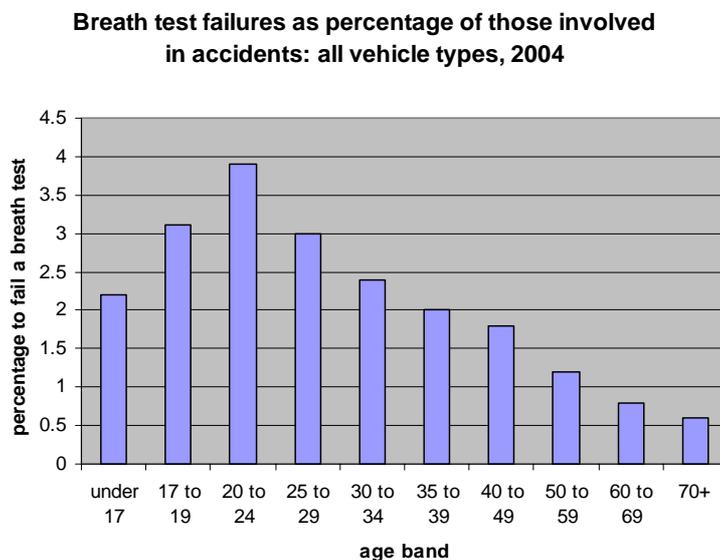
Figure 5.1 Hospital episode statistics 2000/1-2003/4: transport accidents



The role of alcohol and drugs in transport accidents

The Department for Transport estimates that, among the UK population as a whole, there were approximately 590 drink-driving related deaths in 2004 (compared with 580 in 2003), and around 17,000 injuries of which 2,350 were serious. A clear divide between the sexes is apparent in breath test failures, with women's rates about a third of those for men. Young people are more likely than older people to fail a breath test after being involved in an accident. As figure 5.2 shows, the age group with the highest percentage of breath test failures following an accident is 20-24 year olds.

Figure 5.2 Breath test failures as percentage of those involved in accidents: all vehicle types, 2004



In a nationally representative survey, Brasnett found that young male drivers ‘were the most likely to believe they had driven while “over the limit”’. Over one quarter of 16 to 29 year olds admitted to driving while “over the limit” in the previous year’ (Brasnett 2004).

In a study of *The Incidence of Drugs and Alcohol in Road Accident Fatalities*, Tunbridge and colleagues reported a ‘modest’ reduction in the overall level of alcohol use among road accident fatalities between the late 1980s and late 1990s, but conclude that ‘drinking and driving should still be considered a significant road safety issue’ (Tunbridge et al. 2001, p 12).

Assessing the involvement of drugs in road accidents and injuries is much more difficult. Firstly, determining the recency of consumption is problematic: cannabis, for example, can stay in the bloodstream for several weeks after use (Macdonald et al. 2003). Secondly, the presence of drugs is confounded by alcohol consumption. Thirdly, a lack of relevant baseline measures of the prevalence of cannabis among the general (non-accident involved) driving population prevents an accurate calculation of accident risk. A recent review of the international literature concluded that there is ‘insufficient evidence of the accident risk associated with cannabis’, with regard both to assessing the amount of cannabis which is necessary to impair driving and to establishing whether or not there is an association between cannabis use and accident involvement (Department for Transport 2000a). A review by MacDonald and colleagues (2003) concluded that research has yet to demonstrate a consistently increased risk of driving accidents and injury with consumption of cocaine. Both of these reviews only considered the effects of drugs or alcohol on drivers. In contrast, the inclusion of all road users in the study sample used by Tunbridge (see correlational studies section above) acknowledges the possible effect of such substances on the competence of motorcyclists, cyclists and pedestrians. (Unfortunately, the study does not present all its findings for individual classes of road user by age, thereby limiting its usefulness for our review.)

Correlational studies

Ten studies were included which considered the relationship between unsafe road behaviour and accidental injury. A further five were excluded on the grounds of low weight of evidence (Best 2004, Bradbury 1991, Christian and Bullimore 1989, Harrison and Gardiner 1999, Ward et al. 1994).

Six studies contained findings of relevance to unsafe road behaviour (either as a driver/rider or passenger) and accidental injury (Bradbury and Robertson 1993, Desai et al. 1996, Lawson 1991, Maycock 1997, Pickett et al. 2002, Rutter and Quine 1996). Two of these studies considered factors associated with motorcycle accidents (Bradbury and Robertson 1993, Rutter and Quine 1996). Two studied traffic accidents related to running red lights (Lawson 1991) and sleepiness (Maycock 1997). One study looked at seat belt use in road accident casualties who presented with ocular injuries (Desai et al. 1996), and another examined a number of health risk behaviours simultaneously (including non-use of seat belts) among 11, 13, and 15 year old English school children (Pickett et al. 2002).

One study investigated the incidence of drug and/or alcohol use in road accident fatalities (Tunbridge et al. 2001), and Britton and McPherson (2001) estimated the number of road traffic accident deaths attributable to alcohol.

One study investigated pedestrian road safety behaviour, particularly that of young people (Chinn et al. 2004, Christie 1995). A further study looked at children's pedestrian and cycling accidents and the relationship between these and problem behaviour (e.g. danger seeking, playing in the street at weekends) (Department for Transport 1998).

The relationship between social and economic status (SES), unsafe road behaviour, and accidental injury was the focus of only one study (Christie 1995). (A more detailed discussion of SES- and traffic-related injury is presented later).

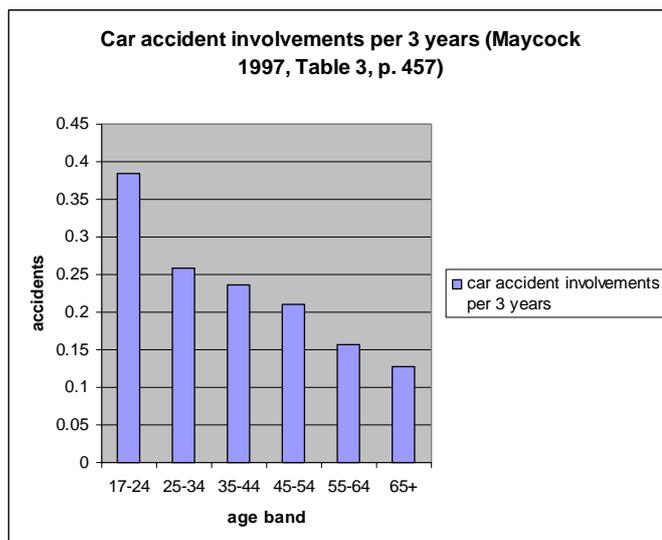
Younger, as opposed to inexperienced, drivers and motorcyclists are more likely to be killed or seriously injured

In a study of *Age and experience in motorcycling safety*, Rutter and Quine (1996) examined the disproportionately high casualty rates among young motorcycle riders. Youth and young riders' beliefs played a much greater role than inexperience. Accidents were associated with patterns of behaviour which can be predicted from riders' beliefs - notably, in the case of this particular age group, a willingness to break the law and violate the rules of safe riding.

Additional evidence to support Rutter and Quine's (1996) assertion that young drivers are more willing to violate traffic laws is found in Lawson (1991). He reports that 'relatively more young drivers aged less than 35 years were "red-light runners" than the "innocent party"' (Lawson 1991, p 23). The age group responsible for most accidents because of running red lights was 20-24 years.

Evidence presented by Maycock (1997) shows that younger car drivers have more accidents than older age groups (see figure 5.3). 'The overall accident frequency for a 17-24 year old driver is 0.385 (accidents per 3 years) falling to 0.127 for a driver aged 65 and over' (Maycock 1997, p 457).

Figure 5.3 Car accident involvements per three years (Maycock 1997, table 3, p 457)



Young people are no more at risk of tiredness-related accidents than other age groups

Maycock (1997) investigated the role of tiredness in accidents and found that tiredness was a factor in 9% of accidents among drivers aged 17-24. This compares with 6% among those aged 25-34 and 12% in the 35-44 age band. The highest proportion (27%) of tiredness-related accidents for all age groups occurred between the hours of midnight and 3 a.m. 17-24 year olds spent a higher percentage of their time driving in the dark, compared to other ages.

Engine capacity is the factor most clearly related to motorcycle injury

In an analysis of the pattern and severity of injuries among motorcyclists in Edinburgh, Bradbury and Robertson (1993) found that 'the factor most clearly related to severity of injury was the engine capacity of the motorcycle involved' (Bradbury and Robertson 1993, p 90). While smaller motorcycles and mopeds are associated with high numbers of injuries among 16 and 17 year olds, these accidents 'often occur at low speed, and the injuries sustained as a result are often relatively minor' (Bradbury and Robertson 1993, p 90). The analysis also found an inverse relationship between age and engine size with the average age of the riders of the most powerful motorcycles being only 21.8 years. As Table 5.1 showed, far more young men than young women sustain motorcycle injuries.

Injury rates are higher among young people in cars who do not wear seat belts

Pickett and colleagues (2002) found that the odds of youth injury (adjusted simultaneously for age, sex, social and economic status, and physical activity) were 7% higher in those who reported non-use of seat belts (95% CI 0.94-1.22 [OR = 1.07]). This study did not investigate whether younger passengers were more or less likely to wear seatbelts than older age groups.

Young people, and particularly young men, have the highest alcohol-attributable mortality

Using mortality data obtained from the Office for National Statistics, Britton and McPherson (2001) reported that 16-24 year olds in the general population in England and Wales in 1996 had a higher number of alcohol-attributable road traffic accident deaths than all other age groups. A more complete picture emerges when male and female deaths are analysed separately. Among males, 16-24 year olds had a higher number of alcohol-attributable road traffic accident deaths than all other age groups. In contrast to this, among females, 25-34 year olds had the highest number of alcohol-attributable road traffic accident deaths; 16-24 year olds had the second highest number of such deaths. Furthermore, 16-24 year old males had over eight times as many alcohol-attributable road traffic deaths as did females of the same age (249 compared with 30). For all other age groups, the numbers of road traffic accidents which were attributable to alcohol were not sufficiently high to be in the top three causes of death.) In studies such as this which just report numbers of deaths and do not calculate risks, the smaller number of female deaths may be explained by women's lower access to cars and higher reliance on public transport (as identified by a study of gender and socio-economic differences in travel patterns in Scotland) (Henderson 2001).

It is difficult to assess whether the presence of drugs in accident victims caused the accident

Tunbridge and colleagues (2001) examined the incidence of drugs and alcohol in 1184 road accident fatalities, noting that the presence of these substances in post-mortem samples does not, in itself, indicate that they directly contributed to the accident.

Victims of fatal accidents aged 16-24 years old are more likely than other age groups to be over the legal alcohol limit

Tunbridge and colleagues (2001) found that 33% of 20-24 year olds who were killed in road accidents tested positive for alcohol consumption over the legal limit. This was the highest proportion of all age groups in the sample; 16-19 year olds came second highest (27%). The study also found that 33% of fatalities among the 16-19 year old age group were 'drug related'. This proportion was higher than that for other age groups. Again, the incidence of mortality was higher among young men.

There was a considerable difference in the age distribution of those who had consumed legally obtained prescription drugs and those who had consumed illicitly obtained drugs. (This study focused on the following medicinal drugs: tricyclic antidepressants, benzodiazepines and medicinal opiates; only the latter, in the form of codeine-derived products, were possible to obtain without medical prescription at the time the study was conducted.) The majority of legally obtained prescription drug consumption was in those fatalities aged 40 and above, with the pattern reversed for illicit drugs. The authors add that 'the high incidence of medicinal drugs in multiple drug combinations - particularly among young casualties - would suggest that at least some of this use was illicit rather than medicinal' (Tunbridge et al. 2001, p 1), implying that even legally obtained drugs are sometimes abused and implicated in road fatalities.

There were sex differences in the types of drugs consumed

Cannabis was the drug most frequently found among 16-24 year old fatalities; cannabis use among both 16-19 and 20-24 year old fatalities was considerably

higher in males than in females. A higher proportion of male 16-19 year old fatalities also tested positive for amphetamines, cocaine or opiates, than females of the same age group (no fatalities tested positive to these drugs in the 16-19 year female age group). In contrast, a higher proportion of fatalities tested positive for each of these three drugs in the 20-24 year old female age group, compared to male 20-24 year olds. Differences in drug consumption also reflected more medicinal use by females. For those aged 20-24 years, the proportion of tricyclic antidepressants was five times higher in female than male fatalities (0.5% versus 0.1%).

People described as 'unemployed' were more likely to test positive for one or more drugs

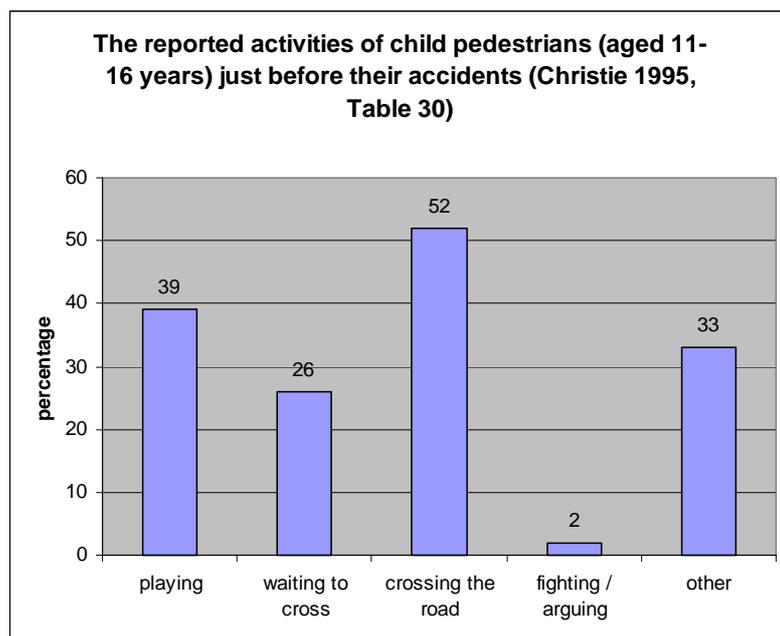
The study by Tunbridge and colleagues (2001) also used socio-economic group as a variable; however, it did so for all types of road user (and all ages) combined, limiting the usefulness of the findings for this review. It was noted that the incidence of drugs 'was highest (38.5%) among those reported as unemployed. This group had a particularly high incidence of cannabis and multiple drug use' (Tunbridge et al. 2001, p 11). Two further studies reported the social and economic status of participants (for all ages combined), but did not use this as a variable in their analyses (Maycock 1997, Rutter and Quine 1996).

Young people were less likely to have pedestrian accidents than children

Christie (1995) examined the circumstances of child pedestrian accidents, including the relationship between socio-economic factors and injury. The study found age to be an independent predictor, with those aged 5-10 years being nearly twice as likely to have an accident compared to those aged 11-16 years. The study also found that the most frequent activity that young people (aged 11-16) were engaged in just before the accident occurred was 'crossing the road' - see figure 5.4. In contrast, for those under 11 years old, attention-absorbing activities not related to the task of crossing the road (most notably playing) featured most strongly.

In a linked study using the same dataset as Christie (1995), Chinn and colleagues (2004) analysed accidents by age, divided into younger children (6-10 years) and adolescents (11-16 years). This study found that there were significant differences in the types of accident experienced by the two age groups. (Accident types were: driver at fault; no 'strategy' used by child; child's crossing strategy 'failed'.) Compared to the younger group, adolescents had fewer accidents in which they used no crossing strategy (e.g. did not look before crossing). The study further found that accident type 'did not vary significantly according to gender' (Chinn et al. 2004, p 6).

Figure 5.4 The reported activities of child pedestrians (aged 11-16) just before their accidents (Christie 1995, table 30)



Environmental factors increase the chance of pedestrian injury

Christie (1995) found that environmental factors affected rates of child pedestrian injury: children were more likely to be injured if they lived on a through road, or a road with a low level of obstructive on-street parking or pre-1914 housing. Playing in the street was frequently predictive of road traffic injury, and significantly more children in the lowest socio-economic group reported playing in the street every day.

In a study of 7-15 year olds from South London who as pedestrians or cyclists had been struck by a motor vehicle and subsequently attended hospital, the Department for Transport found that the following were NOT independent predictors of road traffic accidents: 'time playing in the street after school'; 'self-reported danger seeking'; 'self-reported risky road user behaviour'. 'Playing in the street at weekends' was the only risk-taking behaviour found to be an independent predictor of traffic accidents, resulting in a 21% greater chance of involvement in such an accident (controlling for sex, demographic and exposure variables).

No correlational studies were located which looked at the design of roads (for example, traffic calming schemes).

Young people have different types of accidents alone and in groups

Chinn and colleagues (2004) also reported that young people had different types of accidents when alone, compared to when travelling in groups. When alone, they had fewer accidents in which they did not use any road safety 'strategy' while crossing the road; for example, they were less likely to have an accident in which they did not look before crossing.

This study reported estimates suggesting that groups of 13-14 year olds are more at risk than younger or older age groups. The accident risk was also estimated to be greater to girls when they were with friends than when alone. (The opposite was true for boys.)

Studies of young people's views: how do young people perceive/assess the risks of accidental injury in relation to unsafe road behaviours? What affects this perception of risk?

Eleven studies reported young people's views on accidental injury in relation to unsafe road behaviour. Six of these were excluded from the review, either because they were judged to be of low weight of evidence in terms of answering our review question or because full data could not be obtained in time (Brake 2000, Carthy et al. 1993, Child Accident Prevention Trust 2002, Leslie 1996, Parker et al. 1992, Rolls and Ingham 1992). This left five views studies for the in-depth analysis (Albery and Guppy 1995, Chinn et al. 2004, Coleman and Cater 2005, Danton et al. 2003, Rolls and Ingham 1992).

Risky drivers are more likely to think they will have an accident, but are less worried about this

One study (Rolls and Ingham 1992) explored the views of young male drivers. Participants were divided into two groups, those identified in a previous study as 'unsafe' drivers and those identified as 'safe drivers'. 'Unsafe' drivers were more likely to think that they would be involved in, or cause, an accident involving injury in the next ten years compared to 'safe' drivers, yet they were also less worried about an accident compared to 'safe' drivers. Both 'safe' and 'unsafe' drivers had a fatalistic view of accidents, feeling that they were generally random events and so not worth worrying about.

Taking risks is not the same as driving unsafely

Although they may be aware that they are taking risks while driving, study participants did not feel that they deliberately drove unsafely. The researchers found that those who had been classified as 'unsafe' drivers were more likely to rate their driving as 'risky'. Yet they believed they only took risks when they thought it was safe to do so: when no harm would come of it or they were only placing themselves and not other people at risk (e.g. at night or on country roads with little traffic or few pedestrians). Some also felt that they could drive more riskily while remaining 'safe' if they were driving a fast or a new car. A few drivers deliberately took risks in order to improve their driving (e.g. to make them concentrate more).

Young men overestimated the number of traffic deaths; unsafe drivers gave higher estimates of traffic deaths and injuries than safe drivers

When asked to estimate the number of traffic casualties and deaths there are in Great Britain, 'unsafe' drivers overestimated the number of injured (compared to actual figures) while 'safe' drivers underestimated. Both 'safe' and 'unsafe' overestimated the number of traffic deaths, although 'unsafe' drivers tended to give much greater estimates than 'safe' drivers.

Accidents or dangerous driving were not considered embarrassing

Young male drivers showed no embarrassment at either having had an accident or admitting to driving dangerously. There was an assumption (especially among 'unsafe' drivers) that all male drivers would take risks at some point and it was just unlucky if they crash. This fatalistic view of accidents was common.

Drink-driving was generally considered dangerous, though driving on cannabis was not thought to be dangerous

Studies generally found that young people recognised the dangers of drink-driving. A study of underage drinking found that one of the three main 'safety' outcomes identified by young people (i.e. where being drunk had placed their personal safety at risk) was dangerous driving - either by the young person themselves or by being a passenger of a drunk-driver (Coleman and Cater 2005). A study comparing attitudes to drink-driving and driving under the influence of cannabis found that respondents were generally aware that drink-driving did affect behaviours that increased the risk of accidents which not only risked their own lives but also the lives of others (Danton et al. 2003). In contrast, it was generally believed that driving after taking cannabis did not affect driving (unless large amounts were taken). Indeed, some people thought that cannabis had a positive effect on driving.

Albery and Guppy (1995) examined the differential perceptions of young drivers (aged 17-25) of legal and safe driving levels of alcohol consumption, and reported that young people considered that the legal limit was higher than the limit of what they would consider safe to consume before driving. In addition, young men thought the legal limit was considerably higher than young women did (Albery and Guppy 1995, p 246).

Pedestrians and Cyclists

Young people take more risks in groups

Chinn and colleagues (2004) examined young people's views of risky pedestrian behaviour using an interview survey and focus groups. The study found that young people thought that they would be safer or took fewer risks when alone, compared to when they travelled in groups. Among those walking or cycling home from school in groups, those travelling with three or four friends reported the most risky behaviour. This finding is supported by the statistics from this study presented earlier and by other correlational studies.

Boys aged 13-14 took more risks, as did white young people

Risky behaviour ratings were highest for young people aged 13-14 years compared to those aged 11-12 or 15-16 years. Boys rated their behaviour as more risky than girls and white young people reported being more risky than non-whites. Those in medium-sized towns or suburban areas reported more risky behaviour than those in large towns or rural areas. When asked how much they do things that are risky to impress their friends or because it is fun, boys' average scores were higher than girls for both. Again, the score of 13-14 year olds were the highest. Young people thought that they were significantly more likely to have an accident around roads in the next year when they were with friends compared to on their own. On average, boys thought they had a greater chance of having an accident than girls did.

How do young people manage dangerous driving in relation to accidental injury?

The factors that affect the decision to drive 'dangerously' can broadly be categorised into three types: individual factors, influences from other people, and other factors.

There were a large number of individual factors which young people said influenced their driving decisions. Perceptions of responsibility were weighed against the enjoyment that can be derived from driving, and young people's individual experiences and perceptions of their own abilities and limits all played a part.

Drivers take more risks when driving alone

Some drivers tended to take more risks when they felt that they were only responsible for themselves (Danton et al. 2003, Rolls and Ingham 1992) - for example, they drove faster or more 'riskily' when alone in the car (Rolls and Ingham 1992). Most failed to mention the risk that they may pose to other road users (this was also noted when drivers discussed being able to take greater risks in newer or more powerful cars without being 'unsafe'). Others mentioned that they were more likely to take risks if there were fewer pedestrians or less other traffic around (e.g. at night), suggesting that some young people are using risky night-time driving as a social pursuit in itself.

Risky driving is considered enjoyable

Young people enjoyed taking risks while driving (or being driven): it was agreed that young males often deliberately went out to try risky driving behaviours and this was why they were more likely to have accidents which did not involve any road users beyond other drivers (Rolls and Ingham 1992). Speeding (and other risky practices) were considered fun and exhilarating; they tested both the car's and the driver's abilities and helped to relieve boredom. Risky behaviour was described as deliberate (i.e. characterised by driving violations) rather than due to errors.

Unsafe and safe drivers have different perceptions of what a 'good driver' is

'Safe' and 'unsafe' drivers differed in their definition of what a good driver is: the former emphasised safety while the latter emphasised driving skills (Rolls and Ingham 1992).

Accidents do not seem to affect driving behaviours

Critical incidents (e.g. having an accident) did not appear to have an effect on driving behaviour (Rolls and Ingham 1992).

Some feel they 'grew out' of risky driving as they got older

Some young people felt that they became safer drivers as they got older (Rolls and Ingham 1992). They felt that they 'grew out' of risky driving with lifestyle changes such as getting long term partners or children and financial burdens which meant that they had less money to spend on going out or on cars, or had nicer cars that they were less willing to risk damaging.

Other people affect young people's driving behaviour

Young people felt that other people influenced their driving behaviours in different situations, sometimes by affecting their perceptions of responsibility but at other times in encouraging them to drive more riskily.

Peers encourage risky driving

In general, young people's peers tended to be a negative influence, either legitimising risk-taking because 'everyone does it', directly encouraging risky

driving as passengers, or through a culture of bravado and 'bragging', where taking risks while driving would help to gain kudos and status (Rolls and Ingham 1992).

Drink-driving was not socially acceptable, though driving on cannabis was acceptable

Drink-driving, on the other hand, was not a socially acceptable form of risk-taking. Most people (even those who had done it) did not approve (Danton et al. 2003, Rolls and Ingham 1992). Driving after taking cannabis was generally acceptable (Danton et al. 2003).

Expectations that young people would drive dangerously encouraged them to do so, while some passengers, e.g. parents, reduced risky driving

Some drivers felt that other people (e.g. police, friends, insurers) expected them to drive recklessly and that this encouraged them to do so, possibly because they felt they had nothing to lose (Rolls and Ingham 1992). A few commented that the behaviour of other drivers was a negative influence, while others thought that having passengers (especially parents) was a positive influence as they felt more responsible when others were in the car.

Driving with parents tended to make young people drive better as they wanted to prove that they were good drivers (and did not want to worry their mothers!). A small minority felt that police assumed young men were bad drivers, so they thought they might as well act as expected of them (Rolls and Ingham 1992).

Traffic situations and the type of car affected risk-taking

The situation that young people found themselves driving in affected how risky their driving was: risks were more often taken at night or on quiet, wide or low traffic roads such as those in the country (Rolls and Ingham 1992). Waiting for these circumstances was mentioned by some as a tactic to reduce risks if they had been drinking alcohol.

Fast cars made some drivers feel that they were able to drive more riskily without reducing their safety; those who drove for companies (or who drove company cars) also may take more risks, sometimes due to external pressures from employers. The perceived effect of in-car music systems varied. Some felt that operating old-style players distracted the driver, but they were also thought to help in maintaining concentration. No views studies were identified which discussed young people's attitudes and behaviour in relation to use of mobile phones while driving.

Lack of public transport

Some drivers cited a lack of adequate public transport (or lack of convenient alternatives, such as taxis) as a reason for drink-driving, or accepting a lift from someone who had consumed too much alcohol.

Systematic reviews of effectiveness

A total of 17 systematic reviews were found which considered the effectiveness of measures to change unsafe road behaviour and so reduce accidental injury.

Two reviews looked at motorbike helmet wearing (Coleman et al. 1996, Elkington et al. 2000); seven looked at measures to reduce drink-driving (Coleman et al. 1996, Dinh-Zarr et al. 2004, Elkington et al. 2000, Lund and Aaro 2004, Towner and

Dowswell 2002, Wagenaar and Toomey 2002, Wells-Parker et al. 1995); five looked at measures to reduce dangerous or risky driving (Coleman et al. 1996, Elkington et al. 2000, Hartling et al. 2004, Lund and Aaro 2004, Roberts and Kwan 2001); eight examined the effectiveness of seat belt programmes (Dinh-Zarr et al. 2001, Dowswell and Towner 2002, Johnston et al. 1994, Lund and Aaro 2004, Mackay et al. 1999, Towner et al. 2001c, Turner et al. 2005); and two looked at pedestrian safety education interventions (Duperrex et al. 2002, Towner et al. 2001c).

Two reviews had a primary focus on young people aged 15-24 years (Coleman et al. 1996, Elkington et al. 2000 - the Elkington review built on the Coleman). The focus of the review by Wagenaar and Toomey (2002) was primarily on 16-21 year olds, with some studies distinguishing in their analyses between college students and young people who were not in college. A further two of the reviews specifically addressed the issue of social deprivation and accidental injury prevention in the road environment, revealing an overall lack of evidence in this area (MacKay et al. 1999, Dowswell and Towner 2002).

Motorcycle helmets

In Britain, the wearing of motorcycle helmets was made compulsory for all riders in 1973. More than thirty years later, however, resistance to legislation on helmets remains in this country and elsewhere. (See, for example, the Motorcycle Action Group (www.mag-uk.org), a lobbying organisation that was established in 1973 specifically to campaign for the repeal of the mandatory helmet law.) The efficacy of motorcycle helmets remains a subject of continuing debate and international research (Liu et al. 2003).

A review by Coleman and colleagues (1996) reported that legislation on motorcycle helmet use was effective in reducing fatalities among 15-24 year olds (although it was recognised that this may be due in part to a fall in motorcycle use following legislation). Elkington and colleagues (2000) suggested that, for a range of road safety behaviours (including motorcycle helmet wearing), legislation and enforcement were more effective than other strategies (e.g. media-based campaigns) in reducing injuries.

Measures to reduce drink-driving

Lund and Aaro (2004) found that most educational interventions or skills training for young people either had no effect or had a negative effect. This is possibly because such training results in young people overestimating their abilities. For those aged 15-24 years, Elkington and colleagues (2000) also found little evidence to support education-only interventions.

Wells-Parker and colleagues (1995) looked at remedial interventions with drink/drive offenders (some of whom would have been young people) which were shown to have a positive effect on behaviour and reduce crashes involving alcohol. The review suggested that the most effective type of treatment might be programmes which combine education, psychotherapy/counselling, and contact follow-up (such as probation).

Dinh-Zarr and colleagues (2004) reported details from one study which found reductions in fatal and non-fatal injuries associated with motor vehicle crashes following brief interventions to injured problem drinkers (aged 18-65 years). The interventions consisted of two brief intervention visits one month apart by a personal physician, two follow-up calls by a nurse, and a general health booklet.

For 15-24 year olds, Coleman and colleagues (1996) evaluated the evidence of educational interventions to reduce drink-driving based on models of behavioural change, which assume that targeted information about risks and consequences will result in a shift in attitude and then behavioural change. None of the programmes were found to have been successful. The report noted that it may be helpful to see information and knowledge as pre-conditions for behaviour change which need to be supplemented with other initiatives such as social skills training and role-playing.

A number of reviews, including those which looked specifically at young people, found legislation and enforcement to have positive effects on drink-driving related accidents and injuries (Coleman et al. 1996, Elkington 2000, Lund and Aaro 2004, Wagenaar and Toomey 2002). The reviews by Coleman and colleagues and Lund and Aaro found that raising the legal drinking age reduced young driver fatalities. Wagenaar and Toomey linked a higher legal drinking age with decreased rates of traffic crashes. Coleman and colleagues found the evidence for the stricter enforcement of drink-drive laws or random breath testing 'less clear cut'; and, as the enforcement was not aimed at young drivers particularly, it was thought to be difficult to assess any benefit this might have on preventing casualties among this group (Coleman et al. 1996, p 25).

Elkington and colleagues (2000) recommended backing up legislation with multi-media campaigns and other supportive strategies. Lund and Aaro (2004) found that mobilising social support from other significant people (including parents and waiters in bars) seemed to produce a greater positive effect. This review also provided an overview of a community-based intervention in the USA which aimed to reduce alcohol-impaired driving and other traffic-related injuries. The five-year programme consisted of mass media campaigns, education, and enforcement, and reported a positive effect. Lund and Aaro (2004) went on to recommend the use of a combination of strategies that aim to change attitudes, behaviour, and structural factors, rather than focusing solely on one type of factor. In contrast, a review of community-based injury prevention programmes by Towner and Dowswell (2002) concluded that, although there is increasing evidence of their effectiveness, a positive and sustained impact on injury rates has yet to be demonstrated conclusively.

Measures to reduce risky driving

A number of reviews found that educational interventions or skills training aimed at car drivers or motorcycle riders had no effect, or even a negative effect, in reducing accident or injury rates (Coleman et al. 1996, Lund and Aaro 2004, Roberts and Kwan 2001). One explanation given was that programmes specifically aimed at young people can lead to their being awarded licenses at a younger age, which in turn can have the effect of increasing accidents.

Coleman and colleagues (1996) found evidence from Canadian and US interventions that raising the minimum driving age could have a 'substantial impact on driver accident rates' (p 24). A Cochrane review looking at graduated licensing schemes for young people also found this particular intervention to be effective in reducing crash rates (Hartling et al. 2004). None of the studies included in this review were from the UK. Elkington and colleagues (2000) record that there is 'reasonable evidence' to support graduated licensing schemes and raising the minimum driving age (p 27). The positive influence of curfew laws (restricting young people to daytime driving) is supported by the findings of Coleman et al. (1996).

Seat belt programmes

Towner and colleagues (2001c) found 'reasonable' evidence that seat belt educational campaigns lead to behaviour change. Three studies which included children over the age of 12 in their target group were reviewed: the interventions included pamphlets, counselling, and a reward scheme involving stickers and pizza. Both the reward scheme intervention and the counselling intervention were described as effective by Towner and colleagues. One study reported that higher rates of change were observed in younger children. No evaluations of educational programmes used injury data. Of the nine studies in the review by Towner and colleagues which examined the effects of legislation requiring the restraint of children in cars, only one study included older children (4-15 years). This study reported a decline following legislative change in the number of deaths and serious injuries among children and young people travelling as front seat passengers. Interventions to enforce seat belt laws were found to have achieved 'some increases in observed restraint use' (Towner et al. 2001c, p 52). The review adds, however, that 'campaigns were not always effective with all groups and the size of the effect was sometimes limited' (Towner et al. 2001c, p 52).

Dowswell and colleagues (1996) reported that child passengers aged 11-14 years travelling in the front of vehicles suffered fewer fatal and serious injuries following the introduction of front seat belt legislation in the UK. The evidence from other reviewed studies, however, suggested that educational campaigns encouraging older children to use seat belts have met with 'mixed results' (p 143).

Other reviews did not differentiate between rear and front seat belts in their discussion.

Based on studies conducted in the 1970s and 1980s, Coleman and colleagues (1996) also found that propaganda methods to increase seat-belt use (including leaflets, media campaigns and reward schemes) produced mixed results.

Johnston and colleagues (1994) evaluated the effectiveness of different types of behavioural safety belt programmes among drivers (all ages) and found 'significant evidence' that these increase safety belt use (Johnston et al. 1994, p 319). The review also found that the maximum increase in safety belt use occurred with a programme that combined enforcement with incentives. Similarly, Lund and Aaro (2004) commented on the positive effects of intervention projects which used different kinds of rewards to promote the use of seat belts among children and adults in the USA. One study in their review reported that the long-term effects were better when the strategy was directed at children, rather than teenagers or adults.

Dinh-Zarr and colleagues (2001) reviewed studies (conducted primarily in the USA) which found that safety belt laws and enforcement programmes were associated with increases in safety belt use and decreases in fatal and non-fatal injuries among both teenagers and adults. One study found that seat belt laws were more effective among women. Two studies found that, following the introduction of laws allowing police officers to stop motorists solely for non-use of seat belts, usage increased more among African-Americans and Hispanics than among whites. The review also suggested that this particular intervention may have a greater effect on high-risk drivers (e.g. drink drivers) than on low-risk drivers (Dinh-Zarr et al. 2001, p 54). Lund and Aaro (2004) also found evidence that seat-belt legislation brought about more positive opinions, changed behaviour, and/or reduced the number of fatalities and injuries.

Community-based interventions to reduce injury or increase seat-belt use among children and young people up to the age of 16 were the focus of a review by Turner and colleagues (2005). Types of interventions included: legislation, targeted education, mass media education, environmental, behavioural, and the World Health Organisation's 'safe community' approach (Turner et al. 2005, p 80). Although some programmes achieved considerable improvements in either reduced injury levels or increased use of seat-belts, the review concluded that the results should be interpreted with caution because of the methodological limitations of some of the studies.

MacKay and colleagues (1999) assessed the evidence regarding the relationship between social and economic status (SES) and the uptake of seat-belts and child restraints. They found that 'lower SES was associated with lower restraint use and/or correct use' (Mackay et al. 1999, p 16). A second review in this area by Dowswell and Towner (2002) noted that there was limited evidence about the different effect of seat belt promotion campaigns among children from families in different social and economic circumstances. One intervention study included in this review, which was conducted in low-income areas, included a public information campaign, police enforcement of seat belt laws, and safety education in schools and healthcare settings. These measures were effective in changing behaviour among children.

Pedestrian Safety Education

Two systematic reviews evaluated interventions that were intended to prevent or reduce accidental injury among pedestrians. We found no systematic reviews which addressed the issue of social and economic status, despite this being strongly associated with increased injury risk.

Towner and colleagues (2001c) recorded 'reasonable evidence' that educational campaigns targeted at child pedestrians led to behavioural change and 'some evidence' that they resulted in injury reduction. All the evidence that this review presented for pedestrian skills training and Traffic Clubs related to children aged 10 years and younger.

Fifteen randomised controlled trials of pedestrian safety education met the inclusion criteria of a Cochrane review by Duperrex and colleagues (2002) which focused on assessing reported behaviour, attitude, and/or knowledge, rather than the occurrence of pedestrian injury. In 14 of the studies, the participants were children. The review concluded that, while pedestrian safety education can improve children's road-crossing knowledge and behaviour, the lack of high-quality randomised controlled trials, and the fact that none of the available trials assess injury outcomes, limits claims for the effectiveness of this intervention. They conclude that 'whilst the value of pedestrian safety education remains in doubt, environmental modification and the enforcement of appropriate speed limits may be a more effective strategy to protect children from the hostile traffic environment' (Duperrex et al. 2002, p 13). Dowswell et al. (1996) also emphasises the importance of developing measures that offer passive protection of children, such as environmental improvements, to run alongside active campaigns targeting children themselves.

Current policy in the UK

This is an area where there is a long history of legislation. For over 100 years, maximum speed limits have been a feature of road safety legislation: the Road Traffic Act of 1930, for example, abolished the 20mph speed limit and set a variety

of limits for different classes of vehicle. That year also saw the introduction of the minimum driving age. An Act of 1967 introduced the alcohol breath-test in the UK. The wearing of motorcycle helmets was made compulsory for all riders in 1973. The 1981 Transport Act introduced the two-part motorcycle test, and learner riders were restricted to 125cc motorcycles. In early 1983, the wearing of seat belts by the front seat occupants of cars and light goods vehicles was made compulsory. In the early 1990s speed enforcement cameras were introduced at permanent sites.

The British Government's safety strategy, *Tomorrow's Roads: Safer for everyone* (Department for Transport 2000b), was published in 2000, and an accompanying strategy specifically for improving safety for children was published in 2002 (Department for Transport 2002). As part of the accident reduction strategy set out in *Saving Lives: Our healthier nation*, by 2010 the Government aims to achieve:

- a 40% reduction in the number of people killed or seriously injured in road accidents;
- a 50% reduction in the number of children (under 16) killed or seriously injured; and
- a 10% reduction in the 'slight casualty rate'.

The framework for achieving these aims is organised around 10 main themes:

- Safer for children
- Safer drivers (training and testing)
- Safer drivers - drink, drugs and drowsiness
- Safer infrastructure
- Safer speeds
- Safer vehicles
- Safer motorcycling
- Safer pedestrians, cyclists and horse-riders
- Better enforcement
- Promoting safer road use

The Government aims to improve people's driving skills and general driving behaviour by increasing the status of training and testing. The existing driving test is being revised and advanced qualifications promoted more than they have been in the past. As part of the strategy to develop a more structured approach when learning to drive, a voluntary training logbook has been introduced covering driving skills and manoeuvres as well as night driving, adverse weather and the environment. Accidents caused by drink, drugs and fatigue are also being targeted. High-risk offenders are given additional penalties, and courts have been given the power to send drink-drivers on rehabilitation courses. Breath-testing policy has also been flagged up for revision, and measures to reduce accidents due to fatigue include rules for transport workers and the publicising of advice to all drivers. Details of the Government's latest campaigns can be found on the THINK! Website (www.thinkroadsafety.gov.uk) and a review of the Government's road safety strategy and casualty reduction targets was published in 2004 (Department for Transport 2004).

From September 2006, new rules will apply to children travelling in cars. There will be few exceptions to the requirement that an appropriate child restraint is used, and the existing 'if available' loophole will no longer apply.

With regard to infrastructure, the Government aims to ensure that safety is a 'main objective' when new roads are being planned and constructed, and to promote more co-ordinated local planning taking the needs of pedestrians, cyclists, motorcyclists and horseriders into account as well as motor vehicles. It is also attempting to reduce the number of people driving too fast by publicising the 'dangers of excessive and inappropriate speed and the effect it has on other people's health and quality of life' (Department for Transport 2000b). The Government is attempting to reduce injuries to motorcyclists through a strategy of improved training and improvements to motorcycles themselves.

As the above statistics show, young pedestrians and cyclists suffer a large number of injuries. The Government aims to reduce these by

- changes to the road network (e.g. traffic calming, well-planned pedestrian routes, lighting, improved signal-controlled junctions, and building cycle routes and lanes);
- improving pedestrian behaviour and publicising the importance of being visible to traffic;
- reducing vehicle speeds and traffic levels, and enforcing speed limits;
- promoting considerate driving and safer cycling, including the use of cycle helmets.

The Government's target of reducing the number of children killed or seriously injured in traffic accidents by 50% compared to the 1994-98 average was followed by a *Child Road Safety* strategy document published in 2002 (Department for Transport 2002). This contains a review of progress and a description of some of the publicity initiatives and projects through which the Government hopes to achieve its target. Many of the materials aimed at improving the safety of children and young people have been designed for children under 12, but some - for example, *On the Safe Side* (Department for Transport 2003) - target older age groups. *Child Road Safety* also highlights after-school clubs and information about safer cycling for this age group.

Organisations and websites with information relating to road safety include BRAKE (www.brake.org.uk), the Child Accident Prevention Trust (CAPT) (www.capt.org.uk), SMARTRISK (www.smartrisk.org.uk), the Transport Research Laboratory (www.trl.co.uk), the British Medical Association (www.bma.org.uk/ap.nsf/Content/DrugsDriving), the Driving Standards Agency (www.dsa.gov.uk), the Institute of Road Safety Officers (www.irso.org.uk), the Neighbourhood Road Safety Initiative (www.nrsi.org.uk), the Royal Society for the Prevention of Accidents (ROSPA) (www.rospa.org.uk), National Safety Camera Liaison (www.nationalsafetycameras.co.uk), the Highways Agency (www.highways.gov.uk), Telford Training Consultants (www.ttc-uk.com), the Parliamentary Advisory Council for Transport Safety (www.pacts.org.uk), and Sustrans (www.sustrans.org.uk).

Discussion and implications

Summary of findings

National statistics show that 10,900 young people were killed or seriously injured on the roads in the UK in 2004. Many more young men than women are injured, although the disparity is less among car passengers than for other forms of transport. Those aged under 16 are most at risk of injury on bicycles; at age 16, more are injured on mopeds, and then at 17 and over in cars. Young people aged 17-19 years are the most likely to be involved in drink-drive related accidents. The involvement of drugs in road traffic accidents has yet to be quantified.

Research suggests that younger, as opposed to less inexperienced, motorcyclists are more likely than older motorcyclists to be killed or seriously injured while driving, but also that the factor most clearly related to severity of injury is the engine capacity of the motorcycle involved. Young drivers of cars are also more likely to be injured than older drivers.

Sixteen to twenty-four year olds in the general population in England and Wales in 1996 had a higher number of alcohol-attributable road traffic accident deaths than all other age groups. In addition, within this age group young men had over eight times as many alcohol-attributable road traffic deaths as did young women. Drugs are found in the bloodstream of more young fatal accident victims than older age groups; however, it is difficult to assess whether drugs actually contributed to the accident. A low score based on the father's occupational classification and low family affluence have both been reported as being predictive of injuries occurring on the roads, but the only independent predictor of child pedestrian injury is 'playing in the street'.

Young 'risky' drivers were more likely to think they would have an accident, but were also less worried about this than 'safe' drivers; accidents or dangerous driving were not considered to be embarrassing. Some young people expressed a fatalistic view of the chances of having an accident, and those that had been involved in crashes stated that it had not really affected their driving behaviour. 'Risky' driving was seen as enjoyable and not considered to be the same as driving unsafely. However, different drivers had different perceptions of what a 'good driver' was, with 'safe' drivers emphasising safety and 'unsafe' drivers emphasising driver skills.

The presence or absence of other people influenced driving behaviour. Some passengers, for example parents, would reduce risky driving whereas others, such as peers, might encourage more risky driving. Young men were more likely to take risks than young women. Young people stated that they judge the degree of acceptable risk depending on the situation. Young people driving alone or late at night when the roads are quieter said they were more likely to drive riskily than during the day or when they were responsible for others in the car. Some young people felt they 'grew out' of risky driving as they got older with more expensive cars and family responsibilities. They also said that the social expectation that they would drive riskily made it more likely that they would do so.

Young people expressed a difference in attitudes to drink-driving versus driving on cannabis. Drink-driving was generally considered dangerous and not socially acceptable, whereas driving on cannabis was more acceptable and not thought to be dangerous. Some young people stated that a lack of public transport (or alternatives, such as taxis) made it more likely that they would drink and drive.

There is a large evidence base of systematic reviews that look at interventions designed to reduce traffic injuries. Legislation on the wearing of motorcycle helmets has been found to be effective, as has legislation and enforcement on reducing drink-driving. Raising the minimum driving age and introducing graduated licensing schemes for young people have also been shown to be effective in reducing accidents. Curfew laws, which restrict the times during which new drivers can drive, also reduce accidents. Seat belt campaigns have led to behaviour change and consequential reductions in injuries.

Most education or skills training interventions, or interventions based on models of behaviour change to reduce drink-driving, are ineffective or have a negative effect. Combining different approaches has more effect than using a single approach. Education or skills training has either negative or no effects on driver behaviour and subsequent accidents, possibly because these approaches lead to over-confidence or early licensing. The effectiveness of pedestrian education is not proven. Environmental modification and the enforcement of speed limits may be more effective at pedestrian accident prevention.

Evidence relating to community-based interventions is mixed. Some studies found that the mobilisation of social support was effective in reducing drink-driving. However, while evidence of their effectiveness is increasing, community-based interventions have not yet demonstrated a sustained impact in reducing injury.

Current policy is aimed at reducing substantially the number of people killed or seriously injured on the roads, with particular emphasis on children. Driving skills are being targeted through changes to driver training and testing. Accidents caused by drink, drugs and fatigue are also targeted. The Government is aiming to improve safety for cyclists by making changes to the road network, reducing vehicle speeds, and promoting considerate driving and safer cycling.

Social and economic circumstances (SES)

Despite the fact that pedestrian injuries are a major area of health inequalities, with children from the most deprived areas four or five times more likely to be involved in an accident than children from affluent areas, we identified only one correlational study which explored the relationship between socio-economic factors, unsafe road behaviour and accidental injury (Christie 1995). However there is a body of research examining the relationship between SES and pedestrian or other road traffic accidents.

Four studies conducted in Scotland investigated associations between SES and road traffic accidents; none of these explicitly considered risk-taking behaviours (Abdalla et al. 1997, Chichester et al. 1998, Williams et al. 1996, Williamson et al. 2002). Williams and colleagues (1996) found that a low score based on the father's occupational classification and low family affluence were both predictive of injuries to 11-15 year olds occurring on the roads. Abdalla and colleagues (1997) examined the relationship between road traffic injuries and social characteristics in the former Lothian region of Scotland. Large differences were seen for pedestrian casualty rates when comparing the 15% most deprived areas with the 15% most affluent. The rate for 12-16 year olds and 17-24 year olds in the most deprived areas was more than double that from the same age groups in affluent areas. This difference was far less pronounced when comparing non-pedestrian casualties. For both social groups the older age group had half the rate of pedestrian injuries and nearly three times as many non-pedestrian injuries.

A similar picture emerges from a study by Chichester and colleagues (1998), which showed a significant association between road traffic accidents (RTAs) and area deprivation categories across all age groups.

Trend analyses by age, gender, and victim role [pedestrian or driver] all showed significance in relation to RTA occurrence and deprivation. The most significant relationships by age were found amongst children and teens. (Chichester et al. 1998, p 137)

In a study of head injury mortality among 0-14 year olds in Scotland, pedestrian accidents and other road traffic injuries were the leading causes of injury (75%) (Williamson et al. 2002). Children living in poorer areas had the highest head injury mortality rates. While there was a significant decline in mortality rates for all groups between 1986 and 1995, the risk of a fatal head injury for 10-14 year olds in the poorest areas increased to five times that of those in the most affluent. The authors suggest that the general decline may be explained by environmental factors including the introduction of urban traffic calming schemes.

These three studies strongly suggest that those living in more deprived areas are more likely to be victims of a traffic-related accident. This points to the importance of factors associated with the areas themselves in raising the likelihood of an accident; it may also reflect the wider pattern of social inequalities in accidental injuries.

Noland and Quddus (2004) evaluated the relationship between land-use types, road characteristics, road casualties, and area-wide deprivation in an analysis of the 8414 census wards for England. They found area deprivation and traffic casualties were positively correlated, though less obviously so when only motorised casualties were considered. Their findings suggested that

urban more densely populated areas tend to have fewer traffic casualties while areas with higher employment density have more traffic casualties. The first effect may be due to reduced speeds and higher levels of congestion or possibly the lower design speeds of roads in urbanized areas. The latter effect may be due simply to increased levels of street activity in areas with more employment. Results suggest that increasing speeds in urbanized areas by reducing congestion may have adverse safety consequences. (Noland and Quddus 2004, p 983)

In their analysis of injury rates, traffic calming, and method of travel to school among 4-16 years olds in two UK cities, Jones and colleagues (2005) found that area-wide traffic calming features were associated with reductions in both absolute child pedestrian injury rates and in relative inequalities in those rates. These findings are consistent with the systematic review findings of Bunn and colleagues (2003) who reported that traffic calming resulted in an 11% reduction in fatal and non-fatal road traffic injuries. However, this systematic review did not examine inequalities, or the specific impact on children and young people.

Risk-taking and driver behaviour

As discussed in the introduction, there is a wide body of research on risk-taking behaviour and young people. While some of the studies discussed in this chapter attempt to link risk-taking with consequential injury, most discussion surrounding risk-taking is confined to young people's attitudes and behaviour. We therefore discuss here some of the relevant studies in this category which are concerned with driver behaviour - and possibly accidents - but do not relate this to injuries.

Two studies by Parker and colleagues (Parker et al. 1995, Parker et al. 1992) reported a similar finding to the study by Rutter and Quine (1996) discussed above. Both these studies found that a high driving violation score (based on self-reported behaviour, such as disregarding the speed limit) was an independent predictor of accidents. However, driver 'error' or 'lapse' were not associated with accidents. The authors conclude that

the results indicate that violations are the behaviour that drivers must be dissuaded from committing. They are the type of aberrant driving behaviour most closely associated with accident involvement and, being socially and motivationally based, might be more likely to be amenable to remediation through persuasion. (Parker et al. 1995, p 1045)

Department of Transport statistics for 2005 indicate that there were fewer accidents after dark among the population as a whole and, as mentioned above, that 17-24 year olds spent a higher percentage of their time driving in the dark compared to other ages. A study by Clarke and colleagues (2002) reports that young drivers have 50.4% of their accidents during the hours of darkness (Clarke et al. 2002). As national statistics report that only 27.8% of road traffic accidents occur during darkness among the population as a whole, it would appear, therefore, that young night-time drivers are at a higher risk of accident than night-time drivers in the general population. The study by Clarke and colleagues concludes that darkness seems 'not to be especially dangerous in itself; rather it is the young drivers' reasons and attitudes towards driving in the evening that puts them at an increased risk of having an accident'.

Our search identified limited recent research examining the risks associated with riding motorcycles or driving cars of different engine capacities. However, Clarke and colleagues found that while young drivers of performance cars who were involved in accidents were no more likely to be over the legal limit for alcohol or to have driven through red traffic lights than other road users, they were more likely to be male and be driving recklessly or at excessive speed. It was further reported that young people driving high performance cars had, if anything, higher skills than average, but their 'attitude deficits more than make up for that apparent advantage' (Clarke et al. 2002, p 16).

Implications for interventions

In this topic area there is substantial evidence about the types of interventions which have an impact on injury rates. Specifically, we know that legislation and enforcement programmes can reduce injuries, but that education and skills training is less effective and can be counter-productive. Environmental modification may be more effective than pedestrian education and, while it is promising, the evidence for the effectiveness of community-based interventions is not yet conclusive.

Some of the recommendations for interventions appear to be amenable to implementation through education initiatives. However, given the difficulty of changing behaviour through these types of programmes, innovative interventions which change attitudes and behaviour will need to be developed. Specifically, we make the following recommendations:

- Interventions should challenge the fatalistic view that some young people have of accidents, and encourage young people to see accidents not as random events but as something that their behaviour can affect.
- They should raise awareness that taking risks may equate to driving unsafely even if this is not the intent.

- They should challenge the belief that there are situations when it is safe to drive 'riskily', and the raise awareness that that even if only one person is in the car, the driver is not the only person at risk.
- They should be context-specific, and focus on the situations when some young people perceive it is safe to drive riskily - for example, at night, in the country, or when there are few other cars or pedestrians around.
- If the evidence is clear that smoking cannabis can cause crashes, they should highlight the dangers of smoking cannabis and driving, possibly by equating the taking of cannabis and driving with drinking and driving.
- They should accept (and possibly incorporate) the fact that young people enjoy taking risks while driving and may set out specifically to do this.
- They should challenge perceptions of what makes a good driver - i.e. 'safe' or 'able to drive well and take risks'.
- They should highlight existing incentives, or provide additional incentives, to encourage safe driving behaviour. This would challenge the perspective that young people have nothing to lose. Recent schemes which gave young people substantial discounts on insurance in return for a GPS device to monitor speed (piloted in Northern Ireland) may be useful in this regard. A recent EPPI-Centre systematic review has shown that incentives can be effective in some situations in changing people's behaviour (Kavanagh et al. 2006).
- They should target the peer influence that encourages risk-taking, tackle the perception that it is OK because everyone else does it, and aim to stop bravado and bragging about risky driving behaviour. Encouraging the presence of parents when their children are driving may be an effective intervention, if difficult to implement.
- They should target the specific problem of risky driving in fast cars and motorcycles (e.g. extra license requirements for more powerful cars).

On the basis of the research looked at in our review we do not recommend:

- skills programmes (because of their potential harmful consequences);
- increasing young people's knowledge of number of traffic casualties in the hope that this will change behaviour (they already over-estimate these figures);
- simply highlighting the dangers of drink-driving (young people are already aware of this).

Implications for research

Legislation and regulation have had important roles in reducing injury on Britain's roads. Some of the effectiveness research has found that raising the minimum driving age and introducing graduated licensing schemes can reduce injuries. While the implication for intervention may be clear, additional regulation is a complex issue which needs public support to work. However, serious consideration should be given to further research with possible pilot schemes to see whether the findings from the international evidence are applicable in the UK.

There is a growing body of evidence which suggests that driving on cannabis is as dangerous as drinking alcohol and driving. If this is shown conclusively to be the case, then a study which examines the way that public attitudes towards drinking

and driving changed over the last 20 years may be useful to alter attitudes towards cannabis and driving.

Despite recent interest in the subject, there is little information available about the impact of drugs on road traffic crashes (Anon 2005). This may explain why the issue is not mentioned in the Drug Harm Index (MacDonald et al. 2005). Obtaining good statistical information on this issue is necessary to inform future policy development.

Young people say that critical incidents do not affect their driving behaviour at the same time as saying that shocking images in advertising campaigns are effective. It is important that this contradiction be resolved, since - for example - many mass-media campaigns to reduce vehicle speed rely on the depiction of critical incidents.

Most of the studies of young people's views focused on their individual behaviours rather than environmental and other influences, such as regulation, on their risks of traffic injury. This is a limitation in these studies which is worth of further research attention in the future.

While environmental factors may play the largest role in injury, particularly to pedestrians, there is substantial research and policy interest in reducing injury through improving people's driving. Given the difficulties of changing injury rates identified in the effectiveness reviews, a programme of research which investigates how people learn to drive may be useful, building on the programme of 'road safety and child development research' commissioned by the Department for Transport (Department for Transport 1999).

6. Evidence Synthesis: Bicycle helmets

This chapter focuses on the use of bicycle helmets in relation to accidental injuries to cyclists. Injuries to cyclists are not only related to the use or non-use of cycle helmets. Other factors, such as the lack of safe cycling facilities on the roads (e.g. cycle paths, appropriate lighting) and the potential for other road users not to pay sufficient attention to the safety needs of cyclists may also play a role in current accidental injury rates. (See the previous chapter for relevant statistics in relation to the national picture.)

National picture

The Department for Transport issues yearly summaries of road casualties. The 2004 statistics (Department for Transport 2005) show that there has been a slow fall in the number of young people killed or seriously injured while cycling over the last 10 years. In 2004, there were 702 such casualties (the age breakdown is as follows - 12-15: 365, 16-19: 169, 20-24: 168), compared with an average of 1287 in the period 1994-8. This fall reflects a reduction in both the absolute numbers of casualties and the number of casualties per mile cycled (Department for Transport 2004).

Figure 5.1 in the previous chapter shows the number of completed hospital episodes between 2000/1 and 2003/4. Pedal cycles accounted for the largest number of hospital episodes due to transport injuries for the 12-15 year age group. After the age of 13 the number of hospital admissions fell until by the age of 18, pedal cycle injuries were running at the same rate as pedestrian injuries.

Strategies to increase bicycle helmet use continue to be the focus of most interventions to reduce injury among bicyclists. Yet there remains a strongly polarised debate about the efficacy of cycle helmets to reduce head, face and brain injuries. The balance of the available evidence is that helmets do reduce injuries. An *Effective Health Care Bulletin* from the NHS Centre for Reviews and Dissemination concluded that 'there is good evidence that the use of cycle helmets...can reduce serious injury to children involved in road traffic accidents' (NHS Centre for Reviews and Dissemination 1996, p 1). There have also been a number of systematic reviews which have quantified the efficacy of helmet use in preventing serious injury, and even death, as a result of cycling accidents. A systematic review on helmet effectiveness, published by the Cochrane Library, was written by three of the principle exponents of cycle helmet wearing (Thompson et al. 1999). A meta-analysis by Attewell and colleagues (2001) also examined the evidence on the efficacy of bicycle helmets. Both reviews conclude that helmets are effective at reducing mortality and injury caused by cycling accidents.

Few countries currently have compulsory cycle helmet legislation (Australia was the first to introduce it in the early 1990s, closely followed by New Zealand and some jurisdictions in the USA). Based on the results of their systematic reviews, both Thompson and colleagues (1999) and Attewell and colleagues (2001) strongly advocate for legislative change in this area.

The use of cycle helmets in the UK is, at present, voluntary. The BMA has for many years recommended that all cyclists wear proper fitting helmets, certified to the correct standard; however, since 2004 it has officially urged 'legislation to make the wearing of cycle helmets compulsory for both adults and children' (British Medical Association 2004). In making these recommendations, the BMA has referred to 'solid scientific evidence' that helmets protect against both fatal and non-fatal injuries, as a result of cycling accidents (British Medical Association 2004).

There are also many who reject the claim of the efficacy of helmets in reducing injury, and argue against compulsory legislation. A number of diverse themes characterise this side of the efficacy debate. Some argue that helmets are only effective for low-speed impacts, as they potentially offer protection to the scalp but not the brain, and offer no protection to other parts of the body, where many of the injuries occur in high-impact fatal crashes. Research casting doubt on helmet efficacy has also focused on the methodological weaknesses or defects of scientific studies. Others (while accepting the central point that helmets can protect the head *in the event of an accident*) argue that risk compensation negates the protective effect of helmets (i.e. helmets increase feelings of security and hence lead to less cautious cycling behaviour). It is argued that risk compensation must be taken into account when making policy recommendations. Others oppose compulsory legislation on the grounds that cycle helmet laws reduce cycle use, especially among teenagers, and therefore undermine the known health benefits associated with cycling (including higher life expectancy). This concern is a major factor in the opposition of the CTC, UK's National Cyclists' Organisation (www.ctc.org.uk), and the Royal Society for the Prevention of Accidents (RoSPA) (www.rosipa.com), to compulsory cycle helmets. RoSPA nevertheless recommends that all cyclists voluntarily wear a helmet that meets a recognised safety standard. The adverse consequence to health that would result from a reduction in the number of cyclists is also a primary concern of the British Medical Association (BMA), despite their recent vote for legislative change.

An independent systematic review of efficacy by (Towner et al. 2002) (commissioned by the Department for Transport) builds on earlier reviews in this area. Highlighting the importance of context, this review considers the specific cycling environment in Britain. Taking into consideration a wider range of concerns than some of its predecessors, it more fully acknowledges that 'the effectiveness of helmets at the point of a crash, secondary prevention, is one part of a wider debate on cycling safety' (Towner et al. 2002, p 9). A future Cochrane systematic review by Macpherson and Spinks which will assess the effectiveness of legislative interventions for reducing bicycle-related head injuries explicitly aims to address the hypothesis that legislation reduces the numbers of cyclists in the population (Macpherson and Spinks 2005).

Despite the intensity of the above debate, we only identified one primary correlational study which met our inclusion criteria and considered risk factors associated with accidental injury to cyclists. In a study of social and economic status and 'adolescent' injury Williams and colleagues (1996), found that high family affluence was predictive of more frequent use of bicycle helmets, and low paternal occupational status was predictive of accidental injury when riding a bike.

Studies of young people's views: how do young people perceive/assess the risks of accidental injury in relation to cycle helmet wearing (or non-wearing)? What affects this perception of risk?

A total of eight views studies examined young people's views on the risks of accidental injury in relation to the wearing or non-wearing of cycle helmets (Bendelow et al. 1998, Chinn et al. 2004, Halliday et al. 1996, Joshi et al. 1994, Lee 1993, Takriti and Lee 2000, Taylor and Halliday 1996, Wardle and Iqbal 1998). One study was judged to be of a low weight of evidence and excluded (Lee 1993).

Young people do not think cycling is very risky

Two studies found that young people (10-15 years) did not think that it was very likely that they would have a serious injury caused by a cycling accident (Bendelow et al. 1998, Wardle and Iqbal 1998). Halliday and colleagues (1996) found that some respondents (9-40 years) had a feeling of invulnerability ('it will never happen to me') and that this meant that they did not need to wear helmets. This study also reported that teenagers tended to believe that helmets were only needed in 'dangerous situations' when they felt they were more at risk of accidents (Wardle and Iqbal (1998) and Chinn et al. (2004) also found this belief).

Cycling conditions affected risk perceptions

Study participants' perceptions of risk varied according to the context: there was a belief that cycling was more dangerous in certain conditions, for example, if roads were in poor condition, if it was night or in bad weather (Halliday et al. 1996, Wardle and Iqbal 1998); for certain types of journey, for example, long journeys, on unfamiliar or busy roads (Halliday et al. 1996, Wardle and Iqbal 1998); or with certain types of cycling behaviour, for example, cycling fast (Halliday et al. 1996). Young people tended to believe that helmets only needed to be worn in these 'more dangerous' situations.

Risks were perceived to be greater for younger people

Children were believed to be at more risk because they were less skilled as cyclists and had poor traffic sense and were less safety conscious. Across all ages of respondent, it was agreed that 'children and young people were more at risk from accidents than other age groups'. However when asked 'Who should wear a helmet?', some respondents said cyclists of all ages were equally at risk, while 13-14 year old boys thought adults faced the same risk as young people 'because young cyclists are equally as "road safe as adults" after completing cycle proficiency training' (Halliday et al. 1996). Older people were also thought to be at more risk.

Risk perceptions did not predict helmet-wearing, only intention to wear

One study examined the link between perceived vulnerability (i.e. the extent that young people felt that they were at risk) and helmet wearing. It found that perceived vulnerability was not predictive of helmet-wearing; it only predicted the *intention* to wear helmets (Joshi et al 1994). Halliday and colleagues (1996) found a general agreement that those who were more at risk from accidents had a greater need for protection. This suggests that perceived vulnerability would affect helmet-wearing decisions; however, as respondents were asked about which population groups should wear a helmet rather assessing direct, personal correlations between perceived vulnerability and helmet wearing, this finding cannot necessarily be used as the basis for intervention development.

'Anticipated regret' made helmet wearing more likely

Two studies considered the concept of 'anticipated regret' and its effect on helmet-wearing. Joshi et al(1994) found that respondents who agreed with the statement 'I would never forgive myself if I had an injury that could have been prevented by wearing a helmet' were significantly more likely to wear a helmet than those who disagreed (this was especially so for women).

Some young people did not think that helmets offer enough protection

All five studies focusing on cycle helmet-wearing considered the degree of safety that young people perceived was provided by cycle helmets.

Opinions varied about the degree of protection offered by helmets (see introduction to this chapter). Some felt that helmets offered insufficient protection and that this was a reason not to wear them; more males than females held this view (Halliday et al. 1996). However, other studies found that respondents generally believed that helmets did offer protection. Joshi et al (1994) found that 96% of respondents thought that cycle helmets would reduce the risk of serious head injury. Some people had a 'blind faith' in the protection offered (Halliday et al. 1996). When asked what was disliked about helmet design, respondents very rarely mentioned dissatisfaction with the protection offered by helmets (Taylor and Halliday 1996).

The type of accident and type of helmet affected beliefs about protection

Young people tended to believe that the degree of protection varied depending on the type and severity of the accident and also depending on the design and cost of the helmet (Halliday et al. 1996, Taylor and Halliday 1996). For example, many participants in one survey believed that helmets offer greater protection if a person were simply cycling alone and fell off their bike, compared to a cycle accident which involved a collision with a car (Taylor and Halliday 1996). Some felt that helmets protected only part of the head (Halliday et al. 1996, Taylor and Halliday 1996). A perception that the head was not the body part most likely to be injured in an accident (e.g. compared to hands or knees) was viewed as a disadvantage of helmets by some (Bendelow et al. 1998, Halliday et al. 1996).

Beliefs about helmets' protection did not predict helmet wearing

A belief that helmets would protect cyclists did not always appear to be related to helmet-wearing. Both Halliday et al. (1996) and Joshi et al. (1994) found that perceptions of safety did not relate to whether or not the respondent wore a helmet themselves; however, Takriti and Lee (2000) found that those who owned or wore helmets were 'more likely to say helmets are safer' than those who did not own or wear them. Wardle and Iqbal (1994) also found that those 14-15 year olds who owned and wore helmets thought it would protect their head if accident they had an accident; however, among those who did not own or wear a helmet, belief that it would not protect them was the least commonly expressed view. A questionnaire found that almost all of the main reasons given for wearing a helmet related to the safety aspect of helmets (Taylor and Halliday 1996).

How do young people manage not wearing helmets in relation to accidental injury?

The factors that affected the decision whether or not to wear cycle helmets fell broadly into three types: individual factors, influences from other people, and social and environmental factors (including types of cycle helmets).

An individual's personal decision whether or not to wear a helmet was affected by three groups of issues: critical incidents, perceived exposure to risk, self-efficacy and age. (Self-efficacy can be defined as 'the perception or judgement of one's

ability to perform a certain action successfully or to control one's circumstances', by the survey of Social Science (Magil (ed) 1993).

Having an accident or knowing someone who did encouraged helmet wearing for some young people, although only in the short-term

Two studies found that critical incidents (such as experiencing an accident or injury, or knowing someone who had) did have an effect on helmet wearing, but this effect was only temporary (Halliday et al. 1996, Joshi et al. 1994). Taylor and Halliday (1996) found that a small minority of helmet wearers stated that they wore a helmet because they had had an accident or knew someone who had (general reasons relating to safety and risk issues were more frequently given). This study also found that the most common reasons that respondents thought would encourage them to wear a helmet were if they had had an accident, or if they fully appreciated the dangers.

Some were more likely to wear helmets if they cycled dangerously; others were less likely

Teenagers in one study said that they would wear a helmet if they adopted more 'at risk' cycling behaviours (Halliday et al. 1996), but another study found that those who considered themselves to be 'reckless' (more boys than girls) were less likely to wear a helmets (and also more likely to have had an accident) (Joshi et al 1994).

Joshi et al (1994) found that self-efficacy was not predictive of helmet wearing or intention to wear; although Halliday and colleagues (1996) found that some older teenagers and adults felt that they were too old to change their behaviour.

Peers reduced the likelihood of helmet wearing

Peers tended to be a negative influence, with young people worrying about being teased or that people would laugh at them for wearing a helmet, particularly when first starting to wear it (Bendelow et al. 1998, Chinn et al. 2004, Halliday et al. 1996). Two studies also found that young people believed that if more people wore helmets, they would be more encouraged to wear one (Halliday et al. 1996, Taylor and Halliday 1996).

Parents encouraged helmet wearing; legislation was also thought to encourage helmet use

Parents were often a positive influence on helmet wearing, particularly in insisting on them initially (Halliday et al. 1996, Taylor and Halliday 1996). Some also said that they would wear a helmet if it was the law (and that they believed that this would lead to fewer accidents); younger teenagers were less likely than older teenagers or young adults to believe that legislation would encourage their helmet-wearing (Halliday et al. 1996, Taylor and Halliday 1996)

More attractive helmets would increase likelihood of use; reduced cost may also increase use

The appearance and comfort of helmets were negative influences on young people's perceptions (Chinn et al. 2004, Halliday et al. 1996, Takriti and Lee 2000, Taylor and Halliday 1996); improving the appearance of helmets was sometimes cited as a factor that would encourage people to wear helmets (Halliday et al. 1996), although one study found very that few respondents thought this would

encourage them (Taylor and Halliday 1996). The cost of helmets affected the decision to buy and wear them for some people; cost was also raised as an issue when respondents were asked about factors that would encourage them to wear helmets (Halliday et al. 1996, Taylor and Halliday 1996).

Where respondents cited the effects of promotional influences (such as adverts, safety programmes or documentaries), these were generally on the perceived protection offered by helmets rather than specifically affecting helmet-wearing behaviour (Halliday et al. 1996, Taylor and Halliday 1996).

Perceived Effect of Cycle Helmets on Behaviour

Helmet-wearing was not thought to affect cycling behaviour

Most young people felt that wearing a helmet had little or no impact on their cycling behaviour (Halliday et al. 1996, Joshi et al. 1994, Taylor and Halliday 1996). A minority (about one in five) felt that helmets did affect their cycling; in one study girls were slightly more likely to feel that their cycling was affected than boys (Taylor and Halliday 1996); in another, boys were more likely to cycle faster or more confidently (Halliday et al. 1996).

Young people thought that helmets had positive and negative effects on motorists behaviour

Helmets were perceived as having both a positive and negative influence on the behaviour of motorists. Some thought that wearing cycle helmets made motorists drive more dangerously around them, while others thought that it made them drive more carefully as the helmets made cyclists more conspicuous (Halliday et al. 1996, Joshi et al. 1994).

Systematic reviews of effectiveness

A number of systematic reviews (including Towner et al. (2002)) have measured the effectiveness of a range of different interventions (e.g. educational, promotional, legislative, and community-based) to increase wearing rates of cycle helmets. Some of these reviews focus on a range of barriers and facilitators to use (including age and social and economic status). Typically, the evaluations included in these reviews measured the effectiveness of interventions in terms of behaviour changes (i.e. increased helmet use, purchase, or ownership - self-reported or observed); occasionally, however, injury data were used.

Twelve systematic reviews looked at the effectiveness of interventions to increase bicycle helmet use (Coleman et al. 1996, DiGuseppi and Roberts 2000, Dowswell and Towner 2002, Dowswell et al. 1996, Elkington et al. 2000, Lund and Aaro 2004, Mackay et al. 1999, Royal et al. 2005, Scanlan et al. 2001, Towner et al. 2002, Towner et al. 2001c, Towner and Dowswell 2002). Most studies analysed changes in behaviour (i.e. increases in wearing or ownership - observed or self-reported) rather than injury data.

Two of the twelve reviews reported exclusively on bicycle helmets (Royal et al. 2005, Towner et al. 2002). A considerable number of the interventions considered in five of the reviews targeted children/young people aged 14 years and younger. The target population in the review by Royal and colleagues (2005) was 0-18 years. Neither of the two reviews which specifically looked at young people aged 15-24 (Coleman et al. 1996, Elkington et al. 2000) had a sole focus on bicycling.

A number of reviews stressed a need to develop and evaluate interventions specific to different population subgroups (Coleman et al. 1996, Towner et al. 2002). 'Interventions which have been successful with young children may not be appropriate or achieve similar success with teenagers or adults', as risk-taking between the age groups may not be comparable (Towner et al. 2002, p 80). Scanlan and colleagues (2001) also recommended research in this direction. Four reviews were located which addressed the issue of social deprivation. Two of these reviews (Dowswell and Towner 2002, Mackay et al. 1999) considered a range of injury environments; both found very few studies which examined the impact of cycle helmet initiatives on different socio-economic groups. Furthermore, few of the included studies were UK-based. With an exclusive focus on the promotion of bicycle helmet wearing, Royal and colleagues (2005) attempted to evaluate the effectiveness of non-legislative interventions with respect to social group. Only two of the included studies were set in the UK. One aspect of the review by Towner and colleagues (2002) included a consideration of lower income as a barrier to helmet use.

Educational and Promotional Approaches

Systematic reviews have produced differing findings regarding the effect of information provision or educational campaigns. A review by Lund and Aaro (2004) of accident prevention in general (not focused on young people) found that providing information through a single medium was not effective at changing attitudes and produced little change in behaviour or injury rates, unless the target group was highly motivated. They found that effects were greater if the message was repeated, tailor-made, and delivered face to face or via two-way communication in small groups. They also found that rewards offered for using safety equipment had a positive effect (although none of the studies of incentive programmes looked specifically at bicycle helmets). However, one study in this review did report positive effects on the bicycle helmet wearing of children aged 11-15 years following education in small groups. Reviews by Dowswell and Towner (2002), Dowswell et al. (1996) and Towner and colleagues (2001c, 2002) also reported that educational approaches can have positive effects on bicycle helmet use among children and/or young people, while emphasising the far more limited evidence of an effect on injury. Royal and colleagues (2005) found 'some evidence that interventions set in schools may increase observed helmet wearing' (Royal et al. 2005, p 6). In contrast, a review of interventions in clinical settings reported that counselling school-aged children and their parents was not effective in increasing helmet use. DiGuseppi and Roberts (2000), Roberts and Kwan (2001) and Scanlan and colleagues (2001) found evidence that multifaceted educational campaigns are the most effective and recommended that 'long term awareness campaigns are necessary to move helmet use into the realm of social norm'

Although limited in number, interventions targeting disadvantaged children have been included in a number of reviews. The price of helmets can act as an obstacle to voluntary use, and discount purchase schemes have become an important feature of educational and promotional methods. Reviews by Dowswell and Towner (2002), Dowswell and colleagues (1996), Towner and colleagues (2002) and Lund and Aaro (2004) found that reducing the cost of helmets could facilitate uptake and use. DiGuseppi and Roberts (2000) reported one trial that found that a clinically-based intervention offering subsidised helmets was more effective than one which provided free helmets for school-aged children. In contrast, a review by Royal and colleagues (2005) reported that there is some evidence that providing free helmets

may increase helmet wearing to a greater degree than providing subsidised helmets.

In a review which specifically addressed the issue of social deprivation, Dowswell and Towner et al. (2002) stressed that interventions providing free or discounted helmets (to target audiences aged 0-14 years) produced mixed results. They noted that campaigns promoting helmet wearing were more effective in high income areas, and that younger children rather than teenagers displayed the greatest effects from these efforts. Royal and colleagues (2005) also suggested there may be a tendency for interventions set in schools to be more effective in younger children. Towner and colleagues (2001c, 2002) found that girls benefited more than boys. The review by Mackay and colleagues (1999) specifically examined the relationship between social and economic status (SES) and the uptake of injury-prevention measures; studies of interventions targeting individuals aged between 0 and 19 years were included. The review discussed one evaluation of a school-level intervention which reported that injury outcome was not associated with SES, and two evaluations of promotional programmes which found increased helmet use among children of higher SES. The review by Royal and colleagues (2005) reported that it was unable to assess effectiveness with respect to social group because studies had used different outcome measures or different measures of income level. The review concluded that it 'could not identify the best way of reaching poorer children' (Royal et al. 2005, p 2).

Legislation

Seven reviews considered the impact of regulation or legislation and enforcement. Again, many of the evaluations focused on 0-14 year olds. Coleman et al. (1996), Dowswell et al. (1996), Scanlan et al. (2001), and Towner et al. (2001c, 2002) found that legislative change could have a positive effect on helmet wearing. Although overall there was far less evidence of its effect on injury rates, these reviews and that by Lund and Aaro (2004) did refer to evaluated intervention studies which linked bicycle helmet legislation to reductions in accidents, head injury or death. Elkington and colleagues (2000) supported the conclusions of earlier reviews (e.g. Coleman et al. 1996) that legislation and enforcement represent the most successful strategy for reducing bicycling injuries among young people (15-24 years). Coleman et al. (1996) and Lund and Aaro (2004) emphasised the importance of enforcing legislation.

A number of reviews, including that by Towner and colleagues (2002), did acknowledge that compulsory helmet wearing appears to discourage some child and teenage cyclists, leading to decreased bicycle use. The review by Coleman and colleagues (1996) also found that legislation reduced the overall amount of bicycle use among young people aged 15-25 years. Reduced injuries may therefore be related to a fall in bike use.

Combined Strategies

Six reviews commented on the effectiveness of using a combination of strategies to increase bicycle helmet use. DiGuseppi and Roberts (2000) suggested combining predisposing, enabling and reinforcing factors in the clinical setting (e.g. education with reinforcements or incentives). A number of studies adhered to a general consensus that legislation alone was inadequate. Elkington and colleagues (2000) supported the conclusions of previous reviews that the impact of legislative change can be enhanced with other elements, such as multi-media campaigns and other

supportive strategies (e.g. increasing access to bicycle helmets). A number of reviews reported that a combination of legislative and educational efforts had the potential to increase observed cycle helmet use, and/or reduce cyclist injury (Dowswell et al. 1996, Lund and Aaro 2004, Towner et al. 2001c). Scanlan et al. (2001) recommended that community awareness and educational campaigns become part of an organised phase prior to the introduction of helmet legislation.

Lund and Aaro (2004) reported that positive effects were not found for a programme targeted at low-income parents which combined education, information and a discount purchase schemes to increase helmet use among young people.

Reviews which highlight the effectiveness of combining educational and legislative approaches often refer to the example of Australia, where legislation was not introduced until there was good evidence that attitudes to helmet wearing had changed among the population. Towner and colleagues (2002), however, remind us of the importance of context in injury prevention. They discuss the contrasting example of the USA which paid far less attention (in some cases, none) to pre-legislative educational campaigns. Noting the lack of British studies in their review, they question whether the findings from either Australia or USA are easily transportable to Britain. Coleman and colleagues (1996) reached a similar conclusion.

Community-based childhood injury prevention interventions

One systematic review of community-based approaches to the prevention of childhood injury reported findings that were relevant to the promotion of bicycle helmets. Towner and Dowswell (2002) reviewed ten programmes which used a multi-agency co-ordinated approach; none used a randomised controlled trial design or took place in the UK. Their findings were consistent with those of Royal and colleagues (2005) who found in their review of non-legislative interventions for the promotion of cycle helmet wearing that community-based studies combining free helmets with an educational component produced a positive effect. They also found evidence that community interventions may be more effective than school-based interventions.

Other factors

A number of studies emphasised that increasing bicycle helmet use was only one part of improving bicycle safety. Lund and Aaro (2004) found that greater effects tended to be seen on accidents in general when strategies to tackle structural factors were combined with those that targeted attitudes and behaviour. One of the key points stressed by Towner and colleagues (2001c, 2002) was that helmet promotion and legislation should be viewed within an overall context of bicycle safety, which includes environmental modifications and engineering solutions, such as interventions to reduce speed, change road layouts, or separate bicycles from other traffic. Scanlan et al. (2001) remarked on the paucity of studies in this area, and called for the evaluation of a 'wide variety of designs to separate bicycles from motor vehicle traffic' (Scanlan et al. 2001, p 57).

Current policy in the UK

Tomorrow's Roads: Safer for everyone (Department for Transport 2000b), the road safety strategy, was published in March 2000 by the UK Government, the Scottish Executive and the National Assembly for Wales. This document set out casualty reduction targets which were reviewed in 2004 (Department for Transport 2004).

The review reported that levels of cycling have not increased as much as had been expected, despite a plan to treble the number of cycling trips by 2010 (Department for Transport 2000c). The Government has been encouraging local authorities both to increase the number of people using bicycles as a form of transport and also to make it safer for them to do so. More than £4m in matched funding has been given to 300+ cycling projects (including training projects) throughout the country. The parliaments in Wales and Scotland have also been promoting cycling safety in their respective areas (Sustrans 2001).

Policies targeted at young people mainly centre around the school journey. The Department for Transport and the Department for Education and Skills recently published an action plan which, in part, aims to help schools promote safe cycling (Department for Education and Skills and Department for Transport 2003). This document is a response to changes over the past 20 years in the main ways that children travel to and from school. There has been a sharp reduction in the number of children walking and cycling to school and a doubling in the use of cars, causing potentially dangerous congestion around schools. The document contains case studies and recommendations regarding how schools might go about changing the travel patterns of their students.

Useful websites with information about cycling and accident prevention include: Bike Safe (www.bikesafe.co.uk), Sustrans (www.sustrans.org.uk) and Cycling Scotland (www.cyclingscotland.org).

Discussion and implications

Summary of findings

Despite the debate on whether or not cycle helmets should be compulsory, the balance of evidence suggests that wearing helmets reduces injury in the event of an accident.

Young people in the 'views' studies did not think cycling was very risky and did not think that accidents would happen to them. Cycling conditions (e.g. at night or in bad weather) affected their perceptions of risk and some young people believed that helmets were only needed for certain types of journey. The fact that risk perceptions differed for different types of journey did not predict the wearing of cycle helmets, only the intention to wear one, but young people who 'could never forgive themselves' if they had an injury which a helmet could have prevented were more likely to wear one.

Young people differed in their perceptions about the protection offered by helmets, with some feeling that the head was not the part of the body most likely to be injured in an accident. Beliefs about the safety offered by helmets do not necessarily predict whether a young person is likely to wear one.

'Critical incidents' - whether to the young person or to someone known to them - were reported to change behaviour, but only in the short-term. Teenagers in one study were more likely to wear a helmet if they were engaged in more risky cycling, whereas another study came to the opposite conclusion. Most young people did not feel that wearing a helmet affected the way they cycled, though some expressed concern about the possibility that motorists would think they were less vulnerable and so drive more dangerously around them.

Peers tended to be a negative influence on the wearing of cycle helmets due to concerns about being teased, particularly when first starting to wear one. Parents were often a positive influence, and some young people felt legislation would also

make them more likely to wear helmets. Young people also mentioned that cheaper and more attractive helmets would be more inviting to wear.

Education interventions through a single medium were not effective at increasing the wearing of cycle helmets, but multifaceted interventions were effective. Education interventions targeting small groups had mixed effects, with some studies reporting positive results and others finding no effect.

Acknowledging that the price of helmets can be a disincentive, particularly for disadvantaged children, some interventions which provided subsidised or free helmets did increase helmet use. There was conflicting evidence about the relative effectiveness of providing free and subsidised helmets. There is some evidence to suggest that promotional campaigns have more effect in high income areas, and also that younger children were more likely than teenagers to change their behaviour (especially girls). There is also some evidence to suggest that community-based interventions are more effective than interventions based in the school.

Most primary research on helmet wearing focused on younger children, rather than young people up to the age of 24. Strategies targeted at the older age group may therefore need to be developed and tested.

The balance of evidence suggests that a combination of legislation and enforcement is the most effective means of reducing cycling injury. However, the introduction of compulsory helmet wearing can also lead to a reduction in cycling. In order to avoid this, six reviews recommend a multi-faceted approach in which legislation is preceded by education and promotional campaigns.

Despite Government targets aiming to increase cycling rates, the use of cycles is falling in the UK. Current policy aims to persuade more people to use their bikes through the support of cycling projects, improvements to roads and the changing of travel patterns to and from school. At present, there are no plans to make the wearing of helmets compulsory.

Social and economic circumstances (SES)

A systematic review by Mackay and colleagues (1999) found one UK study (and several other non-UK ones) on the relationship between SES and cycle injuries. This reported that children from economically poor families were at increased risk from bike injuries, and that family size was not associated with increased risk. These findings were consistent with Williams et al. (1996) who found that low paternal occupational status was predictive of bicycle injuries.

Implications for interventions

An implication coming out of the views studies is for the development of interventions which challenge perceived invulnerability and increase perceived vulnerability. The danger of building an intervention on this implication, however, is that it might discourage people from using their cycles at all.

Both the systematic reviews and views studies suggest that the use of cycle helmets would be assisted most by the introduction of legislation to make their wearing compulsory. However, the danger that this could reduce cycling overall should be thoroughly examined, and measures to reduce this danger should be put in place before legislation is introduced.

Interventions should:

- challenge perceptions of what constitutes a 'dangerous situation' to discourage the idea that only certain types of journey warrant the wearing of a helmet;
- aim to translate intention to wear a helmet into actual behaviour;
- highlight the negative consequences of not wearing a helmet if involved in cycling accident in order to raise anticipated regret (though this might also reduce cycle use);
- challenge perceptions of the type and extent of protection offered by helmets to persuade young people that helmets offer significant protection in the event of an accident;
- utilise critical incidents but recognise that they tend to only have a temporary effect on behaviour;
- encourage helmet wearing from a younger age;
- challenge the perception that it is too difficult to change behaviour after years of not wearing a helmet;
- encourage positive peer influence and reduce negative peer influence;
- utilise positive parental influence;
- incorporate local rules and regulations (e.g. in schools);
- improve the appearance and comfort of helmets;
- provide helmets more cheaply or at no cost.

Implications for research

Future research should:

- explore whether messages which emphasise the dangers of cycling simply reduce the number of people using their bikes instead of increasing the use of cycle helmets;
- examine the effect that wearing helmets has on cycling - does wearing helmets really make young people cycle more riskily?

7. Evidence synthesis: sports

The focus of this chapter is the relationship between sports and accidental injury. The positive health benefits of participating in sports are varied in terms of health and well-being, and have been well documented elsewhere. However, sports are not risk-free and some young people participating will sustain injuries. Plugge and colleagues (2002) found that men and women between the ages of 18 and 24 years were more likely to be injured in a sport-related accident than in an accident in the home, at work, or on the road. Identifying and understanding potential risks may help young people and their parents, teachers, coaches and other adults minimise the risks of injury.

National picture

There is currently no national database of sports-related injuries - a point noted for action by the Accidental Injury Task Force (Accidental Injury Task Force 2002). A study in 1995 estimated that there were 29 million 'incidents resulting in new or recurrent injuries' each year of which nearly 10 million were potentially serious (Nicholl et al. 1995), so it is clear that sports injuries are a significant part of the overall burden of injury in the UK. As we noted in the introduction to this review, hospital episode statistics show that the locations of a great many of non-transport injuries are connected with sport - for some age groups these injuries even outnumber the number occurring at home. (See, for example, figure 1.6: 'Hospital episode statistics: locations of falls'.)

A useful source of data on sports injuries was the Home and Leisure Accident Surveillance System (HASS and LASS), funded by the DTI, but it ceased collecting new data in 2002 and the data are now held by the Royal Society for the Prevention of Accidents (RoSPA) (www.hassandlass.org.uk/query/reports.htm). The LASS data below are taken from the 2002 sample which collected data from a nationally representative sample in 16-18 UK hospitals. Figure 7.1 shows the numbers of young people injured according to different sports. The predominance of ball sports such as soccer and rugby is clear, reflecting the larger participation rates in these sports.

Figure 7.1 Numbers of injuries by sport category in 2002: ages 12-24 (LASS data)

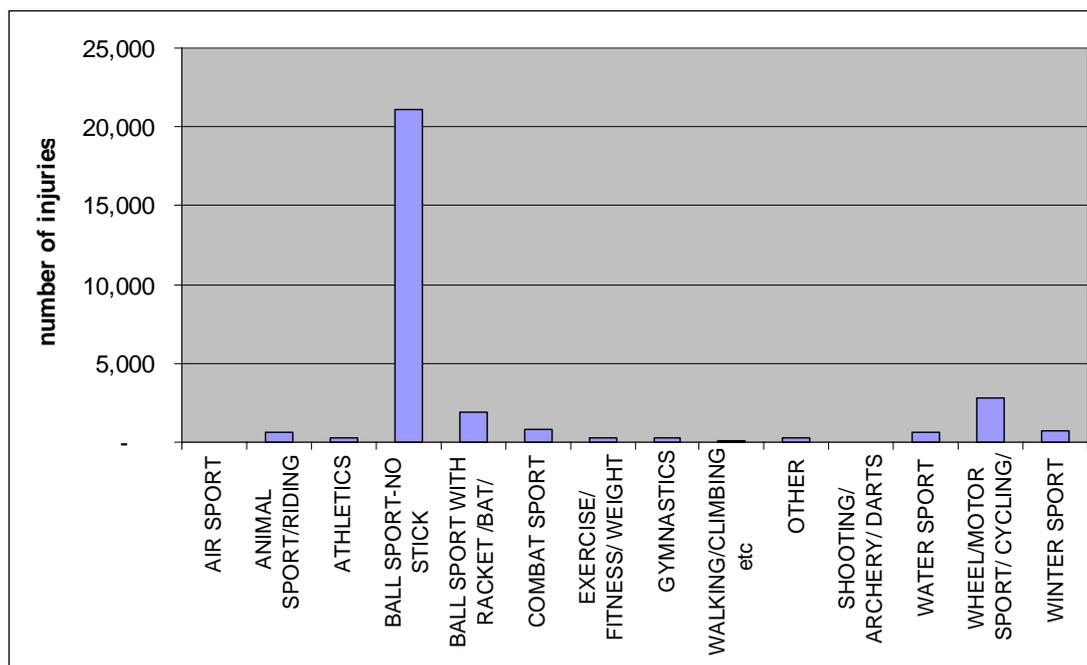
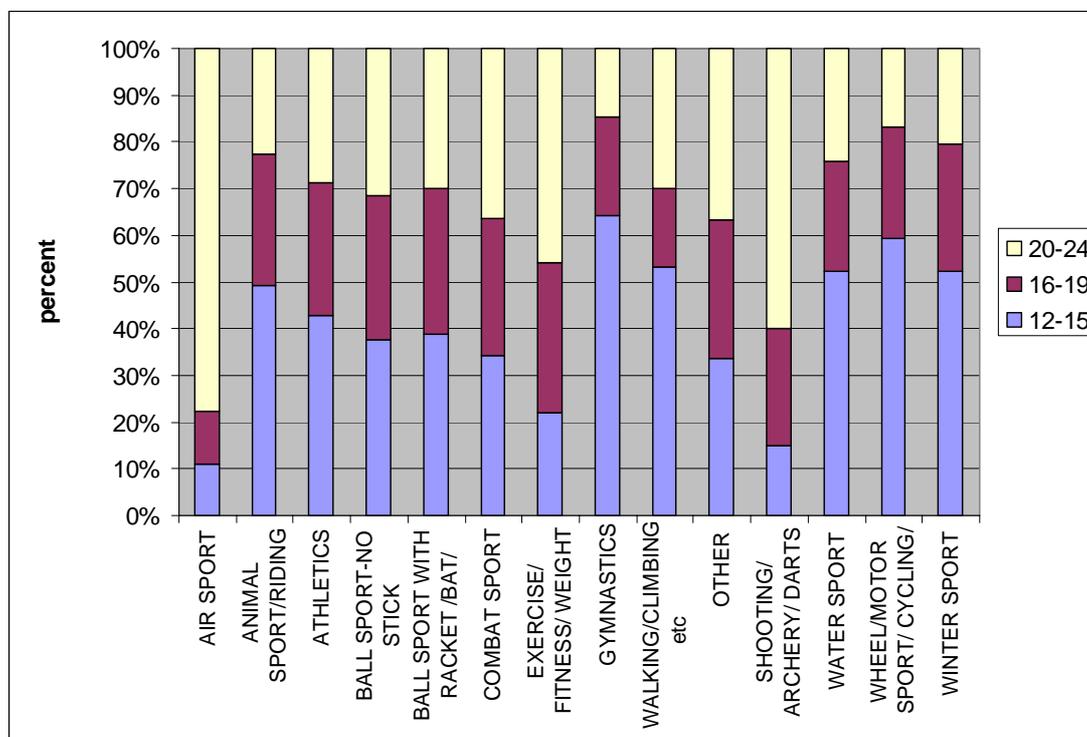


Figure 7.2 breaks down the same information into age bands showing the relative proportions of injuries. Trends in terms of participation rates by age are apparent, with the younger age groups more likely to be injured participating in gymnastics and the older groups while participating in activities such as shooting, air sport and gym-based exercise.

Figure 7.2 Proportions of sports injuries by age in 2002: 12-24 (LASS data)



Correlational studies

We identified twenty-one relevant correlational studies relevant to young people and sports injury. One was judged to be of low overall weight of evidence and was therefore excluded. The remaining studies were all surveys which between them examined a range of sports- and exercise-related injuries.

Six were general surveys of a wide range of injuries and the circumstances in which they occurred, including sports participation (Balding 2002, Beattie et al. 1999, Plugge et al. 2002, Prescott-Clarke and Primatesta 1998, West Surrey Health Authority 2002, Williams et al. 1996).

There were five surveys of sports-related injuries which compared the incidence of injuries across a number of sports (Abernethy and MacAuley 2003, Jones 1987, Nicholl et al. 1991, Pickard et al. 1988, Rowell and Rees-Jones 1988).

Four studies examined particular types of injury, two of which were about eye injuries (Desai et al. 1996, Jones 1987), one about hand injuries (Choyce et al. 1998), and one about sport-related fractures (Hassan and Dorani 2001).

Four studies examined injuries within specific sports: one focused on athletics injuries (D'Souza 1994), and one each on injuries related to ice-skating (Oakland 1990), snow-boarding (Sutherland et al. 1996) and shinty (Maclean 1989). (Shinty is an amateur game, unique to Scotland. Although similar to hockey, it differs in that the stick (caman) can be swung above shoulder height.) The study by Maffulli (1994) focused on four sports (gymnastics, football, swimming, and tennis).

Relationships between specific sports and risk of accidental injury: most injuries occur in football and rugby

There were nine correlational studies comparing injury rates in different sports. Injuries in certain sports are higher than in others which does not necessarily mean that some sports or activities are inherently more dangerous than others, only that they are more popular activities. Nicholl and colleagues (1991) conducted a national study of injuries sustained during sports and vigorous exercise to estimate the incidence and patterns of such injuries. Substantive injuries (for ages 16-45) were most commonly sustained during football (26.7%), rugby (9.9%), racquet sports (badminton, squash, tennis) (9.1%), running (8.2%), and weight training (8.1%). Substantive injury was described as any incident which was potentially serious, or which had at some time required treatment or restricted participation in usual activities.

A markedly different picture emerges when injury incidents (substantive or minor) were estimated by activity as rates per 1000 participation occasions for each of twelve main sports and activities. Across all age groups, per 1000 occasions, rugby (95.7) was the most injurious activity, 50% higher than the estimated rates for football (64.4) and hockey (62.6). Cricket (48.7) and martial arts (45.9) had similar rates and were higher than the next sport which was badminton (28.7). The least injurious activities were swimming and diving, and keep fit.

The above study is the only one to estimate comparative mortality data. Over the eight year period of the study 799 people died in sport- or exercise-related activities. The most hazardous activities were climbing (Estimated Death Rate > 793), air sports (EDR > 640), motor sports (EDR > 146), water sports (windsurfing, boating, canoeing) (EDR 67.5), yachting and dinghy sailing (EDR 44.5), and fishing (EDR 37.4).

The majority of the following studies found injuries to be most common in football (soccer) or rugby. Abernethy and MacAuley (2003) studied children of secondary school age presenting to an accident and emergency department who had received injuries during supervised school sports. They found that 51% of all injuries to 11-18 year olds were sports related. The main causes of injury were rugby (45%) and football (13%). Rugby accounted for three times as many injuries as football, hockey and physical education.

Studies examining sports injuries at accident and emergency departments found that the sports with the most injuries were football and rugby (Jones and Taggart 1994, Pickard et al. 1988, Rowell and Rees-Jones 1988). When details of injuries sustained were examined, however, the picture changed with less common sports, such as rollerblading (fractures) and racquet sports (eye injuries) having higher injury rates.

Maffulli and colleagues (1994) followed the growth and development of 9-18 year old elite British athletes from four sports (gymnastics, football, swimming, and tennis) in a two year longitudinal study. The lowest incidence of injury was found in swimmers (37%). This compared with tennis players (52%), gymnasts (65%), and footballers (67%). (These differences were significant: $p < 0.001$.) Over the two-year period the injury rate of the study participants for all four sports combined amounted to less than one injury per 1000 hours of training.

Maclean (1989) examined shinty-related injuries and found that this sport was top of the list compared to injury rates for other amateur sports, with a rate of two and a half times that of soccer and nearly three times that of rugby. The injury rate in shinty was several times that of hockey, to which it is clearly related.

Relationships between sex and risk of accidental injury

Eleven correlation studies reported on sex differences, nine of which reported more injuries among young men than women.

Nicholl and colleagues (1991) reported more sport-related injuries among men than women in their study, but found no evidence of any sex differences in levels of risk of injury, with estimated risks being very similar for most activities. However, in males the observed injury rate for horse riding was more than twice that for females across all age groups. Using data from annual statistics from the Office for Population Censuses and Surveys (OPCS) for the eight-year period 1982-9, estimated death rates (EDR) were also calculated by gender and activity (as deaths per 100 million participation days). Over the eight-year period of the study, of the 799 people who died in sport- or exercise-related activities, only 104 (13%) were women. Again, however, other than for horse riding there was no evidence that men were at greater risk of fatality than women. Maffulli and colleagues (1994) also found 'no significant associations...between injury rate, injury severity, sex, and pubertal status, with the exception of female gymnasts in whom more injuries occurred in the later stages of puberty' (p 320).

The other studies all found that young men were at higher risk of sports-related injury than young women (Abernethy and MacAuley 2003, Balding 2002, Jones and Taggart 1994, Pickard et al. 1988, Rowell and Rees-Jones 1988).

Hassan and Dorani (2001) found that the commonest sports associated with fractures were football (49%), rollerblading (18%) and cycling (12%) among the boys, and rollerblading (33%), netball (12%) and cycling (9%) among the girls. The proportion of fractures related to rollerblading was significantly higher in girls

compared to boys. There were no differences between boys and girls in the place where injuries occurred.

Choyce and colleagues (1998) examined sports-related hand injuries requiring treatment at an accident and emergency department. There were considerable differences between the sexes regarding injury rates and the actual sport causing injury. The overall male:female ratio was 3.8:1. Injured females were younger than males. In the younger age group (up to and including 16 year olds) the male:female ratio was 2:1; in those aged 17 and over this ratio was 6.6:1. Football was the main cause of male injuries (54%) with a significant proportion of these being to goalkeepers. Netball and basketball were the main source of female injuries (63%).

Beattie and colleagues (1999) surveyed 16-17 year old residents in Scotland and found sporting injuries to be a significant subset of overall injury. Males were subject to more sporting injuries than females ($p < 0.01$), but 'whether this is a reflection of a greater degree of sports involvement or participation in more violent or aggressive activity is unclear' (p 169, 172).

Williams and colleagues (1996) found that a significantly higher percentage of boys than girls reported a sports-related medically attended injury. Sex differences were also found in the type of sports injuries sustained, and severity of injury. Boys reported higher frequencies of sport-related injury, and injuries reported by boys were more severe. Boys most frequently reported fractures and dislocations, whereas girls most frequently sustained sprains and strains.

Relationships between age and risk of accidental injury

There were 10 correlational studies which reported on age differences.

More than half of sports injuries occurred to people in their late teens and early twenties (Choyce et al. 1998, Jones 1987, Nicholl et al. 1991, Pickard et al. 1988), which is probably a reflection of higher participation rates among younger age groups. Inexperienced younger (mostly male) snowboarders were also found to be more at risk than other skiers (Sutherland et al. 1996). However, when considering rates of participation, athletes older than 20 were more likely to be injured than those aged 12-20 (D'Souza 1994), and serious fractures from ice injuries were found to be more likely in older people (Oakland 1990). Using data from annual OPCS statistics, Nicholl and colleagues (1991) found that there was evidence that the risk of a fatal accident increases with age in soccer, horse riding, sailing, and motor sports. The study by Williams and colleagues (1996) found that while there were no significant age differences in the overall frequency of injuries reported, the percentage of sports-related injury significantly increased with age. Age trends were also found in relation to injury severity.

Following the same pattern as the hospital episode statistics, Balding (2002) found the highest number of sports-related injuries in pupils aged 14-15 years, and the lowest in 12-13 years. This pattern was true for females, for males, and for sexes combined.

The pattern of injury emerging from these studies suggests that, as might be expected, the number of injuries is closely correlated with participation rates. However, when participation rates are controlled for, injury becomes more likely among the older age groups.

Relationships between other characteristics and risk of accidental injury

Seven studies reported other factors associated with sports injuries. These factors included social and economic status, place where injury occurred, and relationship with alcohol.

Using a representative sample of Scottish school pupils (mean age 13.6 years) Williams and colleagues (1996) conducted a cross-sectional survey which examined the relationship between social and economic status and risk of injuries. The survey found that 32% of all reported injuries resulted from sport related activities: approximately a quarter were sustained during formal sports activities and 8% during informal leisure activities. Young people from affluent families, or from families with high paternal occupational status, were more likely to suffer sports injuries. The evidence from this study also suggested that a high level of sports participation is associated with a greater risk of injury in general, and also a higher percentage of sports-related injury. Furthermore, more serious injuries were reported by those in the high sports participation group.

Three studies found that the highest cause of injury among teenagers was playing sport (West Surrey Health Authority 2002, Balding 2002) with the *Health Survey for England: The health of young people '95-97* by Prescott-Clarke and Primatesta (1998) showing that sport/exercise accident rates were at their peak at 13-15 years.

Hassan and Dorani (2001) found that overall injuries were more commonly sustained in residential areas (44%), though older children (10-15 years) were more likely to sustain injuries at school. In a study of serious accidental eye injuries the majority of injuries to 5-15 year olds occurred at home, for 16-24 year olds the majority of injuries occurred in sport or leisure facilities (Desai et al. 1996).

In a study of study track and field athletes D'Souza (1994) found that the presence of a coach significantly reduced the number of injuries. Those athletes who trained and competed alone were twice as likely to have suffered an injury at least once during the season, compared to those athletes who had a coach present all the time. The incidence of injury also appeared to be related to the level of competition athletes were involved in, with twice as many injuries among those competing at the lowest category than those involved in the highest levels. The authors found no relationship between gender, hours trained, or event and the incidence of injury rates.

Oakland's survey of ice-skating injuries (Oakland 1990) found that the most common pre-disposing factor involved in injury was alcohol consumption.

Systematic reviews of effectiveness

We found eight relevant systematic reviews of the effectiveness of interventions to reduce or prevent sport and leisure/recreational injuries.

The reviews by Dowswell et al. (1996) and Towner et al. (2001c) focused primarily on the leisure environment. Scanlan et al. (2001) and Coleman et al. (1996) included a range of sports. One review examined running only (Yeung and Yeung 2001). Handoll and colleagues (2001) focused on ankle taping for the prevention of ankle injuries. Norton and colleagues (2004) focused on the prevention of playground injuries. The eighth review, by Lund and Aaro (2004) discussed interventions in a general category of environmental and product modification.

All eight reviews included studies of both sexes. Towner et al. (2001c) and Dowswell et al. (1996) both focused on children aged 0-14 years, and Norton et al.

(2004) included studies which targeted those aged between 0-15 years; 15-24 year olds were the focus of a review by Coleman and colleagues (1996). Both the review by Handoll and colleagues (2001) and that by Yeung and Yeung (2001) included studies of injury-prevention strategies involving subjects with a broad age range. The review by Scanlan and colleagues (2001) did not set an age limit. Its aim was to examine all the existing evidence and 'determine the applicability of this evidence to children and youth' (Scanlan et al. 2001, p 3). Towner et al. (2001c) and Dowswell et al. (1996) both concluded that there was limited evidence regarding the effectiveness of health promotion in preventing injuries among 0-14 year olds in the leisure environment (Towner et al. (2001c) judged none of the evidence to be 'good' or 'reasonable'). The review by Coleman and colleagues (1996) for 15-24 year olds revealed relatively few studies. Likewise, Scanlan et al. (2001) noted an overall lack of evidence of the effectiveness of interventions to reduce sport-related injury, but particularly in relation to children and young people. The review by Scanlan et al. (2001) was the most comprehensive, including 117 evaluated studies of interventions across eight different sports: baseball, basketball, cycling, skiing, American football, hockey, rugby and football (soccer). (The findings on cycling were discussed in the chapter on cycle helmets.)

A number of reviews commented on the generally poor design of the available research in this area (in particular, the lack of controlled studies). Coleman and colleagues (1996) considered whether the positive effects of interventions set in other countries would transfer to the UK. Scanlan and colleagues (2001) questioned the validity of transferring findings from one context to another. No studies in any of the included systematic reviews addressed the issue of social deprivation.

Interventions in the studies included in these reviews fell into five main categories: educational (e.g. changing training regime or team tactics); environmental engineering (e.g. changing playing surface); product engineering (e.g. developing or modifying existing protective equipment); regulatory/legislative (e.g. changing rules and regulations); and multi-factor approaches (often education combined with other factors).

Below we briefly discuss the main findings related to specific sports included in the systematic reviews.

Football (soccer)

Four reviews included studies related to football injuries. Four studies included in the review by Scanlan and colleagues (2001) addressed a range of injury prevention interventions that encompassed different training programmes and educational, environmental, and regulatory strategies. For adult players, the review found modest evidence on the effectiveness of training programmes in reducing injuries. The review recommended further evaluation of shin guards, ankle taping and bracing, protective eyewear and mouth guards, and goal post padding and anchoring. A further recommendation was for research into the suitability of safe playing surfaces for younger players. Coleman and colleagues (1996) included a study of a prevention programme with Swedish elite footballers. The intervention included standardised warm up, ankle taping, shoe design, leg guards, and controlled rehabilitation. The evaluation found that injuries were reduced by 75% when the programme was administered by medical personnel and 50% when supervised by coaches. The authors considered that the result might transfer to the UK experience. In a systematic review of 27 randomised trials focused on sporting activities (including football) that are high-risk for ankle injuries, Handoll and colleagues (2001) found good evidence for the beneficial effect of ankle supports in

preventing ankle sprains in participants with a previous ankle strain (Handoll et al. 2001, p 2). However, for those with previous ankle sprains who did ankle training exercises, the review found limited evidence for reduction in sprains. No conclusions could be made about many of the other interventions (e.g. stretching of calf muscles, ankle taping).

Rugby

Scanlan and colleagues (2001) included five studies on rugby injury prevention, only two of which focused exclusively on children and young people. Custom-fitted mouthguards were found to be effective by four studies (Scanlan et al. 2001, p 139). An evaluation of switching the playing season from autumn/winter to spring/summer found that the risk of injury was higher in summer. Coleman and colleagues (1996) found that, after the introduction of rule changes associated with the tackle, scrum and maul, decreases in the number of rugby union players suffering permanent quadriplegia were reported.

Running

In a systematic review of running injuries by Yeung and Yeung (2001), three main preventive strategies were evaluated in 12 trials: modification of training schedule, stretching exercises, and use of external support or modification of footwear. They concluded that there was a lack of convincing evidence (particularly randomised controlled trials) that the evaluated measures were able to reduce training injuries while still achieving the beneficial effects of exercise. They concluded that the role of knee braces, corrective insoles for malalignment, and the modification of footwear would benefit from further study. Coleman and colleagues (1996) found that warm-up techniques in running were associated with increased injuries (a possible explanation is that athletes who were already injured or had a history of injury might warm up more than uninjured athletes). A randomised controlled trial of a standardised package of warm-up and cool-down exercises undertaken by recreational runners in the Netherlands was found to have influenced knowledge and attitudes, but did not lead to a reduction in observed incidence or severity of injuries.

Swimming

Three reviews discussed interventions aimed at reducing accidental injury from swimming. Towner and colleagues (2001c) found some evidence that parent and child education affected behaviour. They also found reasonable/weak evidence for the effectiveness of a community-based programme targeting 0-14 year olds which involved a life vest loan and bulk discount schemes. Some evidence that modifications to pool design can reduce injuries was also found in this review. Coleman and colleagues (1996) commented generally on the impact of environmental engineering measures (e.g. pool design and barriers) on injury levels, but added that their review had revealed no relevant effectiveness studies for those aged 15-24 years. Both Towner et al. (2001c) and Dowswell et al. (1996) found some evidence of adult/guard supervision of public swimming pools/beaches and injury reduction. Dowswell et al. (1996) reported that teaching children (exact ages unknown) to swim 'seems to offer some protection' (p 144), but the review added that it had found 'no large scale trials comparing injury in children exposed to swimming training programmes' (p 145).

Play in public playgrounds and sports fields

One UK-based community study by Sibert and colleagues (1999, p 103) was included in reviews by both Norton and colleagues (2004) and Towner and colleagues (2001c). It found a reduction in the injury rate after removing monkey bars and increasing the depth of the bark beneath equipment. Norton and colleagues (2004) included a community intervention trial set in New Zealand that found that a programme encouraging schools to reduce playground hazards was effective. Lund and Aaro (2004) found that environmental changes on sports fields and playgrounds reduced the incidence of injuries. This included a study of 'quick release bases', which detach from the ground easily when a player slides into them, used by recreational softball players which were effective in reducing the number of sliding injuries.

Basketball

The findings about ankle injury prevention made by Handoll and colleagues (2001) also applied to the sport of basketball (see above). Basketball also featured in the review by Scanlan and colleagues (2001) who concluded that the use of 'ankle stabilizers or high-top shoes and ankle taping can reduce the incidence of ankle injuries' (Scanlan et al. 2001, p 44).

Baseball

Scanlan and colleagues (2001) concluded that there was good evidence for the effectiveness of 'break-away bases', finding that they were more effective than standard bases in preventing sliding injuries. Coleman and colleagues (1996) came to the same conclusion about modified bases.

Ice hockey

Scanlan and colleagues (2001) found that a regulatory approach to injury reduction (including mandatory use of protective equipment) was effective in reducing injury rates. Injuries were reduced after the implementation of new rules - for example, about high sticking (raising the stick above shoulder height) and the disallowing of 'checking' from behind. One study found that there was a significant association between ice surface size and injury rate: as size increased, the rate of injury decreased. They also concluded that the use of correctly fitting helmets could also be a factor in injury reduction. Coleman and colleagues (1996) found that the introduction of face protectors in ice hockey was linked to decreases in facial injuries.

Weightlifting

Coleman and colleagues (1996) found evidence for the positive effects of weight lifting belts in preventing back injuries.

Squash/racquetball

Coleman and colleagues (1996) found evidence that eye protectors meeting certain standards of specification, face protectors, and guards (closed type) can prevent injury. They further reported that the use of eye protectors increased 'when the equipment was available to be borrowed from the court and information about the specific consequences of not wearing eye protection was displayed' (Coleman et al. 1996, p 51).

Alpine skiing

There were 10 relevant studies in this section of the Scanlan and colleagues (2001) review. The generally poor quality of the studies limited the review's assessment of the effectiveness of the interventions they studied. The review suggested that lessons may be beneficial to beginners, the majority of whom are children and young people.

Horse riding

Coleman and colleagues (1996) found that a multi-agency collaboration publicising the risks of head injury was effective in raising awareness and increasing sales of horse-riding helmets (Coleman et al. 1996, p 51).

American football

Coleman and colleagues (1996) found that the introduction of face protectors was effective in decreasing facial injuries. They also found that mouthguards led to fewer oral and head injuries. They found conflicting evidence for the use of knee braces.

Current policy in the UK

In 2000 the Government published its strategy for sport, *A Sporting Future For All*, (Department for Culture Media and Sport 2000) and has published periodic reviews of progress since then. Two main aims are identified: to see 'more people of all ages and all social groups taking part in sport' and 'more success for our top competitors and teams in international competition' (p 6). In particular, young people are identified as a key group in which to promote sport because of its benefits in terms of health and the development of values such as 'discipline, team work, creativity and responsibility' (p 7). However, while sport is to be encouraged, as the above statistics have shown it is also a major cause of accidental injury among young people. Moreover, an acknowledgement of this is lacking from most policy documents from this period which promote its benefits.

The National Accidental Injury Task Force did identify sports injury as a priority area: one of its 'headline interventions' is to produce safety guidelines for children's sports, and a longer-term aim is to create a sports injury database (Accidental Injury Task Force 2002). The Department of Health is now recognising Sport and Exercise Medicine as a specialty (Department of Health 2004b), arguing that the treatment of sports injuries by non-specialists is inefficient and only deals with the specific injury, rather than being a 'holistic assessment of the patient's needs' (The Sport and Exercise Medicine Working Group 2004).

Organisations with useful online information on this subject include: SportEngland (www.sportengland.org) and the British Association of Sport and Exercise Medicine (www.basem.co.uk).

Discussion and implications

Summary of findings

The greatest numbers of sports-related injuries occur to young people playing football (27%) and rugby (10%) - because these are the most widely played sports. When activity rates are taken into account, rugby is by a long way the most dangerous mass-participation sport. Stick-based sports, such as hockey, also have high injury rates, and eye injuries are more common in racquet sports. One study

found that half of all injuries to young people in an accident and emergency department were sports related, and most studies which examined differential injury between sexes found that young men suffered more injuries than young women. The *Health Survey for England* (Prescott-Clarke P, Primatesta P, 1998) found that sport/exercise accident rates peaked in young people between the ages of 13 and 15 years old.

Athletics injuries are reduced if a coach is present, and there is some evidence to suggest that adult/guard supervision can reduce injuries at swimming pools and beaches. Systematic reviews failed to find strong evidence for interventions to reduce sports injuries, and no studies in any of the reviews tackled the issue of injury in relation to social deprivation. Much of the research is focused on younger children and the question of whether or not these interventions are appropriate to a teenage audience needs to be considered.

With regard to specific sports, the use of custom-fitted mouthguards was found to reduce oral injuries in rugby and changes to the rules reduced very serious injuries in rugby and ice hockey. Similarly, the use of protective equipment reduced injuries to players of American Football, the use of belts benefited weightlifters, and eye/face protectors reduced squash injuries. For those with previous ankle sprains, ankle supports and taping were beneficial in reducing future sprains (in soccer and other sports, such as basketball). Specially designed baseball bases, which come away from the ground easily when players slide into them, were effective in lowering injury rates. Despite considerable research, there is little strong evidence to help runners avoid injury. Neither stretching nor warm up/down regimes appear to be associated with reduced rates of injury.

The environment in which sport takes place can affect injury rates. Smaller rinks are associated with more injuries in ice hockey, and the design of swimming pools can also change injury patterns. Removing monkey bars and increasing the depth of protective bark in public playgrounds can reduce injuries significantly. Reducing hazards in school playgrounds has also limited injuries.

Current Government policy encourages active participation in sport to improve people's mental and physical health. There is renewed interest in sport in schools and, with the Olympics due to be held in London in 2012, in the development of a national team to achieve success for the hosts in this international event. *A Sporting Future for All* (Department for Culture Media and Sport 2000) also recognises the social divide in sports participation and aims to change this. Sports injuries are not a priority area for the Accidental Injury Task Force. However, it does intend to produce safety guidelines for children's sports and to set up a national sports injury database.

Social and economic circumstances

We found very little research which examined sports injuries from the perspective of social and economic circumstances directly. In 2002, SportEngland published a survey of participation which included a breakdown of which sports were played by which socio-economic group. People in the higher managerial and professional groups were more than twice as likely to engage in sporting activity as people who were long-term unemployed or had never worked (Sport England 2002). Likewise, Williams and colleagues (1996) found that for young people family affluence was predictive of both more frequent participation in sport and the use of protective equipment while playing sports.

Implications for interventions

Since supervision and coaching can reduce injuries, opportunities for promoting their presence at informal sporting events should be sought.

Out of all the sports covered in this chapter, rugby is the most dangerous mass participation sport. Not only are injury rates high, but the injuries incurred can be extremely serious: reductions in 'permanent quadriplegia' were sought in one intervention. Since changes to the rules of the game can reduce injury, we recommend that rugby played as part of compulsory education should adopt rules which result in injury rates no higher than other school-based sports.

Implications for research

We have found the evidence base for interventions to be particularly weak in this area and would support the establishment of a national sports injury database.

8. The social circumstances of accidental injury among young people

We stated at the beginning of this systematic review that we wanted to understand more about the relationships between accidental injury and risk-taking behaviour among young people and the social circumstances in which they live. In looking at social circumstances we hoped to understand why there is a steeper social class gradient for death due to an accidental injury than for any other cause of death in children and young people, and why that gap has continued to widen. We found that most of the studies identified did not report the social circumstances of the population, let alone explore the influence of social and economic status (SES) as a factor in the relationship between accidental injury and risky behaviours. Reducing inequalities in health is a key focus of public health policy in the UK. It is therefore disappointing that the findings of this review cannot contribute more towards identifying strategies for interventions with the potential to reduce SES-related accidental injury and death.

This is partly a result of a paucity of studies which seek to anatomise the different and interconnected factors influencing injury risk, and the consequences of a review process driven by questions about individuals' risk-taking behaviour. The question that framed the scope of this review restricted the exploration of the causal pathway between risk factor and injury to a narrow track which conceptually fits with a behavioural model of prevention. In this model, individual 'decisions' to take risks are not necessarily systematically shaped by their social and economic circumstances.

Explanations for the relationship between accidental injuries and inequality have commonly fallen into four categories. These are summarised by Jackson and Towner (1997, p 7) in their literature review on the socio-economic influences on unintentional injury in childhood:

1. **Artefact explanation:** health and class are artificial variables, developed in order to measure social phenomena, and the relationship between them may be an artefact of little causal significance.
2. **Social selection explanation:** social inequalities exist, but people in poor health move down the occupational scale while people in good health move up.
3. **Cultural/behavioural explanation:** this stresses the differences in the way individuals from different social groups choose to live their lives and the behaviour and life styles they adopt. Inequalities exist because 'lower' social groups adopt more dangerous and health-damaging behaviours than 'higher' social groups.
4. **Structuralist/materialist explanation:** the external environment and the conditions in which people live are important influences on risk. In this explanation the 'lower' social groups do more dangerous work, live in more hazardous environments and poorer housing, and have fewer resources to ensure good health and access available health services.

In the UK, health and social policy have been dominated by the cultural/behavioural explanation. When converted into injury prevention practice, this stresses the use of persuasive information and education techniques to modify individual attitudes and knowledge, rather than environmental modification. The individual behavioural approach is reflected in the recent Public Health White

Paper *Choosing Health: Making healthy choices easier* which sets out plans to address inequalities in health by focusing on providing access to greater information and healthier choices for people in disadvantaged groups and areas (Department of Health 2004a, Chapter 2). In this context choice is viewed as the capacity deliberately to select a course of action from the range of options available with full knowledge of the pros and cons.

Applied to accidental injuries sustained by young people while walking or cycling, or children while at play, a behavioural explanation might highlight the heedless risk-taking behaviour of children and young people from disadvantaged social groups, a phenomenon which requires tackling through interventions to target the behaviour of children and young people, or that of their parents. A structuralist approach would suggest that the environment shapes the behaviour of parents and their children and would highlight, for example: the greater difficulty of supervising play from high-rise housing; the dangers of housing where the front door opens directly onto the street; and the lack of traffic calming, cycle pathways, and safe play areas in poorer neighbourhoods.

Considerable debate has been generated by the different causal explanations for health inequalities, a debate which crosses the wider political debate about the role and responsibility of society and individuals. However, most of the evidence suggests that a broad range of different and interrelated factors are associated with injury risk, and that it is the 'cumulative effect of adverse material and social circumstances that is the most important determinant of health inequalities.' (Towner 2005). There may even be a 'dose-response' relationship: research indicates that the effects of SES on all areas of health are apparent at all levels of SES, with each level having better health than the level below (Blane et al. 1990, Head et al. 2002, Marmot et al. 1991).

While limited in its scope, the question asked in our review is important in its own right, and we know of no other systematic review in this area which has sought to quality-assess and synthesise UK evidence on this topic across such a range of study designs. However, what lies outside the framework of the review and thus the concepts which informed the systematic searches is a body of evidence on the ways in which social and economic factors affect injury risk. There has been a tendency to see accidental injury solely in terms of the outcome of engaging in unsafe or risky behaviours. The findings of this review do not support this approach. Instead they suggest that young people do not simply opt into behaviours that are dangerous, with the disadvantaged young choosing these more frequently. The pathways to accidental injury among young people are more complex. In this chapter we describe in more detail what we have learnt about the variation in injury risk associated with the adverse social, economic and environmental circumstances of some young people's lives. We also report our findings from a limited review of reviews (systematic and non-systematic) which focus on social deprivation and unintentional injury.

What correlational studies tell us about accidental injury and SES

The correlational studies contribute little to our understanding of the relationship between SES and injury risk, as only four considered this in any sustained way (Shah et al. 2001, Christie 1995, Tunbridge et al. 2001, Williams et al. 1996). Three reported higher injury risk among young people from disadvantaged backgrounds, while one study found high SES to be predictive of participation in sports and increased sport injuries (Williams et al. 1996). Deaths from drug poisoning were

found to be strongly associated with deprivation (Shah et al. 2001). Three studies found associations between low SES and increased road-related injuries and deaths (Christie 1995, Tonbridge et al. 2001, Williams et al. 1996). Williams and colleagues also reported that children with a low SES background were more likely to have cycling accident and less likely to wear a cycling helmet.

What reviews tell us about accidental injury and SES

We found a total of six reviews which focused on SES and unintentional injury. Only two of these were systematic reviews (Dowswell and Towner 2002, Mackay et al. 1999). These were discussed in an evidence briefing for the UK Health Development Agency (Millward et al. 2003). They both revealed difficulties in synthesising evidence of what might be effective in preventing/reducing accidental childhood injury in disadvantaged groups. This was due to a paucity of original research targeting disadvantaged individuals or groups, a lack of good quality evidence, and many different approaches to the definition and operationalisation of concepts relating to disadvantage. Towner and colleagues (2005) conducted a review about variations in unintentional injury rates according to age, gender, SES, culture and ethnicity, and place. Their report describes and offers explanations for inequalities in injury rates, and examines the extent to which intervention studies have taken inequalities into account in their design, implementation and reporting. The review focused on children aged 0-14 years and was therefore excluded from this study. We recommend this report to those interested in health inequalities and childhood injury prevention.

In 2001 Towner and colleagues updated two systematic reviews published in 1993 and 1996 (Towner et al. 1993, Towner et al. 1996, Towner et al. 2001c) to include international studies published between 1975 and 2000 on the prevention of childhood injuries where the target population included children under the age of 15. Thirty-two of the 155 studies included in the systematic review addressed the issue of social deprivation, and a separate analysis was conducted on these studies (Dowswell and Towner 2002). Whitehead's four approaches to reducing inequalities in health were used as a conceptual framework: strengthening individuals, strengthening communities, improving access to services, and broad economic and cultural change (Whitehead 1995). Definitions of social deprivation and the way target groups were identified varied considerably between the studies, with consequences for generalising the results of a study from one context to another. For example, some defined deprivation in terms of inner city wards, or type of housing or school, while others used family characteristics such as low income, single parent, or occupation.

Only four reviews examined the impact of an intervention on different social groups. Research was not evenly spread over injury target areas, and rarely focused on areas where inequalities are known to be associated with injuries and death. For example Dowswell and Towner (2002) found only one study that focused on reducing pedestrian injuries in socially deprived groups, despite pedestrian injury being the main cause of injury death among children in the UK, and there being a known association between this injury and social deprivation. The initiative to reduce child pedestrian injury evaluated in Glasgow was effective, with children less likely to pick unsafe places to cross the road after the intervention. Rather than environmental change to target injuries in the road that could provide children with a level of passive protection, the intervention studies included in the review aimed to change the knowledge and behaviour of individual children and/or their parents, with mixed results. While provision of free cycle helmets resulted in increased ownership, this had limited effect on injury rates. The relationship

between different types of neighbourhood and patterns of bicycle use was unclear, as was the protective effect of a helmet in different neighbourhoods with different traffic volumes and speeds. No evaluations of instances where environmental change (e.g. cycle pathways) had been used to reduce the risk of exposure to injury among socially deprived children were identified. Interventions to promote in-car safety were found to be partially effective, but again little evidence was presented on the differential impact of these interventions between different social groups. Most interventions were limited to targeting individual behaviour change.

The Dowswell and Towner (2002) review found no studies which addressed injuries in the leisure environment and no mass-media interventions targeted at socially deprived groups. There was a lack of research on interventions to increase access to services, and to achieve broader economic and cultural change. Valuable process information was not presented on the reach of different interventions, making it difficult to judge whether injury risk was partly due to a lack of exposure to health promotion activities. Only six of the included studies had been conducted in the UK.

In 1999, Mackay and colleagues published their report *Systematic Review of the Relationship Between Childhood Injury and Socio-economic Status* (Mackay et al. 1999). This review differed from the Dowswell and Towner (2002) review in that its goal was not to discover and synthesize evidence of 'what works', but to synthesise research evidence regarding the relationship between SES and unintentional childhood injuries, and to determine the potential implications for research, practice and policy about injury prevention that was relevant to the Canadian context. Mackay and colleagues included 57 controlled primary studies published since 1980 which contained an analysis of the relationship between SES and the incidence of risk of unintentional injury or the uptake of injury preventing measures or behaviours.

None of the intervention studies specifically addressed whether SES was related to uptake of the programmes, an important process issue also raised by Dowswell and Towner (2002). In the five intervention studies which focused on use of child passenger restraints, lower SES was associated with lower and incorrect restraint use. Findings from the six non-intervention studies on bicycle helmet use were less clear. One found that injury outcome was not associated with SES; two found increased helmet use among higher SES groups; another found an association with ethnicity (not further described by the authors) but not income; and two studies found helmet use associated with higher incomes. This review, like that by Dowswell and Towner (2002), noted the lack of interventions specifically targeting socially deprived groups.

Thirty-nine cohort and case-control studies included in the review by Mackay and colleagues considered risk factors for a range of injuries. Measures of SES and SES data collection methods varied greatly among the studies. No overall picture could be formed from the data as to the relationship between SES (measured in different ways) and injury risk.

Risk factors for pedestrian injury were the focus of nine studies; two examined risk factors for both cycling and pedestrian injury. Again, there was considerable variation in measures and operational definitions of SES. Several studies found an association, while others did not. Twenty-one of the 47 measures were used less than three times. The quality of the reporting was poor. Analysing SES measures reported in 195 potentially relevant studies, Mackay and colleagues found 47

different measures, most with different operational definitions described as maternal or paternal education, household income, and ethnicity.

This assumption that 'ethnicity' somehow in itself constitutes a risk factor for accidental injury (like the assumption that SES itself does) runs throughout the literature discussed in our review and is clearly unhelpful. Everyone has an ethnicity (just as everyone can be described in terms of their social class). The ways in which different ethnic groups experience injury risk and the factors associated with this constitutes a research question. In general, this is an area within social epidemiology and the sociology of health and illness that is poorly conceptualised and operationalised (Aspinall 2001). The evidence, so far as young people are concerned, is probably that minority ethnic groups have lower risks of injury and associated factors, but the pattern varies by ethnic group (Brannen et al. 1994).

The complexity of the relationship between SES and injury is illustrated by Mackay and colleagues in relation to the issue of parental supervision. Some evidence points to children being at greater risk when parental supervision is low. But what are reasons for the differences in parental supervision? These may be a lack of resources such as time, money and social support. A study of pedestrian injury in children of single parents suggested a link between social support and injury risk. One study suggested that parents from manual occupation groups may supervise their children less closely because they wish to foster their children's independence.

Social Differences in Traffic Injury Risks in Childhood and Youth - A literature review and research agenda was published in 2002 by Laflamme and Diderichsen (Laflamme and Diderichsen 2000). This is not a systematic review, but a well reported and comprehensive review of the literature on social differences in traffic injury in childhood (0-15 years), which did not provide quality appraisal of studies. The authors apply a conceptual framework which they use to identify the mechanisms through which social context, social position, and exposure may contribute to unequal distribution of traffic injury risks (Diderichsen and Hallqvist 1998). In relation to social context the authors found that studies either analysed geographic areas grouped by social and economic status and compared injury rates across the groups, or grouped areas by injury risk and compared socio-economic differences. The findings of both were similar and suggested that injury risks increase with socio-economic deprivation. High population density, lack of safe play areas, fast-moving traffic, and low employment rates were all associated with risk of injury. The authors note the importance of the environment as a determinant of pedestrian injury risk, and conclude that the evidence suggests that children with lower SES or living in more deprived areas are consistently more at risk than others. They suggest that the best explanation as supported by the evidence is 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, p 296).

What Works in Reducing Inequalities in Child Health (Roberts 2002), while not a systematic review, is a considered approach to reviewing the evidence relating to inequities in the area of child public health. We discuss it here because some of the included evidence relates to some of the younger people within our age range. The report covers a range of child health issues, including an analysis of interventions intended to protect children from accidental injury. The increased risk of injury associated with lower social class is related to traffic volume, absence of play areas, poorly protected play areas, and high levels of kerbside

parking. Roberts notes that many evaluations of road safety campaigns directed at children have focused on the child's behaviour, not that of motorists, and have measured effectiveness in terms of knowledge scores rather than changes in road safety behaviour. This review points to evidence of the effectiveness of area-wide traffic calming schemes rather than those targeted at accident black spots in reducing injuries. Behaviour is less important than environment when looking at the causes of child pedestrian accidents.

Two further reviews take a different but related approach in analysing 'neighbourhood effects'. Reading and colleagues (2005) focused on neighbourhood influences on child injury risk in their critique of three large population-bound studies conducted in the UK and the USA. They concluded that there were 'demonstrable' neighbourhood influences on injury risk and rates of injury in children (p 175). Rates of injury are highest among children living in poor and deprived neighbourhoods, regardless of personal characteristics. A second review, by Sampson and colleagues (2002), included over 40 studies of the relationship between neighbourhood characteristics and health outcomes, with a particular focus on young people. This literature provides some understanding of how dynamic social processes operating at the neighbourhood level affect well-being. Like reviewers of the SES literature, Sampson and colleagues found little consistency in the way neighbourhood processes were conceptualised or operationalised in the studies they reviewed, but four 'classes of neighbourhood' mechanisms appeared to have independent validity: social ties; shared norms and collective efficacy; community institutional resources; and the ecology of daily living.

Socio-economic inequalities in injury: critical issues in design and analysis

Reading and colleagues (2005) note that our understanding of the role of neighbourhood influences on injury risk would be much greater if studies provided good quality data on the social and economic status of both households *and* neighbourhoods.

Cubbin and Smith (2002) conducted a limited non-systematic review of the literature on SES and injuries, paying particular attention to study design and the measurement and interpretation of SES. Included studies were categorised according to severity of outcome and level of analysis (individual, ecological, or multi-level).

A strong inverse relationship was found between SES and the risk of fatal unintentional injuries in all ages, and this risk increased as area- or individual-level SES decreased. All but one of five studies identified found an association between low individual-level SES and higher rates of fatal unintentional injury. Four ecological-level studies of SES and fatal unintentional injury found an association between low-SES areas and deaths due to fire, motor vehicles, and other unintentional injuries. After adjusting for individual SES effects, the only multi-level study also suggested similar associations. Comparable findings were reached when non-fatal injuries were analysed.

Cubbin and Smith (2002) found that very few studies focused on the specific relationship between SES and injuries. Like other reviewers they found that studies often used what they described as 'arbitrary' measures of SES which were frequently not clearly defined or justified, and few studies discussed how inadequate measures of SES may have affected the results.

Inconsistency in the relationship between fatal and non-fatal injuries and SES may be due to the variation in severity. Cubbin and Smith (2002) found in their review that fatal injuries and serious injuries (e.g. requiring hospitalisation) were similar in their inverse relationship to SES. The only studies which found no association or positive associations were those where the definition of injury included requiring medical attention or restricted activity for a day. Minor injuries may be under-reported by those in low SES groups if access to health care is limited, whereas more serious injuries are less likely to be under-reported. Cubbin and Smith (2002) also suggest that a positive association between increased SES and nonfatal injuries may reflect increased interest and exposure to more hazardous leisure activities.

Conclusions

The evidence reviewed in this chapter adds weight to the findings of previous chapters: structural factors are important in shaping the control young people are able to exercise over their risk of sustaining a wide range of accidental injuries. Thus a move away from individual behavioural explanations towards a focus on structures and material resources is likely to be a much more productive approach to understanding patterns of accidental injury among young people.

Disadvantaged young people are clearly not opting into a higher risk of injury simply by making the wrong choices. There is a need to move the policy focus away from behaviour and engage with the evidence of both the behavioural and structural elements of the complex pathways to accidental injury.

Measuring SES is especially problematic for children, young people, and women because of the traditional dependence on measures of male occupation (Krieger 1991, Osborn 1987). The multidimensional nature of SES implies that it cannot be measured with only one variable (e.g. income, education); it can be measured at many levels (e.g. individual, family, area), and at different times (e.g. childhood SES and adult SES). Improved study of SES and its component mechanisms is necessary to begin to address inequalities in the distribution of accidental injury. Research needs to report explicitly the definitions of and justifications for the SES measures used, and to acknowledge any potential limitations. Researchers should be explicit about what they mean when they state that they have 'adjusted for' SES, especially when 'adjusting for' SES results in a failure to collect evidence of socially shaped differences in health.

The increasing interest in neighbourhood influences on health is likely to be a more useful approach to understanding patterns of accidental injury among young people. It offers the potential to focus on the social processes and material constraints influencing individual and household behaviour. We concur with Towner (2005, p 81) that examination of the causal pathways to accidental injury has not yet made it clear how approaches known to successfully reduce injury rates can be applied in order 'to bridge the gap related to disadvantage and injury'.

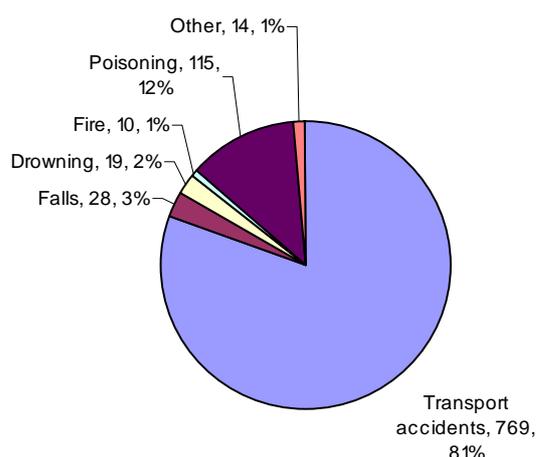
9. Discussion and implications

Mapping the scope of this review onto the burden of accidental injury

Our overarching review question was ‘what are the relationships between accidental injury and risk-taking behaviour and the social circumstances in which young people live’. We sought to answer this question in different topic areas using different types of evidence (national statistics, correlational studies and views studies) and contextualized our findings within current Government policy. In the introduction we reviewed the burden of accidental injury among young people in the UK and observed that transport accidents and accidental poisoning were the biggest causes of accidental death. In contrast, falls accounted for the largest numbers of hospital admissions, followed by transport accidents and exposure to inanimate mechanical forces (of which glass was the most dangerous). The topic areas into which the report is divided reflect the balance of research activity found for this review. But how well does this literature account for the causes of accidental injury?

The main areas of research activity we found relate to drugs, alcohol, transport (including cycle helmets), and sport. The main causes of death among young people in 2004 were transport, poisoning, falls and drowning, with transport and poisoning accounting for 93% of mortality (figure 9.1). The large proportion of our report given over to discussing sport does not fit the overall mortality statistics and neither does the space devoted to alcohol, but the heavy emphasis on transport and drugs does. However, since alcohol is involved in many transport accidents, the length of the chapter on this subject is justified. Fatal sports injuries are comparatively rare, so the chapter on sports cannot be taken to represent the relative importance of these injuries in overall mortality statistics.

Figure 9.1 Underlying causes of death: 15-24 year olds (2004)

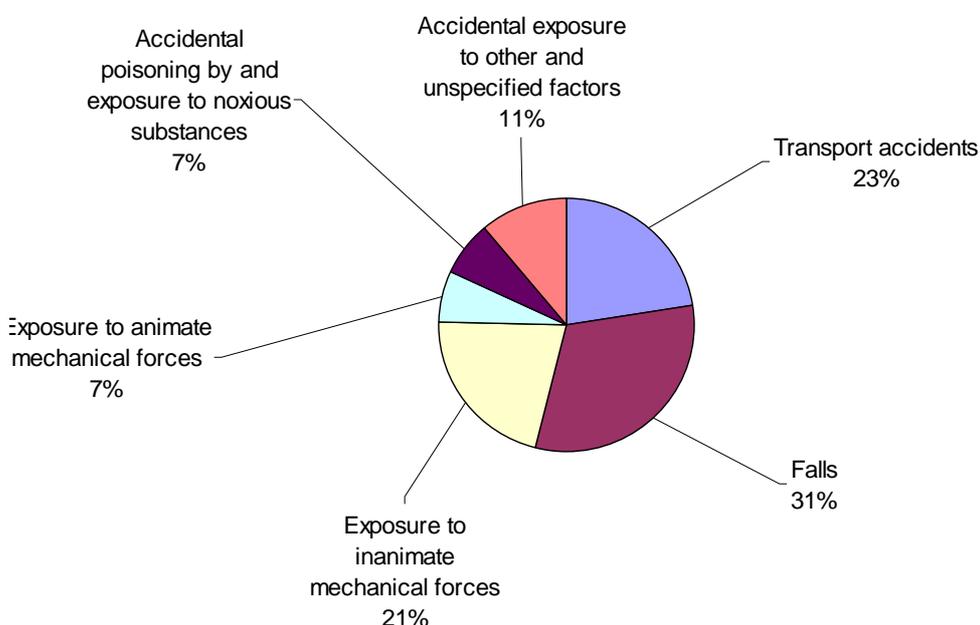


The hospital episode statistics present another picture of causes of injury (Figure 9.2). Falls account for most hospital admissions followed by transport accidents

and 'exposure to inanimate mechanical forces'. As shown in the introduction, sports injuries are to some extent hidden in the hospital episode statistics, with some classified under 'falls' and others under exposure to both animate and inanimate forces, and more injuries due to falls occur at sports areas than any other classified area. Our report therefore maps fairly well onto the causes of hospital admissions in that we have covered all the major areas of classified injury.

It is important to remember that most young people do not have accidents serious enough to be reflected in these figures. The fact that injuries in many areas - for example, transport - have reduced from much higher levels shows that progress is possible, and that many of the injuries suffered by young people are preventable.

Figure 9.2 Hospital episode statistics 2000/1 - 2003/4: accidents to 12-24 year olds (categories with more than 10,000 episodes)



Accidental injury and risk-taking behaviour

Since the search strategy for this review was modelled around a (very broad) definition of risk-taking behaviour, and since the scope of the research we found does map adequately onto the epidemiology of accidental injury, are we able to say how much of the accidental injury observed can be attributed to risk-taking? Since a specific culture of risk-taking is something which is often ascribed to young people, if risk-taking is something which leads to significant injury among young people, we should be able to observe it in the research we have found.

The taking of illegal drugs comes within our definition of risk-taking behaviour and we know that the use of drugs is increasing among young people. But how many injuries are caused by drugs? As Chapter 3 showed, this is not an easy question to answer. Looking in more detail at drugs which are causing injury immediately reveals one significant gap in the research evidence: most of the research in Chapter 3 is concerned with illicit drugs, but approximately half of the young

people who died from poisoning did not take illegal drugs. The same is true when looking at hospital episode statistics: other drugs are associated with many more hospital admissions than those used illegally. Illegal drugs accounted for approximately half of deaths due to poisoning in 2004 and never rank higher than third in terms of hospital admissions. Illegal drugs therefore accounted for approximately 6% of mortality in young people during 2004 and are associated with even smaller proportion of hospital admissions.

The widespread concern about illicit drugs is justified because of the crime and much higher mortality it causes among older age groups. Illegal drugs are associated with violent crime and also with socio-economic deprivation. Given that older age groups in deprived areas are more likely to be poisoned by illegal drugs than young people are throughout the country, it is difficult to sustain an argument which attributes poisoning in young people to a culture of risk-taking behaviour. This is not to say that young people do not take drugs and thereby take risks, but simply that the causes of poisoning cannot be attributed to a culture of adolescent risk-taking since more poisonings occur in older age groups, and poisonings are also associated with belonging to a vulnerable group and areas of high socio-economic deprivation.

As discussed in Chapter 4, it is difficult to quantify the number of accidental injuries (excluding transport) which can be attributed to alcohol. We do know that young teenagers are the only age group to suffer significant acute alcohol poisoning resulting in hospital admissions, and also that more younger than older people are admitted to hospital with evidence of alcohol involvement in their injuries. Injuries with evidence of alcohol involvement resulted in just over 700 hospital admissions of young people between 2000/1 and 2003/4. This compares with nearly 70,000 for transport accidents, 96,000 falls and 65,000 for 'exposure to inanimate mechanical forces'. These data, however, may be incomplete and it should be possible to quantify this area better in the future.

Transport injuries are the most significant cause of death and the second largest cause of hospital admissions. Chapter 5 gave a breakdown of the different classifications of the 10,900 people killed or seriously injured on Britain's roads in 2004. Drinking and driving might reasonably be considered to be a risk-taking behaviour, and we did see that young people aged 20-24 were more likely (by 1.9%) to be involved in accidents in which they failed a breath test than those aged 25-29. The rest of the evidence presented in Chapter 5 does not quantify the impact that risk-taking might have on injury. One study which looked at this specific issue failed to find any connection between different risk-taking behaviours and injury to pedestrians and cyclists. It found that the factor most associated with injury was 'playing in the street at weekends'. Drinking and driving is the one risk-taking behaviour we have identified which the evidence shows leads to injury. While our age group has the highest rates, this is also a problem in other age groups, suggesting that theories of 'adolescent' risk-taking may not explain drink-driving behaviours.

While the UK has a comparatively good overall traffic mortality record compared with other European countries, it has a very poor record on child injuries. The evidence presented in this review does not suggest that this is because children in the UK take more risks on the roads. A study by Bly and colleagues shows that children's exposure to risk in the UK is different from that in other countries and, 'in particular, children in Britain spend more time near, and undertake more road crossing activity in, more major roads; wider roads; roads with higher flows of

traffic; and roads of higher speeds, than children in France and the Netherlands' (Bly et al. 1999, p 2).

In terms of transport injuries, therefore, we do not have convincing evidence that risk-taking plays a significant role in causing injury in any cases other than drink-driving. This is not to say that some of the attitudes expressed in the views studies do not lead to behaviour that can cause injury - there is just no research evidence which maps risk-taking onto transport injuries in a systematic way. Moreover, as the discussion about social and economic circumstances shows, transport injuries are concentrated in comparatively deprived areas of the country. The implication is then that unless we wish to construct a theory of risk-taking that allows for socio-economic differences in behaviour, we must conclude that, while some transport injuries may be the result of reckless, drunken and/or thrill-seeking behaviour, risk-taking does not explain why young people suffer so many transport injuries.

Sport was a contentious area to define in a review about risk-taking. Some sports are definitely more dangerous than others, but it was not possible to draw a line between risky and non-risky sport. We therefore included all sports and found that the lack of good quality data in this area makes it very difficult to quantify the extent of sports-related accidental injury. Young people suffer more injuries than other age groups due to sport, because they play more sport. We did not uncover any evidence to suggest that they play more recklessly or riskily than other age groups. Conceptualising activities which are part of national Government policy as being related to risk-taking is clearly problematic, so again we conclude that risk-taking is not a good way of looking at injuries in this area.

Having examined the evidence presented in each chapter in terms of quantifying the number of injuries attributable to risk-taking, we must conclude that risk-taking does not appear to be a helpful way of explaining the vast majority of injuries to young people.

We have found that translating 'risk-taking', as described in much of the literature on the subject, into behaviours that can form the basis for a systematic review is problematic. We therefore question whether such a broad umbrella term is meaningful in describing the range of activities it encompasses. For example, the reasons that someone might be motivated to place themselves at personal risk may be very different to those which endanger others. Moreover, 'thrill-seeking' behaviours, such as driving at excessive speed, do not seem to sit comfortably with behaviours such as drinking and driving, or cycling without a helmet. Moreover, can the taking of certain drugs as a result of physical dependency really be considered to be risk-taking as conceptualised in the literature described in the introduction? The literature discussing risk-taking behaviours among young people appears therefore to conceptualise risk-taking in ways that differ from the actual behaviours which cause (or are associated with) injury. While there is a large body of international research which shows a correlation between risky behaviours and injury - mostly in relation to transport injury (see, for example, Williams 2003, Turner and McClure 2004, Ulleberg and Rundmo 2003, Hirsch 2003, Pickett et al. 2002) - the constructs and vocabulary used to describe risk in this literature do not necessarily translate into the same constructs used in the theoretical work described in the Introduction. This distinction is important because, as our review has shown, many authoritative discussions on young people's risk-taking behaviours are not accompanied by unequivocal evidence of these behaviours resulting in injuries. The true pathways to injury appear to be much more complex, involving

interactions between people and their environment which cannot be captured by purely behavioural explanations.

However, the views syntheses did find young people expressing some of their behaviour in terms of taking risks. This may, of course, partly reflect the focus on individual risk in media and (some) policy coverage relating to young people and accidental injury. Looking across the views studies in the different topic areas, a number of common themes emerged.

Themes arising from the 'views' studies across topic areas

The 14 studies (Albery and Guppy 1995, Bendelow et al. 1998, Coleman and Cater 2005, Danton et al. 2003, Denscombe 1999, Engineer et al. 2003, Gillen et al. 2004, Halliday et al. 1996, Honess et al. 2000, Joshi et al. 1994, Rolls and Ingham 1992, Takriti and Lee 2000, Taylor and Halliday 1996, Wardle and Iqbal 1998) explored young people's views of risk-taking in general, as well as views relating to specific risk-taking behaviours (drinking, taking drugs, not wearing cycle helmets, dangerous driving, driving under the influence of alcohol or cannabis).

Pleasures/benefits of risk-taking

The risk-taking behaviours explored in these studies were, for the most part, undertaken by young people because they enjoyed them (Bendelow et al. 1998, Coleman and Cater 2005, Engineer et al. 2003, Honess et al. 2000, Rolls and Ingham 1992). Risk-taking behaviours were also carried out for bravado: young people bragged about their activities and carried them out to show off to their friends. Risk-taking was a social activity, so that having an audience was important, either to witness the behaviour itself or to talk about it after the event (Bendelow et al. 1998, Engineer et al. 2003, Rolls and Ingham 1992).

Perceived vulnerability

Although some young people did express a degree of caution about a risk-taking behaviour because of its possible negative consequences (Engineer et al. 2003, Honess et al. 2000, Joshi et al. 1994), on the whole those who participated in risk-taking behaviour did not feel that they were increasing their personal risk of accidental injury as a result (Bendelow et al. 1998, Danton et al. 2003, Engineer et al. 2003, Joshi et al. 1994, Rolls and Ingham 1992, Takriti and Lee 2000). Quite often they recognised that there were risks (Coleman and Cater 2005, Danton et al. 2003, Denscombe 1999, Engineer et al. 2003, Rolls and Ingham 1992) but did not see these as being applicable to themselves personally (Engineer et al. 2003, Rolls and Ingham 1992). Young people sometimes had a sense of invulnerability (Engineer et al. 2003, Halliday et al. 1996). Some thought there were risks, but accepted them as being a part, or a consequence, of the desirable activity (Coleman and Cater 2005, Wardle and Iqbal 1998).

Those who did not take risks (e.g. did not take drugs, or wore cycle helmets) rated their personal vulnerability to those risk-taking behaviours as higher (Bendelow et al. 1998, Engineer et al. 2003, Halliday et al. 1996). The context in which the risk-taking behaviour took place often affected how risky young people thought that the behaviour was (Halliday et al. 1996, Rolls and Ingham 1992, Wardle and Iqbal 1998).

Factors affecting risk-taking behaviour

Critical incidents

In general the studies found that while critical incidents (a significant event, such as an injury to oneself or a friend or relative) did have an effect in reducing risk-taking behaviour (Denscombe 1999, Engineer et al. 2003, Halliday et al. 1996, Honess et al. 2000), this effect tended to be only temporary (Denscombe 1999, Halliday et al. 1996, Joshi et al. 1994).

Peer influences

Peers tended to encourage risk-taking behaviour (Bendelow et al. 1998, Coleman and Cater 2005, Danton et al. 2003, Engineer et al. 2003, Halliday et al. 1996, Honess et al. 2000, Rolls and Ingham 1992), although on some occasions they did act to reduce risk-taking, for example by stopping a friend who was drunk from carrying out a dangerous prank (Danton et al. 2003, Rolls and Ingham 1992).

Legal influences

A number of young people said that they were not, or would not be, prevented from participating in risk-taking behaviours if they were (or are) illegal (Bendelow et al. 1998, Danton et al. 2003, Rolls and Ingham 1992, Taylor and Halliday 1996).

Environmental influences

The decision to undertake risk-taking behaviours often depended on how dangerous the young person perceived the situation to be (or, rather, how dangerous they perceived that behaviour in that situation to be) (Halliday et al. 1996, Rolls and Ingham 1992).

These findings from the views studies present a complex picture which again does not entirely fit the stereotype of young people as inveterate risk-takers. These studies are likely to under represent the perspectives of non-risk-takers, since the young people who were risk-takers were more likely to be vociferous about it.

Strengths and limitations of this review

There are very few systematic reviews covering accidental injury and risk-taking behaviour among young people, and none we know of that have included such extensive searches for grey literature and included research evidence from national statistics, correlational studies, studies examining young people's views, and systematic reviews. Not all reviews also contextualise their findings within current Government policy. The scope of this review is therefore extremely broad, both in terms of the types of research it contains and in the breadth of topics that it covers. Because of this, it is able to draw conclusions with some authority. Concentrating as it does on UK research and policy, it is highly relevant to policy-making in the UK, but less useful to readers with other national interests. Knowledge from other countries is not entirely absent, because of the international effectiveness evidence in the systematic reviews running throughout the report. Another significant contribution of the review is its scope in terms of age group: while there has been substantial activity reviewing accidental injury among children, young people have received comparatively less attention.

The perspective taken in this review has also been important. Examining research from the 'behavioural' viewpoint has enabled us to take a critical look at the evidence base which underpins many current health promotion interventions. The

conclusions about general approaches to research and the difficulty of explaining accidental injury through behaviourist approaches alone are strengthened by the broad scope of the review.

The review has been challenging from a methodological and operational point of view. Most systematic reviews tend to be fairly narrow in their research questions and even those which 'map' research activity fairly broadly to begin with usually narrow down the scope and number of studies to be examined in detail. Unusually, the scope of our review is broad throughout, the only major limitation being the restriction to UK research for some types of evidence in order to make the workload manageable while maintaining its policy relevance to its commissioning body, the Department of Health (England). Reviewing evidence over so many topic areas presented numerous challenges, not least in devising a report structure that could adequately represent the key messages and selecting appropriate quality assessment tools for studies using so many different research methods and designs.

Previous experience has shown us that searching for 'views' studies is difficult and time-consuming as they are not always found through simple electronic searches. Searching for these studies across a large range of different topic areas compounded this problem. Correlational studies are easier to retrieve, but much less easy to classify in terms of their research design - even when full papers are available for consultation. There are established and evolving methods for synthesising the results of different types of studies, but fewer methods for combining results *across* study types (e.g. Dixon-Woods *et al* 2005, Thomas *et al* 2004). Some methods are available, but we found that the 'views' and correlational studies covered such different populations, perspectives and issues that it was not possible to combine them in a satisfactory way; we therefore synthesised the results of each type of study separately.

Our review focuses exclusively on research published in the English language. The small amount of research published in other languages that we have come across contains hints of different cultures and perspectives of risk-taking (for example Le Breton 2004) These perspectives are not included in this review. Many of the trials reported in the systematic reviews we found were carried out in other countries - chiefly the USA - so these findings cannot necessarily be transferred to the UK. Moreover, the systematic reviews often included people that were older and younger than the age group that is the focus of this review, generating additional issues concerning generalisability.

The 'behavioural' perspective also limited the range of research which was included. This was not a systematic review of 'risk' and accidental injury, so some studies which focused on environmental and social determinants of injury could not be included if they did not also include reasons for injury which could be attributed to individual behaviours. The review is also limited by its other major criterion for inclusion: accidental injury. While there is a large literature on risk-taking among young people, examining this work would not necessarily have provided the review with good information about the relationship between risk-taking and accidental injury. All studies in the review needed to discuss not only a risk-taking behaviour (such as substance abuse), but also its relationship to injury. Thus, papers on young people's views were only included if they contained views about risk-taking *and* injury. This has meant that the many studies on, for example, young people's views on drugs were not included (e.g. Highet 2006). The same limitations applied to the inclusion of systematic reviews, meaning that we have not included evidence on, for example, drug abstinence programmes (unless related to injury). Similarly, while there is a body of research that examines the clustering of certain

behaviours, such as early sexual activity, alcohol and drugs (e.g. Wight et al 2000), this literature was not within the scope of this review, unless it also reported information about injury as well.

As with all systematic reviews, while we searched extensively for relevant research, we cannot be sure we have found *all* relevant studies. We have a large number of Government reports and reports from other bodies, but cannot be sure that all 'grey' literature, especially, has been found. Our search strategy attempted to combine an exhaustive search of 15 electronic databases and ten key journals with 'pearl growing': using existing reviews, bibliographies and reference lists to identify relevant research. While, when searching bibliographies, we did not find that our database and journal search had missed relevant research, it is possible that a different strategy would have yielded different results. There are also major gaps in the research we have reviewed. The 'views' studies do not typically contain the perspectives of those most vulnerable groups in the UK who suffer the majority of injuries. In particular, the young people in the 'views' studies concerning drugs do not appear to be the same groups of young people who are being poisoned by overdose in the correlational studies. In addition, the questions asked in the studies often reflected the 'behavioural' model. We have plenty of views of why young people do or do not wear cycle helmets, but not so many about whether cyclists view the protection they are given on the roads as adequate. We have small hints - such as the concern that wearing helmets will make cars drive less sensitively - of the vulnerability they feel, but no in-depth examination of such points of view.

There are certain methodological limitations in the studies in the review which should be borne in mind. As the 'cautionary note' in Chapter 1 explains, it is important not to over-interpret the results of correlational studies and infer causal links which are not justified. While, for example, taking drugs may be associated with higher injury rates, we do not know how all these injuries occur. Views studies, too, often have limitations in terms of their sample sizes and ranges of the contexts in which their participants lived. As stated in our methods, we used a thematic analysis to bring the findings of the views studies together. This involved identifying key themes and concepts from each study and then 'translating' them into one another. The aim of the method is to identify themes which are commensurable across studies and to explore areas of disagreement. However, some topic areas had relatively few studies (for example, transport) and so some themes were only identified in one or two studies. While this is not necessarily a problem, since the value of a theme or concept is not reliant on the number of studies from which it came, it may limit its transferability or generalisability and we therefore state the origins of each theme so that readers are able to judge for themselves its utility for their particular situation.

How this review relates to other systematic reviews

Turner and colleagues (2004) have published the only other systematic review that we know of which has also looked explicitly at risk-taking behaviour and accidental injury. Turner and colleagues' review also found that published studies on the relationship between risk-taking and injury are mostly 'theoretical commentaries' (Turner et al. 2004, p 93). On the basis of the research they did find, they came to very different conclusions: that

risk-taking behavior, however it is measured, is associated with an increased chance of sustaining an injury except in the case of high skilled,

risk-taking sports where the effect may be in the other direction. (Turner et al. 2004, p 99)

These results are based on four studies - one examined injury as a driver in a car crash; two concerned ski injuries; and one study explored links between criminality, sensation-seeking and spinal chord injuries. There are three main differences between these studies and the ones included in our review: first, the studies discussed in Turner and colleagues' review include people of all ages, not just young people; second, most are from the USA (with the addition of one from Finland and one from the Netherlands); and third, three of the studies examined risk-taking and injury explicitly by scoring participants on 'Zuckerman's sensation-seeking scale'.

There are important similarities in the results of these two reviews. The four studies about driving included by Turner and colleagues tend to agree with us regarding drinking and driving, and also suggest that speeding and not wearing seatbelts are associated with injury. While we agree that certain driving behaviours can lead to injury, we did not find any UK research which supports Turner and colleagues' broader assertion that 'risk-taking behaviour, however it is measured, is associated with an increased chance of sustaining an injury'. We would question whether, in fact, they identified sufficient research to make this claim.

It is also worth noting with regard to reviews and other primary research that studies which correlate high scores on psychological scales with increased rates of injury have not established that risk-taking *causes* injury, only that there is some kind of relationship. The lack of research establishing a causal link between the two has been a major factor in the conclusions contained in our review.

Implications and recommendations

The lack of evidence which consistently links individual risk-taking with accidental injury is clearly the most striking finding of this review. This, together with the substantial literature describing social and 'neighbourhood' explanations of injury, suggests that a move away from individual behavioural explanations towards a focus on structures and material resources is likely to be a much more productive approach to understanding patterns of accidental injury among young people.

However, while we have observed the importance of socio-economic factors to accidental injury, we have also seen the difficulty of understanding these factors properly from the current evidence base. As discussed in Chapter 8, very few correlational studies examine possible structural causes of injury, and those that do so use different and/or unclear definitions. We need not only clearer definitions of social and economic status (SES), but better quality information on how different factors within these definitions interrelate and how they impact on accidental injury rates among young people. Despite clear evidence of socio-economic injury gradients, most interventions examined in the review of reviews in each chapter appear to be formulated as though this is not a significant issue. Recent policy statements which are more cognisant of this fact are welcome, but we also need better information in order to develop interventions which address the structural causes of injury.

Gender differences are a second theme to emerge consistently in almost all the research we have looked at in this review. There are pronounced differences between young men and young women both in rates and types of injury and in their exposure to different injury risks. Studies which examine young people's views are often eloquent on the subject of the different cultures of masculinity and

femininity which contribute to shaping their behaviour, particularly with respect to transport and alcohol-related accidents where there is almost an expectation that taking risks is a normal feature of young men's lives. This is an essential context for understanding, for example, why in the 16-24 year age group young men are eight times more likely than young women to have an alcohol-related road accident. A focus on gender differences reveals some notable research gaps, for example the higher drug-related mortality risk among young women, and the greater vulnerability of young women to road accidents when travelling in groups.

The gender differences highlighted in our review are part of a much wider pattern of gender differences in health (Krieger 2003, Wamala and Lynch (eds) 2002). Strikingly, SES and gender as axes of inequality are rarely analysed together, with a resulting loss of understanding about how the two intersect in shaping health outcomes (Macintyre and Hunt 1997).

One implication of the significance of gender in relation to injuries among young people is clearly that preventive interventions need to take gender into account. Rather than ignoring cultures of gender in relation to risk-taking and risk-awareness, preventive interventions need to build on these so as to attract the attention and change the behaviour of young men and women.

While we have proposed that priority should be given to exploring structural and socio-economic factors in relation to accidental injury, it also would be possible to examine risk-taking in a more systematic way. For example, research which scores people on various 'sensation-seeking' scales and relates these scores to injury rates does not establish cause and effect. An approach which examines the precise circumstances of injury may go some way to untangling the risk-taking issue and possibly provide insights into how this relates to socio-economic factors too. In particular, we need to know more about the context of injury and where injuries take place. This is another area where there are significant unexplored gender differences.

Bearing in mind stated Government aims of increasing physical activity in the population as a whole, we also recommend that attention be given to ensuring that young people are not exposed to additional risk of injury as a result. In particular, if cycling is to be promoted as a healthy and environmentally friendly form of transport, we need to address the significant risks faced by cyclists sharing busy roads with much faster and heavier vehicles. The significant variations in injury rates between different sports should also be examined and the place of dangerous sport in the school curriculum should particularly be considered.

The hospital episode statistics have been useful in this report in showing how the distribution of injuries suffered by young people varies by age and how it is in the early teenage years that many 'new' injuries begin to occur. We do not yet have a full understanding of the burden of accidental injury, and data from accident and emergency departments will be a valuable addition to our statistical evidence base. However, there are limitations to the World Health Organisation's current ICD codes, and additional steps will need to be taken if we want to understand, for example, the relationship between different sports and injury. The increased availability of hospital statistics will also mean that research into how people decide to attend accident and emergency will become even more critical. If there is also a socio-economic gradient in attendance at hospital, then the interpretation of hospital statistics will depend on understanding how this operates.

We question the idea that risk-taking behaviour as an umbrella concept can be regarded as a useful model to explain accidental injury among young people.

However, since some behaviours clearly lead to injury, we recommend a more fine-grained approach which is more sensitive to the underlying motivations, history and reasons for injury. Rather than focusing on 'risk-taking', behavioural interventions need to take account of people's different situations and recognise a striking finding across the systematic reviews - that education/information interventions alone have limited or no impact. This may not be because young people are unreceptive to the messages of such interventions, but because the influences of other factors, including the environment and social context, have an overriding importance. For example, the fact that certain driving behaviours lead to injury may suggest that a model of individual risk is appropriate, the evidence shows that the high socio-economic gradient in these injuries means that models of 'neighbourhood risk' may be more suitable for understanding some categories of injury.

Part II: Technical description of the review

10. Methods

User involvement

For systematic reviews to be relevant to policy and practice, potential users of the review must be involved in key stages of the review process (Peersman et al. 1999, Rees et al. 2004). User involvement was sought for this review through an Advisory Group with members drawn from researcher, policy-maker and practitioner communities. Young people were consulted about the findings from the views syntheses via two interviews. Since gaining the effective participation of young people in an adult-dominated Advisory Group can be problematic, the aim of the interviews was to ensure that the perspective of the target population was reflected in the review. The aim of the focus groups was to ascertain the extent to which the findings of the review resonated with the perspectives of young people.

The Advisory Group met after the preliminary searches for the review were complete and advised on the scope of the review and the presentation of the review products. The group was asked whether the review should look at all topic areas or focus more intensively on a more limited set of areas (for example, drug and volatile substance abuse). The view of the group was that all areas, including sport, were of interest, and the review therefore continued to have a broad scope. The group also considered whether the proposed limit of the review to UK research was appropriate and, given the broad scope, decided that it was. (An international perspective was gained through the systematic reviews of effectiveness.)

The group also gave advice on sources of evidence for the review and, at times during the review, provided the reviewers with relevant papers. The group was also concerned that the review should not adopt a simplistic view of 'risk-taking' because of the danger of ignoring the considerable evidence showing that environment plays a great role in the burden of accidental injury. Finally, the group also considered what the appropriate way of presenting the review's findings should be. The original proposal was for the review to present the results of the individual syntheses separately and for a full 'technical' report to be written at the end of the review. However, the advisory group decided that it would be better for the review to be presented at the end in its entirety. This report is therefore the outcome of this decision and has been written with a policy and practice audience in mind, leading with the context and results of the review and recognising that the more 'technical' description of review process and methods contained in Part II may be of secondary interest to some readers.

Two interviews were carried out with young people to discuss the findings from the views syntheses and the implications that were derived from them findings. Both took place in West London, with young people accessed through a youth project and young offenders' team. Interviews were planned to take place with groups of 8-10 young people, with one group containing younger teenagers (12-14 year olds) and the other with older young people (15-24 year olds). In the event, one group contained two boys aged 12-13 years and the other group contained two boys and one girl aged 13-16 years. Parents were informed of the interviews beforehand and were given the opportunity to opt their child out. Before the interviews took place, the researcher explained the reason for and nature of the discussions, confirmed that they would be confidential and asked for the young people's verbal consent to take part. Participants were given a £5 gift voucher to thank them for their time. The interviews were not tape recorded, as youth workers reported that the

recording of previous group discussions had made the participants very wary. Both lasted for approximately 20-30 minutes.

In the discussions, the findings and the implications derived from them were reported and the young people were asked for their comments on whether or not the findings seemed to be 'true' and whether the implications made sense to them. The discussion with the two 12-13 year olds covered the topics of bicycle helmets and alcohol. The 13-16 year old group discussed drugs; car, moped and motorbike driving behaviour (focusing particularly on speeding and driving under the influence); bicycle helmets; and alcohol.

The young people generally agreed with the findings from the views synthesis, although those who did not participate in risk-taking behaviour themselves understandably found it more difficult to discuss views relating to these behaviours. They found it harder to move beyond their personal experiences and views to consider the implications for interventions that had been derived from the views synthesis. It may be that the lack of discrete, concrete interventions meant that this involved too high a level of abstraction for them.

On reflection, while the consultation with young people provided some validity to the findings of the views syntheses, it would be wrong to claim that their involvement changed or shaped the review in any significant way. Methods for involving young people in what can be a long and technically complex review process still need to be developed. We have recently completed a systematic review which had far more involvement with young people. As well as taking considerable time and resource, the lessons learned from that review included allowing the young people to change the focus and scope of the review - something which may be problematic in specifically tendered projects.

Mapping exercise

Following recommendations for a two-stage commissioning process for systematic reviews in health promotion by Peersman et al. (1999), the review was carried out in two stages: a mapping exercise followed by an in-depth review of a sub-set of studies. The mapping exercise identifies and describes the range of relevant research activity that has been undertaken in terms of its substantive characteristics (e.g. type of intervention, type of behaviour) and methodological characteristics (e.g. study design). Based on policy and practice needs, studies are chosen for the in-depth review, which assesses their quality and synthesises their findings. Because the initial specifications of systematic reviews within public health/health promotion are often broad, the mapping and quality-screening exercise is designed to enable the review's commissioners and potential users to be involved in further specifying the precise scope and/or prioritising the questions for the in-depth review. This also ensures that the review is manageable within the timescale.

The mapping phase of the review asked the question:

What research has examined the relationship between accidental injury and risk-taking behaviour among young people?

Many different types of research are included in the map and the aim is simply to describe the extent of the evidence base in this area. The quality of studies in the map was not assessed and the findings are not all reported. However, the map was used to inform decisions taken with regard to the remainder of the review. In the event, the advisory group decided that the topic scope of the review should be broad and the review was made manageable by concentrating on UK research.

Inclusion and exclusion criteria for mapping exercise

To be included in the mapping exercise, reports of studies had to meet all of the following criteria:

- to be about both accidental injury and risk-taking behaviour; and
- the population had to be:
 - a. children or young people between the ages of 12 and 24 years (when the age range of a study went beyond these boundaries the average age had to be between 12 and 24 or data needed to be presented separately for this age group); and
 - b. from the UK ; and
- studies had to be published between 1985 and 2005 and data collected during that time period; and
- studies types included were of the following categories:
 - c. 'views' study; or
 - d. 'correlation' study; or
 - e. outcome evaluation; or
 - f. systematic review; and not
 - g. case history; and not
 - h. 'think pieces'.

The review was also restricted to studies published in English. This was because members of the team did not speak additional languages, did not have access to or the ability to search databases in other languages, and did not have the resources to screen and translate documents in other languages. Since the focus of the primary research was on UK studies, most relevant research will have been published in English.

For the purposes of this review, 'accidental injury' was defined as any injury resulting from an unplanned and unexpected event that occurs at a specific time from an external cause. Injuries or death due to transport (rail, road, air, water), poisoning, falls, fire, flames and smoke, natural and environmental factors, submersion, suffocation, foreign bodies, and other accidents (such as unintentional drug- or drink-related death/injury) were included. Studies were excluded if the injury was intentional, such as in cases of para-suicide, confirmed suicide, homicide, or injury purposely inflicted by others. Studies where it was not known whether the injury was accidental, or where injury occurred afterwards, were excluded (e.g. development of lung cancer later in life due to current smoking). Studies where a small proportion of the injuries or deaths may have been non-accidental were included where it was made explicit that the majority of these events were unintentional.

'Risk-taking' behaviour was defined as: any impulsive or thrill-seeking behaviour; risky car, motorbike, bicycle, or pedestrian behaviour (such as non-use of cycle helmets, speeding or unsafe overtaking); any sporting activity; drinking alcohol; taking illegal drugs or misusing prescription/over the counter drugs; and also any behaviour defined by the authors or participants as risk-taking. Studies were excluded if the behaviour was related to sexual activity, suicide, self-harm or para-suicide, or normal car, cycle or motorbike usage (although use of a very powerful

motorcycle or car coupled with inexperience was deemed to be risk-taking behaviour). Smoking was included in the study only when it resulted in an immediate injury (such as a burn from a cigarette, or injuries resulting from a house fire).

Systematic reviews that fulfilled the accidental injury and risk-taking behaviour criteria were included, regardless of age or population criteria. Studies of the effectiveness of safety equipment (but not of its efficacy) were also included if they met the age and population criteria.

In order to answer our review questions (stated in Chapter 1), we searched for four types of research:

- studies examining the perspectives and experiences of young people regarding risk-taking and accidental injuries ('views' studies);
- studies exploring the statistical relationship between variables ('correlational' studies);
- systematic reviews containing studies which examine the effectiveness of interventions to prevent accidental injuries; and
- national statistics on rates of accidental injuries (from the Office of National Statistics and a small number of other bodies which collate such information for the Government).

In order to place the research evidence within the UK policy context, key Government papers in each topic area were sought and the websites of relevant organisations searched. In addition, the map of policy compiled by the Child Accident Prevention Trust was used (Hayes 2005).

Identification of studies for the mapping exercise

(a) Search strategy

Systematic searches were conducted on seven major databases (PsycINFO, ASSIA, CINAHL, EMBASE, ERIC, SSCI, MEDLINE), and eight specialist databases (BiblioMap, SPECTR, NOSHPPLUS, SPORTDISCUS, TOXLINE, SIGLE, National Research Register, Health Development Agency, Sport and leisure index - Birmingham). A highly sensitive search using both indexing terms and free text terms was developed in Medline (see Appendix B). This was tailored to individual databases in order to accommodate their differing index terms where these were available. Searches were carried out between September and November 2004 and methodological filters were not used. Quality control exercises identified that our initial searches missed a number of potentially relevant systematic reviews, and additional searches were conducted to resolve this.

The journals we handsearched were the ten journals which contained the greatest number of relevant studies in the electronic searches. They were:

- *Social Science and Medicine* (1984-2004)
- *British Journal of Sports Medicine* (1984-2004)
- *Injury Prevention* (1995-2004)
- *Addiction* (1993-2004)
- *BMJ* (1994-2004)

- *Accident Analysis and Prevention* (1984-2004)
- *Journal of Public Health Medicine* (1990-2004)
- *Archives of Disease in Childhood* (1984-2004)
- *Injury* (1984-2004)
- *Drug and Alcohol Dependence* (1984-2004)

Bibliographies of relevant studies were scanned, websites of the Department of Health, Department for Transport, Home Office, the Transport Research Laboratory, and ROSPA were searched, and authors and key informants/organizations contacted.

(b) Screening process

Stage 1: Screening on title and abstract

All records identified in the above process were downloaded, with their citations and abstracts where available, into reference management software (Reference Manager 10) and screened for relevance against the review inclusion criteria. Where the downloaded citation did not contain enough information on which to base a decision, the study was included at this stage.

Stage 2: Screening on full paper

The full paper was obtained for all the relevant studies identified in Stage 1 of the screening process. The full paper was screened against the review criteria by two researchers working independently. Disagreement was resolved by a third researcher.

Classification of studies for the mapping exercise

Relevant studies were then coded on EPPI-Reviewer software using a standardised keywording system developed by the EPPI-Centre (Peersman and Oliver 1997). The reports were classified in terms of type of study (e.g. case-control, cohort study), the country where the study was carried out, the study population (e.g. general population, young people), and the focus of the study (e.g. accidents, alcohol). Reports describing or evaluating interventions were assigned additional keywords about the intervention site, intervention type and provider.

Each study was also coded with review-specific keywords which described the type of risk-taking behaviour (e.g. use of or failure to use safety equipment), whether it was a 'views' study, whether it contained information about inequalities, and whether it explored any additional variables (e.g. age, sex, intensity of risk-taking behaviour). A filter to identify research carried out in the UK was used and records of UK and non-UK conducted research were downloaded separately.

In-depth review

Moving from broad characterisation (mapping) to in-depth review

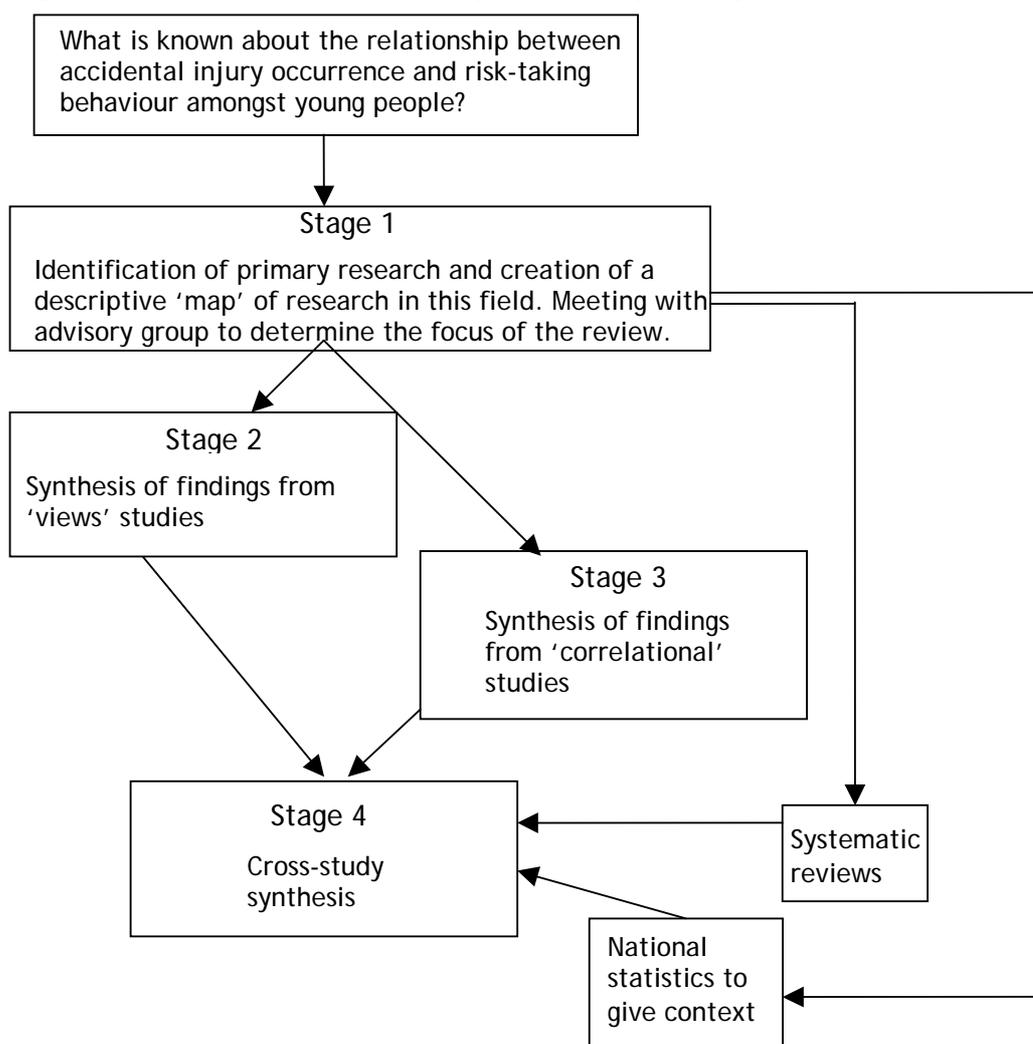
Final decisions about which kinds of studies to include in the in-depth review, and thus the inclusion and exclusion criteria for in-depth review, were made in consultation with the Advisory Group on the basis of the results of the mapping phase of the review. It was agreed to prioritise groups of studies according to five broad areas of risk-taking behaviour. These areas were:

- Drug use (illegal drugs and misuse of prescription/'over the counter' drugs)
- Unsafe road behaviours (including pedestrian behaviour and driving under the influence of drugs or alcohol)
- Cycle helmets
- Alcohol
- Sports

A decision was taken to prioritise primary research published in the UK. These studies were identified within our reference management system, and are the focus of the in-depth review. Systematic reviews contain both UK and international research.

A graphic showing the flow of the different types of studies through the review is shown in figure 10.1. Thus, the 'views' studies, 'correlational' studies, and systematic reviews were synthesised separately before being brought together in the final synthesis. This method was used for each of the topic areas.

Figure 10.1 Flow of the different types of study through the review



Detailed description of studies in the in-depth review

The EPPI-Centre has standard frameworks to collect data from many different study designs, which have been used in previous reviews examining the barriers to and facilitators of health behaviour change among young people (Harden et al. 2001, Rees et al. 2004, Shepherd et al. 2001). This framework was used for extracting data from 'views' studies. The EPPI-Centre recently undertook a review of 'correlational' studies (Garrett et al. 2004), and the framework used in that review was adapted for use in this study. In addition to the use of generic data-extraction frameworks, categorisations that capture specific details about accidental injury and risk-taking behaviour were developed. The results of this process will be made available as a searchable database on the Web (<http://eppi.ioe.ac.uk/webdatabases/Intro.aspx?ID=4> - further information can be found in Appendix B).

Assessing the quality of studies, data extraction and weight of evidence

Before studies were entered into the syntheses, they were examined for threats to their reliability and validity. All data extraction and quality assessment was conducted electronically using specialist systematic review software (EPPI-Reviewer). Agreed versions were entered onto the EPPI-Centre's specialised computer database for analysis and storage. We used different quality-assessment tools for the different types of study:

(a) Studies describing young people's perspectives and experiences ('views' studies)

Tools

Criteria for assessing the methodological quality of studies describing young people's perspectives and experiences built on those used in earlier EPPI-Centre reviews. Studies were assessed according to 12 criteria covering three main quality issues. The first five relate to the quality of the *reporting* of a study's aims, context, rationale, methods and findings. The next five relate to quality of data collection and analysis, and the final two questions to whether or not the data collection and analysis methods were appropriate to helping young people to express their views. An additional criterion was used to decide to what extent the study was able to answer our review questions.

Methods

Two reviewers worked on each study, comparing their decisions and coming to a consensus. Each reviewer independently completed the data extraction and quality assessment tool for 'views' studies, and selected those parts of the findings which addressed our review questions. They met and compared responses to all questions and agreed a final version of the data extraction. Studies were judged to be of high, medium or low methodological quality based on the answers given to the tool described in the previous paragraph. In addition, each study was judged to be very useful, quite useful, or not useful in helping to answer the review question. For example, a study could meet all the inclusion criteria but not present findings by the relevant age group. A judgement about the overall weight of evidence was reached by consensus. This was based on a combination of how useful the study was in helping to answer the review question and the quality of the study. In terms

of overall weight of evidence, studies were considered to be high (i.e. high quality and very useful), medium high (i.e. high quality and quite useful or medium quality and very useful), medium (i.e. medium quality and quite useful), or low (low quality and any level of usefulness, or not useful and any quality). Studies judged to have a low overall weight of evidence were not included in the synthesis.

b) Correlational studies

Tools

For the review of correlational studies mentioned above (Garrett et al. 2004) a tool for assessing this type of study was developed at the EPPI-Centre. This tool centred on assessing possible threats to the validity of correlational studies identified by Cook and Campbell (1979). This tool was used as our core data-extraction tool for all correlational studies and asked questions about the validity of studies which helped us to then apply the specific quality assessment tools described below.

As the criteria for assessing the quality of correlational studies varies according to study design we identified other quality assessment tools with which to assess study quality:

- Case-control studies were assessed using a tool developed by the National Institute for Clinical Excellence (NICE) (NICE 2004b). This tool included 11 items for assessing study quality.
- Cohort studies were also assessed using a tool developed by the National Institute for Clinical Excellence (NICE 2004a). This tool included 14 items for assessing study quality.
- Surveys were assessed using a modified version of criteria suggested by Crombie (1996), with additional questions appropriate to secondary analyses of existing data.

Methods

Pairs of reviewers worked on each study, comparing their decisions and coming to a consensus. In the first instance one reviewer independently data-extracted and fully completed the core correlational study tool, including study findings. The second reviewer conducted partial data extraction of the study, including study findings. They met and compared responses to all questions and agreed a version of the data extraction, with any differences being decided with a third reviewer. Both reviewers independently undertook quality assessment and then met to agree both the quality of the study and its usefulness in helping to answer the review question. Studies were judged to be of high, medium, or low methodological quality according to the appropriate study-type-specific quality assessment tool. In addition, each study was judged to be very useful, quite useful, or not useful in helping to answer the review question. For example, a study could meet all the inclusion criteria, but in the final analysis not present findings by the relevant age group. A judgement about the overall weight of evidence was reached by consensus. This was based on a combination of how useful the study was in helping to answer the review question, and the quality of the study according to its particular appraisal tool. In terms of overall weight of evidence, studies were considered to be high (i.e. high quality and very useful), medium high (i.e. high quality and quite useful or medium quality and very useful), medium (i.e. medium quality and quite useful), or, low (low quality and any usefulness, or not useful and any quality). Studies judged to have a low overall weight of evidence were not included in the synthesis.

(c) Other evidence in the syntheses

The findings from systematic reviews of effectiveness are also included in the syntheses. They were used as 'short cuts' to the findings of primary research and were required to state their search strategies and methods of quality assessment. The latest statements of Government policy in each topic area, both in paper and electronic form, are the basis of the summaries of current policy. Finally, a custom report of the latest Hospital Episodes Statistics was used to give a detailed age breakdown of transport injuries resulting in hospital admission. Gross figures for the years 2001-4 were used and no attempt was made to run statistical tests or compare different injury rates by year. The statistics are used as one valuable way of estimating usually non-fatal injuries in each topic area.

Evidence syntheses

This review contains three syntheses. Each of the syntheses employs different methods developed to suit the types of studies under investigation, and utilises specially written reporting and analytical functionality built into our software, EPPI-Reviewer.

(a) Synthesis of studies describing young people's perspectives and experiences

The 'views' studies were synthesised using methods developed in a series of systematic reviews funded by the Department of Health (England) at the EPPI-Centre (Brunton et al. 2003, Shepherd et al. 2002, Thomas et al. 2003). The authors' findings were downloaded from EPPI-Reviewer into a qualitative analysis software package, NVivo, and a thematic analysis conducted following guidelines for the analysis of textual data more commonly employed in the context of primary research (Harden 2006, Thomas et al. 2004). A limited hierarchy of themes emerged naturally across the different topic areas (drugs, alcohol, transport and cycle helmets). Direct quotations from the primary studies, and sometimes from their participants, have been used to show how the themes which emerged relate to the original studies.

(b) Synthesis of correlational studies

The findings from the correlational studies which were entered into EPPI-Reviewer took the form of both numeric and textual data. Due to the different range of study designs, and different statistical methods employed in the analyses, it was not appropriate to combine these statistical data in a meta-analysis. Instead, the findings from EPPI-Reviewer were entered into more than 100 pages of tables, organised according to the five prioritised areas of risk-taking behaviour, type of accidental injury, particular variable, and numerical data. Reviewers working in pairs then confirmed the direction of the association that any particular variable of risk-taking behaviour was thought to have on accidental injury. The tables allowed reviewers to bring the findings of the studies together in a uniform way which allowed the numerical findings and the textual data to be combined in a narrative conceptual synthesis.

(c) Cross-study synthesis

The implications for policy and practice which emerged from the two syntheses above form the basis of the discussion sections in each evidence synthesis. Originally, it had been proposed to juxtapose implications for interventions against one another in a more formal way but, when the results from the syntheses began

to emerge, it became clear that this would have involved an unacceptably large amount of reviewer interpretation. It was therefore decided that a more transparent presentation of the results of the individual syntheses would ensure that the review did not stray too far from the studies it is based upon.

The completed review

After the evidence syntheses were written, each member of the team worked independently to suggest recommendations based on each synthesis. The final piece of conceptual work involved mapping the research we identified against the overall burden of accidental injury among young people. This enabled us to assess the extent to which risk-taking behaviour is able to explain injury in this age group. Since the correlational studies contained so little information about the social circumstances of their participants, we drew on a wider literature in our discussions in order that this important component of our review question was covered adequately. As this literature was not searched for using the same systematic searches described above (to do so would amount to another large review in its own right), we have not based our conclusions on the findings of these studies.

11. Map results

Flow of literature through the map

Our searches identified a total of 4981 records: comprehensive searches of bibliographic databases identified 3935 citations; scanning bibliographies, identification of citations from searches for ongoing schemes, online screening of full text journal indexes, contact with authors, and serendipitous discovery resulted in the identification of a further 1046 potentially relevant citations.

After removing 1325 duplicates, the titles and abstracts of 3656 records were screened. Most of these did not meet the inclusion criteria and were excluded from the map (N = 2058, 56.3%). A high proportion of these studies were excluded because their main focus was not accidental injury or risk-taking behaviour (N = 1434, 69.7%); 464 studies (22.5%) were excluded on the grounds that they were not carried out on a UK population; 88 (4.3%) studies were excluded because they did not include the age group relevant to this review (young people aged between 12 and 24); 66 studies (3.2%) were excluded on the grounds that the study design was not appropriate for our review (e.g. they were case histories, think pieces, or non-systematic reviews); and a further 6 (0.3%) were excluded because the study was not published between 1985 and 2005, or the data were not collected during that time period.

A total of 1598 reports were identified as being potentially relevant for inclusion in the mapping exercise. Full reports were obtained and processed for 1495 (94%) of these within the timescale for the review. After the screening of the available full reports, 1327 were excluded. This high level of exclusion was attributable to many records having been included at the first stage of screening on the basis of limited information (e.g. title only available, or limited information in the abstract). Most of the reports (N = 479, 36%) were excluded because the study was not carried out on a UK population; 288 reports (21.7%) were excluded because the main focus was not on accidental injury or risk-taking behaviour. Others were excluded at this stage because they did not study the relevant population of young people aged 12-24 years (N = 262, 19.7%); 45 studies (3.4%) were excluded because the study was not published between 1985 and 2005, or the data were not collected during that time period; and a further 253 studies (19%) were excluded on the grounds that the study design was not appropriate for our review. This last total also included a number of systematic reviews which, on closer inspection, were not reviews of intervention studies.

A number of reports were found to be linked to others already in the reference management database (that is, both studies used the same dataset). Twenty-five reports were consequently coded as linked (secondary) reports in the database. When this stage of the review was completed, a total of 168 reports of 143 separate studies had been identified for inclusion in the map. Figure 11.10 summarises the flow of studies through these phases of the review.

Characteristics of studies in the map

One aim of the mapping exercise is to describe the extent of the evidence base in this area. The studies in the map have not all passed tests for relevance and methodological quality, and therefore their findings are not all reported.

The map included a number of different types of research:

- Studies exploring the statistical relationship between variables ('correlational' studies)
- Studies examining the perspectives and experiences of young people regarding risk-taking and accidental injuries ('views' studies)
- Systematic reviews containing studies which examine the effectiveness of interventions to prevent or reduce accidental injuries

Of the 143 separate studies in the map, 94 were 'correlational' studies. In addition, there were 25 'views' studies and 24 systematic reviews. Studies were published between 1985 and 2005, with 66 out of 143 (46%) published after 2000.

Correlational and views studies were conducted looking at UK populations only. In contrast, systematic reviews carried out in any country were sought to give the review an international perspective on effectiveness research.

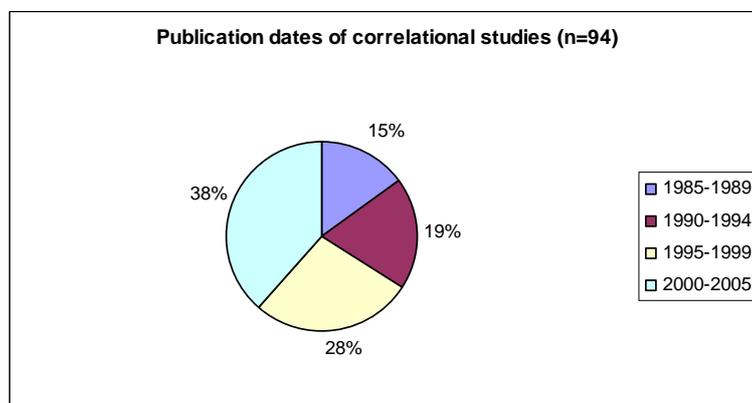
Correlational studies

There were 94 correlational studies in the map.

(a) Publication date

Fourteen correlational studies had publication dates between 1985 and 1989, 18 were published between 1990 and 1994, 26 had publication dates between 1995 and 1999, and 36 were published after 2000 (Figure 11.1).

Figure 11.1 Publication dates of correlational studies (N = 94)



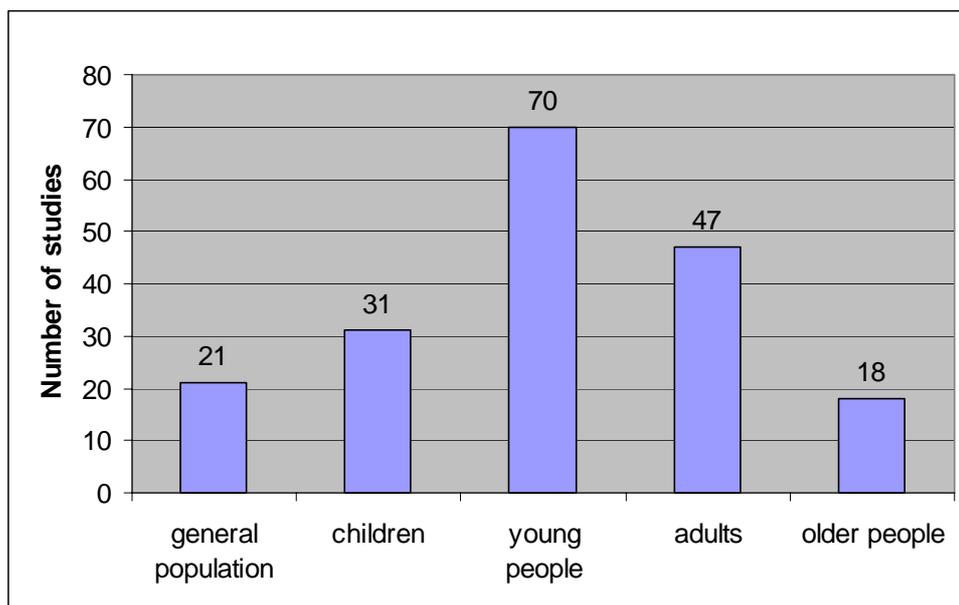
(b) Study design

The correlation studies identified were of the following design: 72 surveys, 11 secondary analyses, 4 case-control studies and 7 cohort studies.

(c) Population

The majority of correlational studies (N = 75; 79.8%) examined the relationship between risk-taking behaviour and accidental injury among mixed sex populations. Sixteen studies focused on males only and three females only. Nearly three-quarters of the correlational studies (N = 70; 74.5%) examined the relationship between risk-taking behaviour and accidental injury in young people aged 11-21. A total of 47 studies included adults (22+ years) in their sample, 31 studies included younger children (<11 years), and 18 studies included older people. The general population was the study population of twenty-one studies (figure 11.2).

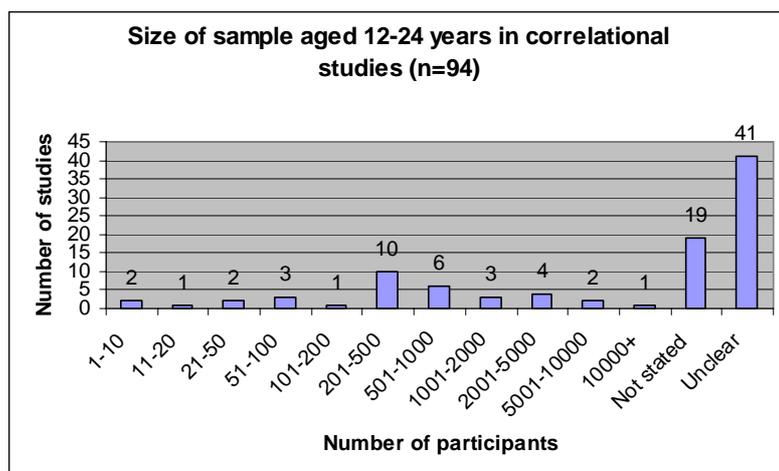
Figure 11.2 Characteristics of study population in correlational studies (N = 94)



A total of 23 correlational studies contained information relating to inequalities. Across the studies there was a lack of consistency in the way that this was defined. In some studies the social and economic status of participants was explicitly stated (i.e. based on occupational classification). Other studies recorded one or more of a wide range of measures associated with an individual's social and economic circumstances, including educational achievement, living arrangements, car ownership, and the receipt of free school meals. Less commonly, data in relation to socio-economic inequalities at the area, rather than individual, level were collected. Very few studies addressed specifically the issue of deprivation in their main analyses of injury risk factors.

As Figure 11.3 below demonstrates, the studies covered a wide variety of sample sizes for the age group 12-24 years (ranging from 1-10 to 10,000+ individuals). Ten correlational studies (10.6%) had between 201 and 500 participants aged 12-24 in their sample. The second most common sample size for this age group was 501-1000, with six studies (6.4%) having this number of individuals. All other sample sizes for the 12-24 years age band contain between one and three studies. A large number of studies (N = 41; 43.6%) did not make explicitly clear the size of their sample who were aged 12-24 years; hence, such studies were coded as 'unclear'. However, for many of these studies, a rough estimation of the size was possible because the authors used, for example, age 11 or age 25 as the lower or upper age limit when grouping individuals by age (or it was implicit that individuals in the sample would not be as young as 11 years). A further 19 studies (20.2%) did not state the size of their sample of 12-24 year olds, or provide sufficient information that would have allowed even a calculated guess; therefore, they were coded as 'not stated'.

Figure 11.3 Size of sample aged 12-24 years in correlational studies (N = 94)



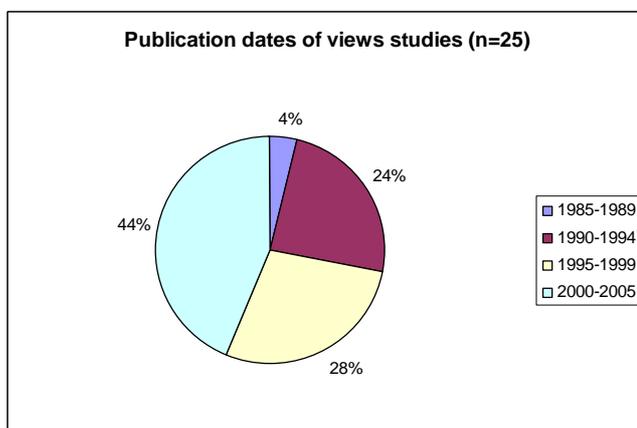
Views studies

There were 25 views studies in the map.

(a) Publication date

One study had a publication date between 1985 and 1989 (Bowling 1989), six studies (24%) were published between 1990 and 1994, seven studies (28%) had publication dates between 1995 and 1999, and 44% of reports (N = 11) were published after 2000 (Figure 11.4).

Figure 11.4 Publication dates of views studies (N = 25)



(b) Study design

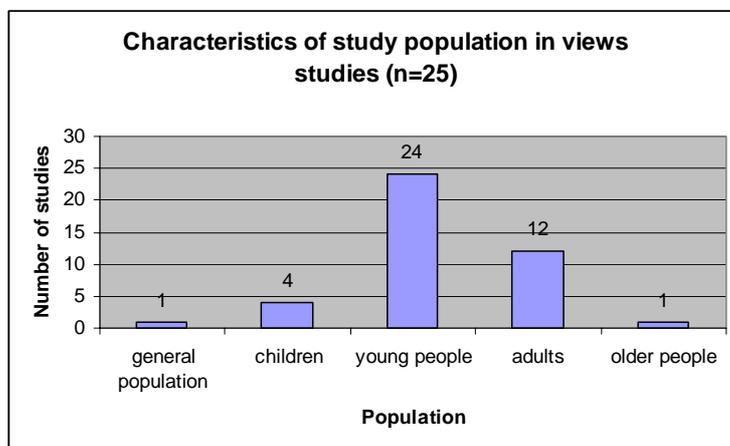
All twenty-five of the views studies were surveys.

(c) Population

Almost all views studies (N = 24; 96%) examined the views of mixed sex populations. One study focused on males only (Rolls and Ingham 1992), and no studies considered the views of females only. The vast majority of studies (N = 24; 96%) considered the views of young people (11-21 years). Twelve studies included adults

(22+ years) in their study population, with younger children and older people featuring in the samples of four studies and one study respectively. The views of the general population were also sampled in one study (Figure 11.5).

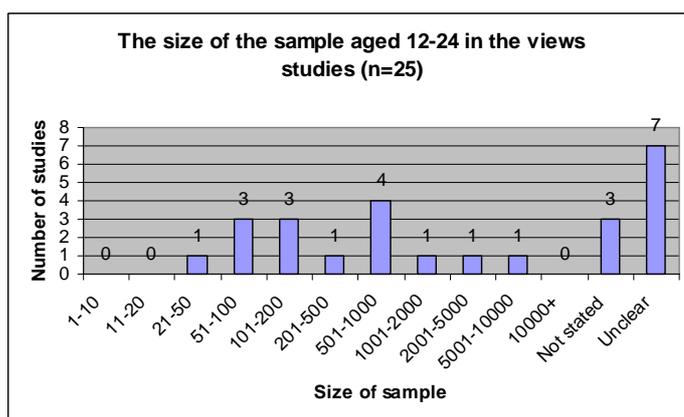
Figure 11.5 Characteristics of study populations in views studies (N = 25)



A total of twelve views studies contained information relating to inequalities. Details of the social and economic status of study participants were occasionally stated (either explicitly or implicitly); the ethnicity of the samples was less commonly reported. Some views studies used deprivation (either at individual or area level) in their analysis of young people’s views.

All the views studies had at least 21 individuals in the proportion of their sample aged 12-24 years. Again, the category with the highest frequency was ‘unclear’, with seven studies (28%) (figure 11.6).

Figure 11.6 The size of the sample aged 12-24 in the views studies (N = 25)



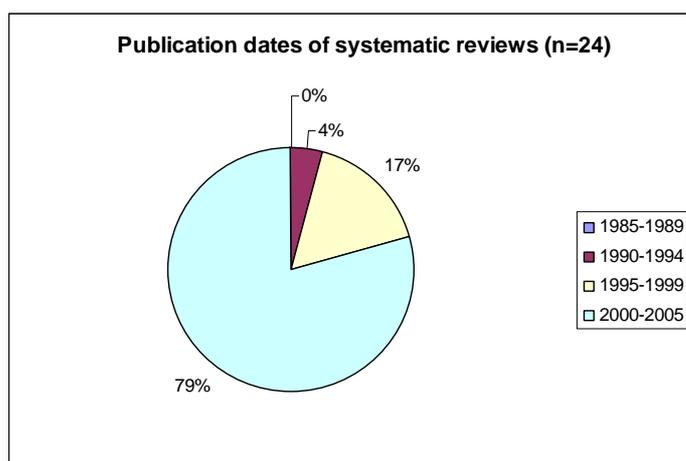
Systematic Reviews

Systematic reviews facilitated a ‘short cut’ to the findings of primary research on the effectiveness of accidental injury prevention strategies. There were 24 systematic reviews in the map.

(a) Publication date

The oldest systematic review was published in 1994 (Johnston et al. 1994). Four reviews were published between 1995 and 1999 (Coleman et al. 1996, Dowswell et al. 1996, Mackay et al. 1999, Wells-Parker et al. 1995). The majority of reviews (N = 19; 79%) were published after 2000 (figure 11.7).

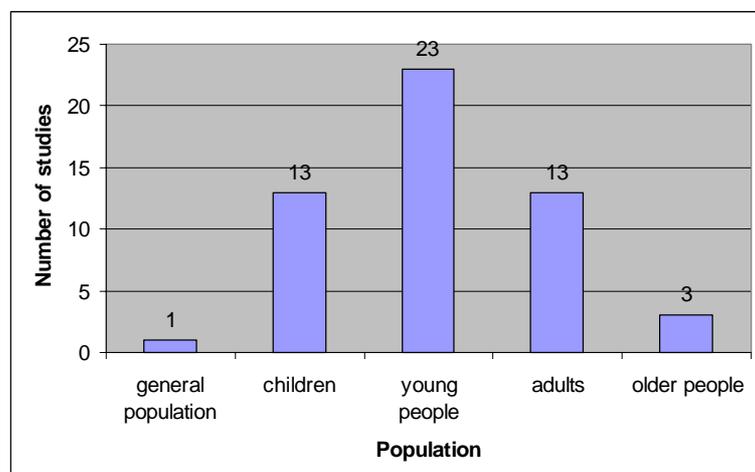
Figure 11.7 Publication dates of systematic reviews (N = 24)



(b) Population

None of the 24 systematic reviews restricted their inclusion criteria to one sex only. The vast majority of the reviews (N = 23) included injury prevention interventions which targeted young people whose ages fell within the range 11-21 years. Thirteen reviews included adults (22+ years) and thirteen reviews younger children. Three reviews also included older people among their study population. In one review, the interventions aimed to prevent accidental injury in the general population (figure 11.8).

Figure 11.8 Characteristics of the study populations in the systematic reviews (N = 24)



A number of reviews (N = 9) assessed the effectiveness of interventions to prevent injury among young children and teenagers. The age band 0-14 years was the focus of four reviews (Dowswell and Towner 2002, Dowswell et al. 1996, Towner et al. 2001c, Towner and Dowswell 2002). One review each targeted 0-15 year olds (Norton et al), 0-16 year olds (Turner et al. 2004), and 0-18 year olds (Royal et al. 2005). Two reviews considered the effectiveness of interventions targeting populations aged between 0 and 19 years (DiGuseppi and Roberts 2000, Mackay et al. 1999). In a tenth review (Towner et al. 2002) many of the interventions were also targeted at young children and teenagers.

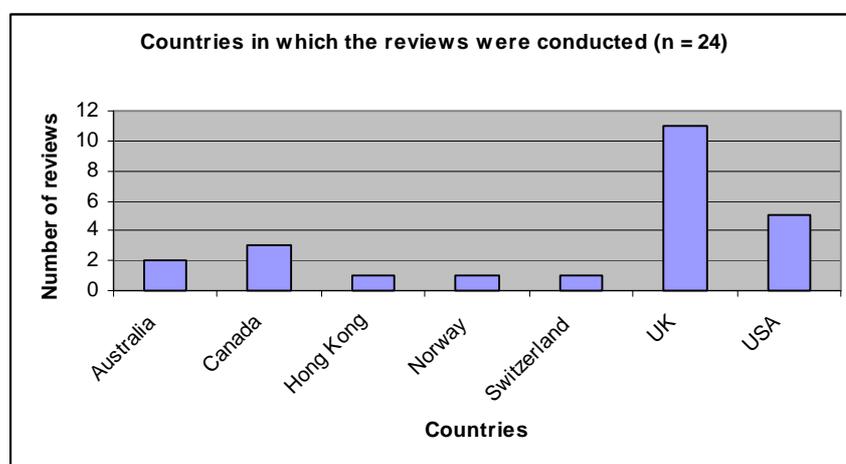
Two systematic reviews in the map (both published by the Cochrane library) focused solely on older teenagers. The first of these two reviews, by Roberts and Kwam (2001), assessed interventions aimed at reducing injury among 15-19 year olds. More recently, the review by Hartling et al. (2004) presented results for 16 year olds alone and for 16-19 year olds combined.

Other reviews (N = 3) considered older adolescents and young adults. Of these, two were located which specifically looked at those aged 15-24 years (Coleman et al. 1996, Elkington et al. 2000). The focus in the review by Wagenaar and Toomey (2002), was almost exclusively on 16-21 year olds (with only one reviewed intervention targeting a population aged up to 24 years).

Six systematic reviews contained information relating to inequalities that was relevant to our review. Of these, the most comprehensive were two reviews which specifically addressed the issue of social deprivation across a range of injury environments (Dowswell and Towner 2002, Mackay et al. 1999). With an exclusive focus on the promotion of bicycle helmet wearing, the review by Royal et al. (2005) attempted to evaluate the effectiveness of interventions with respect to social group. One aspect of the review by Towner et al (2002) (which also had a sole focus on the activity of bicycling) included a consideration of lower income as a barrier to the effectiveness of interventions. The remaining two reviews (Dowswell et al. 1996, Lund and Aaro 2004) also indicated an appreciation of the importance of social and economic circumstances as a factor in injury risk and the effectiveness of interventions to reduce injury.

Nearly half of all the systematic reviews (N = 11) were conducted in the UK (see figure 11.9).

Figure 11.9 Countries in which the reviews were conducted (N = 24)



Across the 24 systematic reviews, interventions to reduce injury among young people fell under the following main categories:

- Educational/promotional (e.g. information, counselling, leaflets, TV campaigns, incentives/rewards)
- Environmental engineering
- Product engineering (developing or modifying existing protective equipment)
- Regulatory/legislative (including enforcement)
- Multi-factor approaches (often education combined with other factors)
- Community-based approaches

From mapping to in-depth review

The mapping exercise was followed by in-depth review of a subset of studies. The process of selecting the studies for the in-depth review involved extracting data (both numerical and textual) from the correlational and views studies, and a detailed examination of the studies for threats to their reliability and validity. All data extraction and quality assessment was conducted electronically using specialist systematic review software (EPPI-Reviewer). Two reviewers worked independently on each study, then met to compare their decisions/responses and reach a consensus. A judgement about the overall weight of evidence was based on a combination of how useful the study was in helping to answer the review question and an assessment of the methodological quality of the study. (A study could be judged as not useful if, for example, it met all the inclusion criteria, but in the final analysis did not present findings by the relevant age group. A study could fail on quality if, for example, the response rate was less than 70% or heavy selection bias was present.) In terms of overall weight of evidence, studies were considered to be high (i.e. high quality and very useful), medium high (i.e. high quality and quite useful or medium quality and very useful), medium (i.e. medium quality and quite useful), or, low (low quality and any usefulness, or not useful and any quality). Studies which were judged to have a low overall weight of evidence were excluded from the evidence syntheses.

Of the 143 separate studies included in the map, 59 were excluded on the grounds that they were judged to have a low overall weight of evidence in terms of answering our review question. The majority of those excluded (N = 50) were correlational studies; in addition, nine views studies were excluded from the in-depth analysis. Forty-three of the fifty excluded correlational studies dealt with injuries within the sports and leisure/recreation environment. This left a total of 84 studies which were integral to the review (44 correlational studies, 16 views studies, and 24 systematic reviews).

Characteristics of studies in the in-depth review

The database of studies used in the in-depth review is available for online searching at: <http://epi.ioe.ac.uk/webdatabases/Intro.aspx?ID=4> (see Appendix B)

The evidence syntheses were organised according to five prioritised areas of risk-taking behaviour. The selection of these topic areas was based on the studies found

in the review. The different syntheses fall under the following themes: drugs, alcohol, transport, cycle helmets and sports/recreation.

Table 11.1 Number of studies in each synthesis (N = 84, not mutually exclusive)

	Drugs	Alcohol	Transport	Cycle helmets	Sports/recreation
Number of in-depth correlational studies in each evidence synthesis	13	5	10	1	20
Number of in-depth correlational studies in each evidence synthesis which contain information relating to inequalities	5	1	5	1	10
Number of in-depth views studies in each evidence synthesis	6	5	5	7	0
Number of in-depth views studies in each evidence synthesis which contain information relating to inequalities	5	5	2	1	0
Number of in-depth systematic reviews in each evidence synthesis	0	1	17	12	8
Number of in-depth systematic reviews in each evidence synthesis which contain information relating to inequalities	0	0	2	6	0
Total	29	17	41	28	38

The totals in the above table add up to more than the total number of studies as some contained information relevant to more than one synthesis. Of the 84 separate studies included in the in-depth analysis, 33 contained information relating to inequalities which was useful for our review, of which 19 were correlational studies, 8 were views studies, and 6 systematic reviews. For each type of research (correlational, views, systematic reviews) we found that the literature was not evenly distributed across different risk-taking behaviours (also referred to in the systematic reviews as 'injury environments') (see table 11.1).

Findings from four correlational studies featured in more than one synthesis (Balding 2002, Desai et al. 1996, Pickett et al. 2002, Williams et al. 1996). A similar situation arose for six views studies (Bendelow et al. 1998, Chinn et al. 2004, Coleman and Cater 2005, Danton et al. 2003, Denscombe 1999, Engineer et al. 2003). In-depth analysis revealed that 42% of the included systematic reviews (N =

10) were found to contain information on the effectiveness of interventions that was relevant for two or more evidence syntheses (Coleman et al. 1996, Dinh-Zarr et al. 2004, Dowswell and Towner 2002, Dowswell et al. 1996, Elkington et al. 2000, Lund and Aaro 2004, Mackay et al. 1999, Scanlan et al. 2001, Towner et al. 2001c, Towner and Dowswell 2002).

Drugs synthesis

After excluding two studies (Hammersley et al. 1992, Measham et al. 2000) for low weight of evidence, thirteen correlational studies were included in the drugs synthesis. One was judged to have a high overall weight of evidence in terms of answering the review question (Bird and Hutchinson 2003), seven were judged to be medium high (Bird et al. 2003, Frischer et al. 1993, Obafunwa and Busuttil 1994, Oyefeso et al. 1999, Schifano et al. 2003, Shah et al. 2001, Uren 2001), and five were assessed as medium quality (Balding 2002, Frischer et al. 1997, Gossop et al. 2002, Hickman et al. 2003, Roberts et al. 1997).

There were a total of six views papers which were included in this synthesis (Boreham and Shaw (2002) was excluded from the in-depth analysis). Two were classified as high overall weight of evidence (Bendelow et al. 1998, Engineer et al. 2003), and four as medium (Danton et al. 2003, Deehan and Saville 2003, Denscombe 1999, Gillen et al. 2004).

No systematic reviews examining the effectiveness of interventions to reduce or prevent drug-related injury were located.

Correlational studies

The thirteen correlational studies relating to drugs included two surveys (Balding 2002, Hickman et al. 2003), three cohort studies (Frischer et al. 1997, Gossop et al. 2002, Roberts et al. 1997), and eight secondary analyses. The study designs were cross-sectional (N = 2), retrospective (N = 10), and prospective (N = 1). Studies were published between 1993 and 2003.

Five studies analysed data from England and Wales (Oyefeso et al. 1999, Roberts et al. 1997, Schifano et al. 2003, Shah et al. 2001, Uren 2001), five studies took place in Scotland (Bird and Hutchinson 2003, Bird et al. 2003, Frischer et al. 1993, Frischer et al. 1997, Obafunwa and Busuttil 1994), two in England (Gossop et al. 2002, Hickman et al. 2003) and one in the UK as a whole (Balding 2002).

One study was a large school-based survey which considered accidental injury and drug use. The remaining twelve studies examined mortality relating to drug use. Three studies focused specifically on mortality amongst individuals who injected drugs (Bird et al. 2003, Frischer et al. 1993, Frischer et al. 1997), one study (Schifano et al. 2003) examined deaths related to taking ecstasy (alone or with other drugs), two studies focused on mortality related to the use of a range of (mostly Class A) drugs (Roberts et al. 1997, Uren 2001), one study specifically included individuals who used heroin within their sample (Hickman et al. 2003), and five studies considered mortality among individuals who used prescription and/or over the counter drugs as well as illegal drugs (Bird and Hutchinson 2003, Gossop et al. 2002, Obafunwa and Busuttil 1994, Oyefeso et al. 1999, Shah et al. 2001).

In eleven of the twelve studies which examined drug-related mortality, the study population was comprised of individuals who, at the start of the study, were identified as those who took drugs. The twelfth study examined drug-related mortality among men recently released from prison. This was the only study which

focused on males only; all other studies examined a mixed-sex population. Children and young people aged 10-15 years were the study population of one study (Balding 2002). Mortality among young people who took drugs (in both cases, those aged 15-19 years) was the specific focus of only two studies (Oyefeso et al. 1999, Roberts et al. 1997).

In eleven of the thirteen studies, the analyses explored accidental injury/mortality rates by different ages (the exceptions were Roberts et al. 1997 and Obafunwa and Busuttill 1994). Sex as a variable was included in the analyses of eleven studies (the exceptions were Bird and Hutchinson 2003 and Balding 2002).

Five correlational studies contained information relating to inequalities. In three studies the social and economic status (SES) of the individuals within the actual sample was implicitly stated using a range of measures associated with SES. Balding (2002) presented data on the percentage of children in the schools from which samples were drawn who qualified for a free school meal; in the study by Schifano et al. (2003) the focus was on occupational status (i.e. employed or not) and living arrangements (i.e. with a partner or parents etc.); and the study by Shah et al. (2001) focused on deprivation at an area rather than an individual level. In one study (Gossop et al. 2002) it was unclear what data had been collected in relation to social and economic status, although it was implicit that it had been collected, since homelessness was used as a variable (see below). One study explicitly reported the ethnicity of the sample (Hickman et al. 2003), while the study by Balding (2002) left exact details about the ethnicity of individuals unclear (it only provided an indication of the ethnic composition of the schools from which the sample was drawn).

In addition to age and sex, twelve studies considered a range of other variables, including social and economic status, region and drug type. Of the three studies which implicitly stated the social and economic status (SES) of participants, one study did not analyse its results by SES (Balding 2002). The other two studies (Schifano et al. 2003, Shah et al. 2001) did analyse their results by SES; however, neither did this for individual age groups. The study by Gossop et al. (2002) reported that the risk of fatal drug overdose was associated with homelessness. A further study analysed regional variations in deaths related to drug taking (Uren 2001). On a lesser scale, region was also included as a variable in the study by Bird et al. (2003). Again, however, for all three of these studies, their findings were for the whole sample and were not presented specifically for young people. No studies analysed their results by ethnicity.

One study used self-completion questionnaires to collect data (Balding 2002). In one of the twelve studies which examined mortality relating to drug use, data collection methods involved the use of a one-to-one interview in conjunction with secondary data (Gossop et al. 2002). The remaining eleven studies used only secondary data. Seven of these used only routinely collected mortality data (Bird et al. 2003, Frischer et al. 1993, Obafunwa and Busuttill 1994, Roberts et al. 1997, Schifano et al. 2003, Shah et al. 2001, Uren 2001). The remaining four studies cross-referenced national mortality data with additional datasets - registered teenage drug addicts (Oyefeso et al. 1999); drug injectors receiving treatment for drug misuse (Frischer et al. 1997); registered drug users (Hickman et al. 2003); and ex-prisoners (Bird and Hutchinson 2003).

Five studies used measures which are commonly found in epidemiological studies: these included rates (Uren 2001), age-standardised rates (Shah et al. 2001), expected prevalence rates (Bird et al. 2003), mortality ratios (Frischer et al. 1993), and standardised mortality ratios (Oyefeso et al. 1999). The study by Shah also

used descriptive statistics, such as frequency counts and percentages; two studies used only this method (Balding 2002, Schifano et al. 2003). Six studies also employed statistical methods, of which one used univariate analysis (Obafunwa and Busuttill 1994) and five studies undertook multivariate analysis using a variety of methods (e.g. multiple logistic and Cox regression) (Bird and Hutchinson 2003, Gossop et al. 2002, Hickman et al. 2003, Frischer et al. 1997, Roberts et al. 1997).

Views studies

The six included views studies were all cross-sectional surveys published between 1998 and 2004.

The sample in all six studies included young people (up to age 21 years) of both sexes. Three studies (Danton et al. 2003, Deehan and Saville 2003, Engineer et al. 2003) also considered the views of young adults (primarily those 25 years and under). Five studies contained information relating to inequalities. In three studies the social and economic status of the individuals within the actual sample was explicitly stated (Bendelow et al. 1998, Deehan and Saville 2003, Engineer et al. 2003); in two studies this detail was implicit (Denscombe 1999, Gillen et al. 2004); and in the final study it was unclear (Danton et al. 2003). Four studies explicitly stated the ethnicity of the study population (Bendelow et al. 1998, Danton et al. 2003, Deehan and Saville 2003, Denscombe 1999); it was not stated in the other two studies.

One study was conducted at several locations across the UK (Engineer et al. 2003), and another involved an English sample (Danton et al. 2003). Two studies took place in the Midlands (Bendelow et al. 1998, Denscombe 1999), one study in the South East of England (Deehan and Saville 2003) and a one in a North Eastern English town (Gillen et al. 2004). Places used for data collection included nightclubs, schools, and a youth club.

The most popular method of data collection was focus groups, which were used in five views studies (the exception was Deehan and Saville 2003). Three studies (Danton et al. 2003, Engineer et al. 2003, Gillen et al. 2004) only used focus groups. Two studies used one-to-one interviews to collect some of their data. Three studies used self-completion questionnaires, one study a hypothetical scenario (including vignettes), and one study other documentation.

Of the six views studies identified, five used qualitative data collection and analysis techniques (the study by Deehan and Saville did not state what methods were used). Three studies used standard thematic analysis techniques (Bendelow et al. 1998, Denscombe 1999, Gillen et al. 2004), one study used the Framework approach (Engineer et al. 2003) and one used Grounded Theory (Danton et al. 2003). The study by Bendelow et al. (1998) also used quantitative methods to analysis their data.

Alcohol

Five correlational studies were included in the alcohol synthesis. One was classed as having a high weight of evidence in terms of answering our review question (Pickett et al. 2002), one was judged to be of medium high usefulness (Williams and Shams 1998) and three rated as medium (Bagnall 1998, Balding 2002, Hutchinson et al. 1998). After excluding one study (Boreham and Shaw 2002), there remained a total of five views papers which were included in this synthesis. Four were classified as having a high weight of evidence (Bendelow et al. 1998, Coleman and Cater 2005, Engineer et al. 2003, Honess et al. 2000), and one medium high

(Denscombe 1999). One systematic review was found to contain useful information and was used in the synthesis.

Correlational studies

The five correlational studies which considered the relationship between alcohol consumption and accidental injury were all surveys published between 1988 and 2002. The design of one study was prospective; the remaining four were cross-sectional studies. Two studies were conducted on UK populations (Balding 2002, Hutchinson et al. 1998), one in Scotland (Williams and Shams 1998), one in England (Pickett et al. 2002), and one in Great Britain (Bagnall 1998).

Alcohol consumption was the risk-taking behaviour in all five studies. Four studies were surveys of school pupils which considered injuries in general; two explicitly examined medically-treated injuries (Pickett et al. 2002, Balding 2002). The fifth study looked specifically at facial injury requiring treatment at an accident and emergency department (Hutchinson et al. 1998).

In one study the population were aged 13 years (Bagnall 1998), in another they were 10-15 years (Balding 2002), a third study focused on 14-15 year olds (Williams and Shams 1998), and the final school-based study considered 11, 13 and 15 year olds (Pickett et al. 2002). The remaining study was a hospital-based study of 6114 individuals from the general population (Hutchinson et al. 1998). In all five studies, the study population was mixed sex. In three studies, age was used as a variable in the analysis (Balding 2002, Hutchinson et al. 1998, Pickett et al. 2002). Likewise, sex was included as a variable in three studies (Bagnall 1998, Hutchinson et al. 1998, Williams and Shams 1998).

One correlational study (Balding 2002) contained information in relation to inequalities. This study presented statistics on the percentage of children in the schools used in the sampling that qualified for a free meal, thereby implying the study population's social and economic status (Balding 2002). A further study (Williams and Shams 1998) did not report clear details about the sample's social and economic status. Williams and Shams (1998) explicitly reported the ethnicity of the sample, while Balding (2002) reported some details about ethnic composition of schools, but not on the ethnicity of individuals within the study sample. Williams and Shams (1998) focused part of their research question on associations between ethnicity and accidental injury. No studies analysed their results by social and economic status. Three studies used other variables (e.g. country) none of which were relevant to our review.

Three studies used a self-completion questionnaire to collect their data (Bagnall 1998, Balding 2002, Williams and Shams 1998). The study by Pickett et al. (2002) also used a questionnaire for data collection; however, the type was not stated. In the fifth study, the data collection method used was a one-to-one interview (Hutchinson et al. 1998).

Of the five correlational studies about alcohol-related injuries, one used descriptive statistical methods only (Balding 2002). Two also undertook univariate analysis using inferential statistical methods (Bagnall 1998, Hutchinson et al. 1998) and two undertook multivariate analysis, using multiple logistic regression (Pickett et al. 2002), and logit modelling (Williams and Shams 1998).

Views studies

All five included views studies were surveys, and all examined the views of young people (11-21 years) of mixed sex. One study (Engineer et al. 2003) also included

the views of adults (22-24 years). All five studies contained information relating to inequalities.

Four studies used focus groups for data collection (, Bendelow et al. 1998, Denscombe 1999, Engineer et al. 2003, Honess et al. 2000), three studies used one-to-one interviews (Coleman and Cater 2005, Denscombe 1999, Honess et al. 2000), three used self-completion questionnaires (Bendelow et al. 1998, Denscombe 1999, Honess et al. 2000), one used hypothetical scenarios (Bendelow et al. 1998), and one used other documentation (Bendelow et al. 1998).

Of the five views studies identified, all used qualitative methods. Four used standard thematic analysis techniques (Bendelow et al. 1998, Coleman and Cater 2005, Denscombe 1999, Honess et al. 2000). The remaining study (Engineer et al. 2003) stated that the 'Framework' approach was used. The study by Bendelow et al. (1998) also used quantitative methods (descriptive univariate and bivariate statistics).

Systematic reviews

One systematic review, conducted in the USA, was found to contain useful information on the effectiveness of interventions to reduce alcohol-related injury in young people (Dinh-Zarr et al. 2004). The study populations of the reviewed studies included children, young people, and adults of mixed sex. The review did not contain information relating to inequalities.

Transport

A total of five studies were excluded from the in-depth analysis (Best 2004, Bradbury 1991, Christian and Bullimore 1989, Harrison and Shepherd 1999, Ward et al. 1994), leaving ten correlational studies for inclusion in the transport synthesis. Two of these eleven were judged to have a high overall weight of evidence (Department of Transport 1998; Pickett et al. 2002), four were coded as medium high (Britton and McPherson 2001, Christie 1995, Desai et al. 1996, Rutter and Quine 1996) and four medium (Bradbury and Robertson 1993, Lawson 1991, Maycock 1997, Tunbridge et al. 2001).

Of the views studies which examined the perspectives and experiences of young people regarding risk-taking in the road environment and accidental injuries, six studies were judged to contain a low weight of evidence and were excluded (Brake 2000, Carthy et al. 1993, Child Accident Prevention Trust 2002, Parker et al. 1992, Rolls and Ingham 1992). Consequently, a total of five views papers were included in this synthesis. Two of these studies were judged to have a high overall weight of evidence (Coleman and Cater 2005, Chinn et al. 2004) and three were coded as medium (Albery and Guppy 1995, Danton et al. 2003, Rolls and Ingham 1992).

Seventeen systematic reviews were found to contain useful information and used in this synthesis.

Correlational studies

The ten road correlational studies included seven surveys, two secondary analyses (Britton and McPherson 2001, Lawson 1991) and one case-control study (Christie 1995). The study designs were as follows: cross-sectional (N = 7), retrospective (N = 1), and prospective (N = 2). Studies were published between 1991 and 2004.

Three studies took place in England (Department of Transport 1998, Lawson 1991, Pickett et al. 2002). Two studies took place in Scotland (Bradbury and Robertson 1993, Desai et al. 1996). The UK was the focus of three studies (Christie 1995,

Maycock 1997, Rutter and Quine 1996); one study took place in Great Britain (Tunbridge et al. 2001), and a further one in England and Wales (Britton and McPherson 2001).

The correlational studies in this synthesis considered the risk-taking behaviour of different categories of road user. Car drivers were the focus of two studies (Maycock 1997, Lawson 1991), as were motorbike riders (Bradbury and Robertson 1993, Rutter and Quine 1996). One study each was concerned with pedestrians (Christie 1995), car occupants (driver or passenger) (Desai et al. 1996), motor vehicle passengers (Pickett et al. 2002) or pedestrians/cyclists (Department of Transport 1998). One study differentiated between several different classes of road user in its analysis (Tunbridge et al. 2001). The study by Britton and McPherson (2001) did not explicitly state what categories of road user were included.

The majority of studies (N = 7) considered non-fatal, medically attended injuries. One study examined road accidents that resulted in either fatal or non-fatal injury (Lawson 1991). Two studies collected data on fatalities only (Tunbridge et al. 2001, Britton and McPherson 2001). Of the ten studies, one study looked specifically at ocular trauma (Desai et al. 1996), and one study examined head injuries (Bradbury and Robertson 1993).

The following risk-taking behaviours thought to be associated with road accidents were explored in the analyses: non-wearing of motorcycle helmet (Bradbury and Robertson 1993), engine capacity (Bradbury and Robertson 1993), running red lights (Lawson 1991), driver sleepiness (Maycock 1997), non-use of seat belts (Desai et al. 1996, Pickett et al. 2002), lack of safe strategies for crossing the road (Christie 1995), and 'problem behaviour' (i.e. danger seeking, playing in street at weekends) (Department of Transport 1998). One study investigated the incidence of drugs and/or alcohol in road accident fatalities (Tunbridge et al. 2001), and the study by Britton and McPherson (2001) estimated the number of road traffic accident deaths attributable to alcohol. The aim of one study was to assess the role of age and experience (Rutter and Quine 1996).

All ten studies explicitly included young people aged within the range 11-21 years among their study populations. One study analysed risk behaviour and injury solely among young people aged 11, 13 and 15 (Pickett et al. 2002). Three studies also included children aged 10 years and under in their sample (Desai et al. 1996, Christie 1995, Department of Transport 1998). Of these, two studies looked exclusively at children and young people: 5-16 year olds (Christie 1995) and 7-15 year olds (Department of Transport 1998). Adults were included in the study population of seven studies (Bradbury and Robertson 1993, Britton and McPherson 2001, Desai et al. 1996, Lawson 1991, Maycock 1997, Rutter and Quine 1996, Tunbridge et al. 2001) and older people in four studies (Britton and McPherson 2001, Desai et al. 1996, Lawson 1991, Maycock 1997).

In eight studies the study population was mixed sex; two studies examined males only (Maycock 1997, Rutter and Quine 1996). In nine studies, the analysis explored accidental injury rates by different ages (Rutter and Quine 1996 was the exception). The one study which differentiated between several different classes of road user did not present all its relevant findings for drivers, motorcyclists, pedestrians and so on by age (Tunbridge et al. 2001). Sex as a variable was included in the analysis in six studies (Bradbury and Robertson 1993, Britton and McPherson 2001, Christie 1995, Department of Transport 1998, Desai et al. 1996, Tunbridge et al. 2001).

Five correlational studies contained information relating to inequalities. Five studies stated the social and economic status of the individuals within the actual sample; in three studies this information was explicitly stated (Christie 1995, Maycock 1997, Tunbridge et al. 2001), and in two, it was implicit (i.e. the study used measures associated with SES) (Department of Transport 1998, Rutter and Quine 1996,). Only one study reported the ethnicity of the sample (Christie 1995). One study used social and economic status as the primary variable in their analysis of factors associated with injury among children and/or adolescents (Christie 1995). The study by Tunbridge et al. (2001), also used socio-economic group as a variable; however, it did so for all types of road user (and all ages) combined, thereby curtailing the usefulness of the findings for this review. The one study which reported the ethnicity of the sample also included this as a variable in the analysis (Christie 1995). Of the seven studies which considered a variety of other variables, those which were discussed in our report in relation to an association with injury risk were engine capacity (Bradbury and Robertson 1993) and group size of travelling companions (Christie 1995).

Five studies used only one data collection method (Britton and McPherson 2001, Lawson 1991, Maycock 1997, Rutter and Quine 1996, Tunbridge et al. 2001). Four used two or more methods (Christie 1995, Bradbury and Robertson 1993, Department of Transport 1998, Desai et al. 1996). In one study, the data collection methods were unclear; the authors stated that a questionnaire was used, but did not state what type (Pickett et al. 2002). Further details are as follows: self-completion questionnaire only (N = 2); clinical test only (N = 1); secondary data only (N = 2); secondary data and other documentation (N = 1); self-completion questionnaire and one to one interview and practical test (N = 1); observation and one to one interview (N = 1); one-to-one interview with other documentation and clinical test (N = 1).

Of the ten correlational studies selected for in-depth analysis, three used descriptive statistical methods only (Bradbury and Robertson 1993, Lawson 1991, Tunbridge et al. 2001). One study (Desai et al. 1996) also used inferential statistical methods (univariate analysis) and five studies (, Christie 1995, Department of Transport 1998, Maycock 1997, Pickett et al. 2002, Rutter and Quine 1996) undertook multivariate analysis using a variety of techniques such as factor analysis and multiple logistic regression. The remaining study (Britton and McPherson 2001) analysed data via use of an epidemiological measurement (population attributable fraction).

Views studies

The five views studies were all cross-sectional surveys published between 1992 and 2005.

The study population in all five views studies included young people. One study also included children in their study sample (Chinn et al. 2004). Adults were included in three studies (Albery and Guppy 1995, Danton et al. 2003, Rolls and Ingham 1992), and older people in one views study in the transport evidence synthesis (Albery and Guppy 1995). Four of these studies examined the views of mixed sex populations (the exception was Rolls and Ingham 1992 which focused on males only).

Two views studies in the transport evidence synthesis contained information relating to inequalities. Two studies explicitly stated the social and economic status of the participants in their sample (Coleman and Cater 2005, Rolls and Ingham 1992). In one study, this information was unclear (Danton et al. 2003) and

in two studies it was not stated (Albery and Guppy 1995, Chinn et al. 2004). The ethnicity of the sample was explicitly stated in one study (Danton et al. 2003) and not stated in the remaining four studies.

Two studies used focus groups to collect their data (Danton et al. 2003, Chinn et al. 2004). Other data collection methods included the use of one-to-one interviews (Coleman and Cater 2005, Rolls and Ingham 1992) and self-completion questionnaires (Albery and Guppy 1995).

Of the five views studies, four used qualitative data analysis methods (Chinn et al. 2004, Coleman and Cater 2005, Danton et al. 2003, Rolls and Ingham 1992). Of these, one study used the Grounded Theory approach (Danton et al. 2003) and three used a thematic analysis technique (Chinn et al. 2004, Coleman and Cater 2005, Rolls and Ingham 1992). The remaining study (Albery and Guppy 1995) used quantitative methods (multivariate data analysis techniques).

Systematic reviews

Seventeen relevant systematic reviews were included in the transport synthesis; publication dates ranged from 1994 to 2004, with twelve reviews published after 2000.

Two reviews looked at motorbike helmet wearing (Coleman et al. 1996, Elkington et al. 2000); six looked at measures to reduce drink-driving (Coleman et al. 1996, Elkington et al. 2000, Lund and Aaro 2004, Wagenaar and Toomey 2002, Wells-Parker et al. 1995); five looked at measures to reduce dangerous or risky driving (Coleman et al. 1996, Dinh-Zarr et al. 2004, Elkington et al. 2000, Hartling et al. 2004, Lund and Aaro 2004, Roberts and Kwan 2001), eight examined the effectiveness of seat-belt programmes (Dinh-Zarr et al. 2001, Dowswell et al. 1996, Dowswell and Towner 2002, Johnston et al. 1994, Lund and Aaro 2004, Mackay et al. 1999, Towner et al. 2001c, Turner et al. 2005) and two looked at pedestrian safety education interventions (Duperrex et al. 2002, Towner et al. 2001c).

Sixteen of the reviews were of injury prevention interventions which targeted young people whose ages fell within the range 11-21 years. Nine reviews also included adults (22+ years) and eight younger children (0-10 years). Three reviews included older people among their study population. In one review, the interventions aimed to prevent accidental injury in the general population.

Two systematic reviews contained information on inequalities which was relevant to the transport evidence synthesis (Dowswell and Towner 2002, Mackay et al. 1999).

Cycle helmets

There was one correlational study in the cycle helmet synthesis (Williams et al. 1996). It was judged to have a medium high weight of evidence in terms of answering our review question. After excluding one study (Lee 1993), there were a total of seven views papers included in the in-depth analysis on cycle helmets. Three were classified as having a high weight of evidence (Bendelow et al. 1998, Chinn et al. 2004, Halliday et al. 1996), and four medium (Joshi et al. 1994, Takriti and Lee 2000, Taylor and Halliday 1996, Wardle and Iqbal 1998). Twelve systematic reviews were found to contain useful information about the effectiveness of interventions.

Correlational studies

One study was included which contained relevant information for this synthesis (Williams et al. 1996). This study was a cross-sectional survey of 3044 adolescents of mixed sex aged 11, 13 and 15 years, with a principal focus on associations between social and economic status and adolescent injuries. A self-completion questionnaire was utilised for data collection and descriptive statistics and multivariate data analysis techniques were used (multiple logistic and multiple linear regression).

Views studies

Seven views studies were found to contain useful information; publication dates ranged from 1994 to 2004.

The views of young people (aged 11-21 years) of mixed sex were examined in all seven studies. Alongside these, younger children's views were also collected in four studies (Chinn et al. 2004, Halliday et al. 1996, Taylor and Halliday 1996, Wardle and Iqbal 1998). Two studies also examined the views of adults (Halliday et al. 1996, Taylor and Halliday 1996). One study contained information relating to inequalities.

Focus groups were used to collect data in four studies (Bendelow et al. 1998, Chinn et al. 2004, Halliday et al. 1996, Wardle and Iqbal 1998). The study by Taylor and Halliday (1996) used a one-to-one interview. Self-completion questionnaires were used by three studies (Bendelow et al. 1998, Takriti and Lee 2000, Wardle and Iqbal 1998). Bendelow et al. (1998) also used a hypothetical scenario and other documentation.

Of the seven views studies identified, four used qualitative methods for data analysis (Bendelow et al. 1998, Chinn et al. 2004, Halliday et al. 1996, Wardle and Iqbal 1998). All of these used standard thematic analysis techniques. The studies by Wardle and Iqbal (1998) and by Bendelow et al. (1998) also used quantitative data analysis. The remaining three views studies used quantitative methods only; of which one (Taylor and Halliday 1996) used descriptive statistical methods, one (Takriti and Lee 2000) used inferential statistics (univariate analysis) and one (Joshi et al. 1994) used multivariate data analysis techniques (multi-linear regression).

Systematic reviews

The twelve systematic reviews were published between 1996 and 2005, with nine of these published after 2000.

In one systematic review, the study population was the general population (Lund and Aaro 2004). The remaining eleven systematic reviews included young people in their target population. Nine reviews also included children (the three that did not were Coleman et al. 1996, Elkington et al. 2000, Lund and Aaro 2004), five also included adults (Coleman et al. 1996, Elkington et al. 2000, Scanlan et al. 2001, Towner and Dowswell 2002, Towner et al. 2002), and one study also included older people (Towner 2002). The overall focus in all twelve reviews was a mixed sex study population.

Two thirds (N = 8) of the systematic reviews were conducted in the UK, two in Canada (Mackay et al. 1999, Scanlan et al. 2001) and one each in Australia (Elkington et al. 2000) and Norway (Lund and Aaro 2004).

Six systematic reviews contained information on inequalities which was relevant to the cycle helmet evidence synthesis (Dowswell et al. 1996, Dowswell and Towner

2002, Lund and Aaro 2004, Mackay et al. 1999, Royal et al. 2005, Towner et al. 2002). The reviews found relatively few studies which examined the impact of cycle helmet initiatives among different socio-economic groups, although they found more than were identified for other injury areas. Royal et al. (2005) were further restricted in their aim to evaluate the effectiveness of interventions with respect to social group by inadequacies in their source data.

The review by Mackay et al. (1999) also provided brief details of a study which found an association between ethnicity and helmet use.

Sports

A total of 43 potentially relevant correlational studies were excluded from the in-depth analysis as they did not tell us enough to be able to compare injuries between sports. Of the remaining twenty studies, one was classified as having a high weight of evidence in terms of answering our review question (Prescott-Clarke and Primatesta 1998), seven were judged to be of medium high usefulness (Desai et al. 1996, D'Souza 1994, Jones and Taggart 1994, Nicholl 1991, Sutherland et al. 1996, Williams et al. 1996, Rowell and Rees-Jones 1998), and the remaining twelve were rated as medium (Abernethy and MacAuley 2003, Balding 2002, Beattie et al. 1999, Choyce et al. 1998, Hassan and Dorani 1991, Jones 1987, Maclean 1989, Maffulli 1994, Oakland 1990, Pickard et al. 1988, Plugge et al. 2002, West Surrey Health Authority 2002).

There were no views studies included in this synthesis, one having been excluded on the grounds of low overall weight of evidence in terms of answering our review question (Bowling 1989).

Eight systematic reviews were found to contain useful information in relation to the effectiveness of interventions to reduce injuries in the sport and leisure environment.

Correlational studies

The twenty correlational studies in this synthesis were surveys published between 1987 and 2003. The vast majority (N = 17) of the studies employed a cross-sectional study design, and three used a prospective design (Desai et al. 1996, Maffulli 1994, Oakland 1990).

Six correlational studies were general surveys of a wide range of injuries and the circumstances in which they occurred, including sports participation (Balding 2002, Beattie et al. 1999, Prescott-Clarke and Primatesta 1998, Plugge et al. 2002, West Surrey Health Authority 2002, Williams et al. 1996). Five studies compared the incidence of injuries across a number of sports (Abernethy and MacAuley 2003, Jones 1987, Nicholl 1991, Pickard et al. 1988, Rowell and Rees-Jones 1998). Five studies examined injuries within specific sports; one focused on athletics injuries (D'Souza 1994), and one each on injuries related to ice-skating (Oakland 1990), snow-boarding (Sutherland et al. 1996) and shinty (Maclean 1989). The study by Maffulli (1994) focused on four sports (gymnastics, football, swimming, and tennis). Four studies examined particular types of injury: two of these were of eye injuries (Jones 1994, Desai et al. 1996), one of hand injuries (Choyce et al. 1998), and one of sport-related fractures (Hassan and Dorani 2001).

Nineteen studies examined a mixed sex population. In one study, the sample consisted of males only (Maclean 1989). One study used the sample drawn from the general population (Rowell and Rees-Jones 1998). All other nineteen studies included young people (aged 11-21 years) within their study population. Twelve

studies also included children aged less than 11 years in their sample, and twelve studies also included adults (aged 22 years and over). Older people were also included in the study population of six studies.

Nine studies examined the relationship between age and risk of accidental injury in the sports/leisure environment (Balding 2002, Choyce et al. 1998, D'Souza 1994, Jones 1987, Nicholl 1991, Oakland 1990, Pickard et al. 1988, Sutherland et al. 1996, Williams et al. 1996). Eleven studies examined the relationship between sex and risk of accidental injury (Abernethy and MacAuley 2003, Balding 2002, Beattie et al. 1999, Choyce et al. 1998, Hassan and Dorani 2001, Jones 1994, Maffulli 1994, Nicholl et al. 1995, Pickard et al. 1988, Rowell and Rees-Jones 1998, Williams et al. 1996). Fifteen studies included other variables in their analyses, seven of which proved relevant for our report (including social and economic status, alcohol consumption and presence of coach at time of injury).

A total of ten sport-related correlational studies contained information in relation to inequalities. The social and economic status of the study participants was explicitly stated in three studies (Choyce et al. 1998, Maffuli 1994, Williams 1998); in four studies this status was only implied (Balding 2002, Jones 1994, Prescott-Clarke and Primatesta 1998, West Surrey Health Authority 2002). In a further three studies this detail was not reported clearly (Beattie et al. 1999, Nicholl et al. 1995, Plugge et al. 2002). One study explicitly stated the ethnicity of the study participants (West Surrey Health Authority 2002) and in one study (Balding 2002) this information was unclear (as the study only presented data on the percentage of ethnic minority children in the schools from which they drew their samples). A further study stated the ethnicity of the adults in their sample (defined in their study as those aged 16 years and over), but it was unclear whether they collected data on the ethnic status of children who participated in their study (Prescott-Clarke and Primatesta 1998). One study analysed their data by social and economic status (Williams et al. 1996). No studies analysed by ethnicity.

In one study (Pickard et al. 1988) the data collection methods were unclear (stating only that a proforma was used, but not whether the patient completed it, or whether an interview was conducted by staff). Further details are as follows: self-completion questionnaire (N = 9); clinical test (N = 3); secondary data (N = 4); one-to-one interview (N = 7); self-completion report or diary (N = 1); observation (N = 2); other documentation (N = 3).

For data analysis, one study used an epidemiological measure (rate) only (Maclean 1989). Seven studies employed descriptive statistical methods: Abernethy and MacAuley (2003), Balding (2002), Choyce et al. (1998), Jones (1994), Jones (1987), Maclean (1989), Nicholl et al. (1995), Pickard et al. (1988). (Nicholl et al. (1995) also used epidemiological measures). Nine studies used both descriptive and inferential statistical methods (univariate analysis): Beattie et al. (1999), D'Souza (1994), Desai et al. (1996), Hassan and Dorani (2001), Maffulli 1994, Oakland (1990), Rowell and Rees-Jones (1998), Sutherland et al. (1996), West Surrey Health Authority (2002). (Sutherland et al. also used epidemiological measures). Three studies used multivariate data analysis techniques (in addition to descriptive and inferential statistics): Plugge et al. (2002) (factor analysis), Williams et al. (1996) (multi-logistic regression) and Prescott-Clarke and Primatesta (1998) (multi-logistic regression).

Views studies

There were no views studies included in this synthesis.

Systematic reviews

Eight systematic reviews were found which matched the selection criteria for this synthesis; publication dates ranged from 1996 to 2004 (five were published after 2000).

The reviews by Dowswell et al. (1996) and by Towner et al. (2001c) focused primarily on the leisure environment. One review focused solely on running injuries (Yeung and Yeung 2001). A review by Handoll et al. (2001) examined one specific type of intervention (ankle taping) that could be applied to a number of high-impact sports, including football and basketball. Scanlan et al. (2001) and Coleman et al. (1996) did not limit their initial search to particular sports; however, Scanlan et al. (2001) excluded from their in-depth analysis those sports that did not attract at least three articles. Norton et al. (2004) discussed interventions to prevent or reduce playground injuries. The eighth review, by Lund and Aaro (2004) discussed sport-related injury prevention interventions under a general category of environmental and product modification.

All eight reviews included intervention studies which included participants from both sexes. The studies reviewed by Lund and Aaro (2004) drew their samples from the general population. The remaining seven reviews were of interventions which included young people (11-21 years) in their target populations. In addition, four reviews included adults (Coleman et al. 1996, Handoll et al. 2001, Scanlan et al. 2001, Yeung and Yeung 2001) and four included children aged 10 years and under (Dowswell et al. 1996, Norton et al. 2004, Scanlan et al. 2001, Towner et al. 2001c). More specifically, the reviews by Towner et al. (2001c) and Dowswell et al. (1996) both evaluated the literature on the prevention of injury to children and young people aged 0-14 years. Norton et al. reviewed studies which targeted those aged between 0-15 years. The review by Coleman et al. focused on 15-24 year olds. Both Handoll et al. (2001) and Yeung and Yeung (2001) included studies of injury prevention strategies involving subjects from adolescence to middle age.

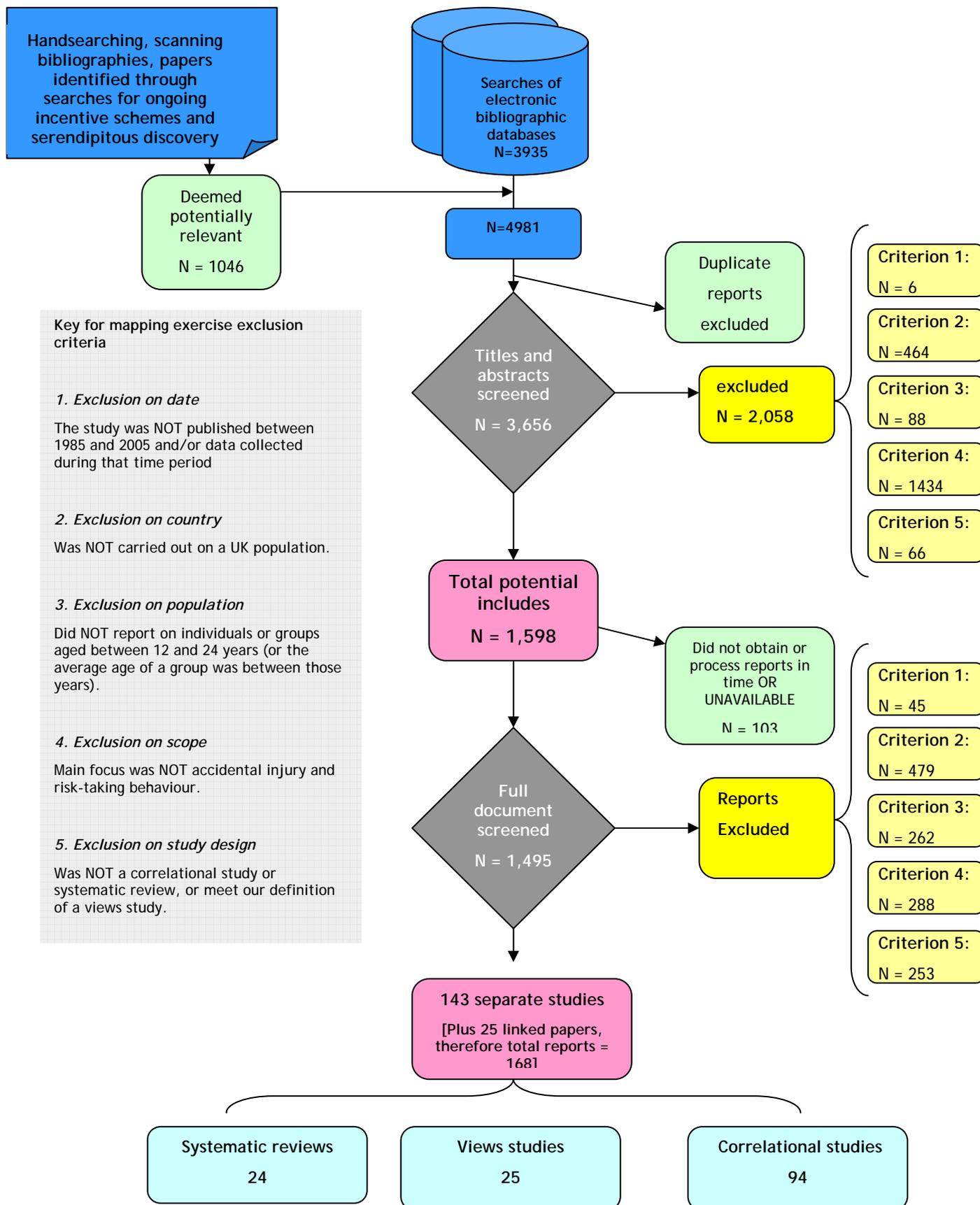
No reviews contained any relevant intervention studies which addressed the issues of inequalities or ethnicity in relation to injuries within the sports and leisure environment.

Coleman et al. (1996) addressed the issue of whether positive effects of interventions set in other countries would transfer to the UK situation. The review by Scanlan et al. (2001) also questioned the validity of transporting findings from one context to another.

The eight systematic reviews contained relevant evidence on interventions to prevent or reduce sports/recreational injuries in rugby, American football, football, basketball, alpine skiing, baseball, ice hockey, running, swimming, weight lifting, horse riding, squash/racquetball, and play in public playgrounds or sports fields.

Of the eight systematic reviews, five were conducted in the UK (Coleman et al. 1996, Dowswell et al. 1996, Handoll et al. 2001, Norton et al. 2004, Towner et al. 2001c), and one review each was set in Canada (Scanlan et al. 2001), Hong Kong (Yeung and Yeung 2001) and Norway (Lund and Aaro 2004).

Figure 11.10 Flow of studies through the review



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Appendix A: Terms used in database searches

Search Strategy: MEDLINE via OVID 1966 to October Week 2 2004

- 1 exp accidents/
- 2 exp accident prevention/
- 3 exp accidental falls/
- 4 exp accidents home/
- 5 exp accidents traffic/
- 6 exp drowning/
- 7 exp Poisoning/
- 8 "wounds and injuries"/
- 9 exp burns/
- 10 ((accident\$ or unintention\$ or unnecessary\$ or near\$) adj5 (harm\$ or injur\$ or death\$ or fatal\$ or morbidity or mortality or burn\$)).mp.
- 11 (accident\$ or injur\$ or crash\$).ti.
- 12 exp Accidents, Occupational/
- 13 or/1-12
- 14 exp RISK/
- 15 Risk taking/
- 16 risk reduction behavior/
- 17 harm reduction/
- 18 exp impulsive behavior/
- 19 exp risk management/
- 20 accident proneness/
- 21 (risk\$ adj3 (behav\$ or take or takes or taking or high or low or reduc\$ or assess\$ or perception\$ or perceive\$ or judge\$ or manage\$)).mp.
- 22 ((risk\$ or thrill\$ or adventur\$ or sensation\$ or buzz) adj3 (view\$ or opinion\$ or belie\$ or attitud\$ or talk\$ or discus\$ or interview\$)).mp.
- 23 helmet\$.mp.
- 24 ((safety or seat) adj2 belt\$).mp.
- 25 speeding.mp.
- 26 (ski or skis or skier\$ or skiing).mp.
- 27 (snow adj2 (board\$ or sport\$)).mp.
- 28 (danger\$ adj2 (drive\$ or driving)).mp.
- 29 ((thrill\$ or sensation\$ or adventur\$) adj2 seek\$).mp.
- 30 ((swim\$ or sport\$) adj3 (alcohol\$ or drug\$ or illicit\$ or drunk\$ or drink\$)).mp.
- 31 ((accident\$ or unintention\$) adj3 (drug\$ or overdose\$)).mp.
- 32 ((drive\$ or driving\$) adj2 (danger\$ or care\$ or attention\$ or unsafe\$ or risk\$ or speed\$ or drunk\$ or drink\$ or intoxicat\$ or influence\$ or alcohol\$ or drug\$ or illicit\$ or stimulant\$ or cannabis\$)).mp.
- 33 or/14-32
- 34 exp Child, Preschool/ or exp Child/ or exp Adolescent/
- 35 (young adj3 (female\$ or male or males or men or man or woman or women or people)).mp.
- 36 (youth\$ or juvenile\$ or teenage\$ or adolescen\$ or boy\$ or girls\$ or student\$ or pupil\$).ti.
- 37 exp adolescent behavior/ or exp child behavior/
- 38 or/34-37
- 39 and/13,33,38
- 40 limit 39 to (human and english language and yr=1985 - 2004)

41 (uk or united kingdom or GB or great britain or england or scotland or wales or ireland or ulster or britain).in.

42 40 and 41

Search Strategy: PsycINFO via OVID 1967 to October Week 2 2004

1 exp accidents/

2 exp accident prevention/

3 exp home accidents/

4 exp transportation accidents/

5 exp pedestrian accidents/

6 exp swimming/

7 exp poisoning/

8 drowning.mp.

9 "wounds and injuries"/

10 ((accident\$ or uninten\$ or unnecess\$ or near\$) adj5 (harm\$ or injur\$ or death\$ or fatal\$ or morbidity or mortality or burn\$)).mp.

11 (accident\$ or injur\$ or crash\$).ti.

12 exp wounds/

13 exp injuries/

14 exp safety/

15 exp working conditions/

16 exp industrial accidents/

17 exp occupational exposure/

18 exp work related illness/

19 or/1-18

20 exp risk factors/

21 exp risk management/

22 exp risk perception/

23 exp risk-taking/

24 harm reduction/

25 exp impulsiveness/

26 exp accident proneness/

27 (risk\$ adj3 (behav\$ or take or takes or taking or high or low or reduc\$ or assess\$ or perception\$ or perceive\$ or judge\$ or manage\$)).mp.

28 ((risk\$ or thrill\$ or adventur\$ or sensation\$ or buzz) adj3 (view\$ or opinion\$ or belie\$ or attitud\$ or talk\$ or discus\$ or interview\$)).mp.

29 helmet\$.mp.

30 ((safety or seat) adj2 belt\$).mp.

31 speeding.mp.

32 (ski or skis or skier\$ or sking).mp.

33 (snow adj2 (board\$ or sport\$)).mp.

34 ((danger\$ or risky) adj2 (drive\$ or driving)).mp.

35 ((thrill\$ or sensation\$ or adventur\$) adj2 seek\$).mp.

36 ((accident\$ or uninten\$) adj3 (drugs or overdose\$)).mp.

37 ((swim\$ or sport\$) adj3 (alcohol\$ or drug\$ or illicit\$ or drunk\$ or drink\$)).

38 ((drive\$ or driving) adj2 (danger\$ or care\$ or attention\$ or unsafe\$ or risk\$ or speed\$ or drunk\$ or intoxicat\$ or influence\$ or alcohol or drug\$ or illicit\$ or stimulant\$ or cannabis)).mp.)

39 or/20-38

40 (young adj3 (female\$ or male or males or men or man or woman or women or people)).mp.

41 exp elementary school students/ or exp primary school students/ or exp junior high school students/ or exp middle school students/ or exp high school students/ 42 (youth\$ or juvenile\$ or teenage\$ or adolescen\$ or boy\$ or girl\$ or student\$ or pupil\$).ti.

43 adolesen\$.mp.

44 exp adolescent development/

45 child.mp.

46 exp predelinquent youth/

47 exp juvenile delinquency/

48 exp marijuana/

49 or/40-48

50 and/19,39,49

51 limit 50 to (english language and yr=1985 - 2004)

52 (uk or united kingdom or GB or great britain or england or scotland or wales or ireland or ulster or britain).mp.

53 51 and 52

Search Strategy: CINAHL (Cumulative Index to Nursing and Allied Health Literature) via OVID 1982 to October Week 3 2004

1 exp accidents/

2 exp accident prevention/

3 exp accidental falls/

4 exp accidents traffic/

5 exp accidents home/

6 exp accidents occupational/

7 exp drowning/

8 exp poisoning/

9 "Wounds and Injuries"/

10 exp burns/

11 ((accident\$ or uninten\$ or unneces\$ or near\$) adj5 (harm\$ or injur\$ or death\$ or fatal\$ or morbidity or mortality or burn\$)).mp.

12 (accident\$ or injur\$ or crash\$).ti.

13 or/1-12

14 exp risk/ or injury/

15 exp injury/

16 exp risk for injury/

17 exp trauma/

18 exp risk for trauma/

19 exp risk taking behaviour/

20 risk reduction behaviour.mp.

21 exp impulse control disorders/

22 exp child behaviour disorders/

23 exp child development disorders/

24 harm reduction.mp.

25 exp risk management/

26 accident proneness.mp.

27 (risk\$ adj3 (behav\$ or take or takes or taking or high or low or reduc\$ or assess\$ or perceive\$ or judge\$ or manage\$)).mp.

28 ((risk\$ or thrill\$ or adventur\$ or sensation\$ or buzz) adj3 (view\$ or opinion\$ or belie\$ or attitud\$ or talk\$ or discus\$ or interview\$)).mp

29 helmet\$.mp.

- 30 ((safety or seat) adj2 belt\$).mp.
- 31 speeding.mp.
- 32 (ski or skis or skier\$ or skiing).mp.
- 33 (snow adj2 (board\$ or sport\$)).mp.
- 34 (danger\$ adj2 (drive\$ or drinking)).mp.
- 35 ((thrill\$ or sensation\$ or adventur\$) adj2 seek\$).mp.
- 36 ((swim\$ or sport\$) adj3 (alcohol\$ or drug\$ or illicit\$ or drunk\$ or drink\$)).mp.
- 37 ((drive\$ or driving) adj2 (danger\$ or care\$ or attention\$ or unsafe\$ or risk\$ or speed\$ or drunk\$ or drink\$ or intoxicat\$ or influence\$ or alcohol or drug\$ or illicit\$ or stimulant\$ or cannabis\$ or marijuana\$)).mp.
- 38 ((accident\$ or uninten\$) adj3 (drug\$ or overdose\$)).mp.
- 39 exp child,preschool/ or exp child/ or exp adolescent/
- 40 (young adj3 (female or male or males or men or man or woman or women or people)).mp.
- 41 (youth\$ or juvenile\$ or teenage\$ or adolescen\$ or boy\$ or girl\$ or student\$ or pupil\$).ti.
- 42 exp adolescent behaviour/
- 43 exp child behaviour/
- 44 or/14-38
- 45 or/39-43
- 46 and/13,44-45
- 47 limit 46 to (english and yr=1985 - 2004)
- 48 (uk or united kingdom or GB or great britain or england or scotland or wales or ireland or ulster or britain).in.
- 49 47 and 48

Search Strategy: EMBASE via OVID 1980 to 2004 Week 42

- 1 exp accidents/
- 2 exp accident prevention/
- 3 exp accidental falls/
- 4 exp accidents home/
- 5 exp accident traffic/
- 6 exp drowning/
- 7 exp poisoning/
- 8 exp occupational accident/
- 9 "wounds and injuries"/
- 10 ((accident\$ or uninten\$ or unnecess\$ or near) adj5 (harm\$ or injur\$ or death\$ or fatal\$ or morbidity or mortality or burn\$)).mp.
- 11 exp accidents/ and accident related phenomena.mp.
- 12 (accident\$ or injur\$ or crash\$).ti.
- 13 ((accident\$ or uninten\$) adj3 (drug\$ or overdose\$)).mp.
- 14 exp burns/
- 15 or/1-14
- 16 exp risk/
- 17 exp danger, risk, safety/ and related phenomena.mp.
- 18 exp risk management/
- 19 exp risk reduction/
- 20 risk taking/
- 21 harm reduction/
- 22 exp impulsiveness/
- 23 exp accident proneness/
- 24 (risk\$ adj3 (behav\$ or take or takes or taking or high or low or reduc\$ or assess\$ or perception\$ or perceive\$ or judge\$ or manage\$)).mp.

- 25 ((risk\$ or thrill\$ or adventur\$ or sensation\$ or buzz) adj3 (view\$ or opinion\$ or belie\$ or attitud\$ or talk\$ or discus\$ or interview\$)).mp.
26 helmet\$.mp
27 ((safety or seat) adj2 belt\$).mp
28 speeding.mp.
29 (ski or skis or skier\$ or skiing).mp.
30 (snow adj2 (board\$ or sport\$)).mp.
31 (danger\$ adj2 (drive\$ or driving)).mp.
32 ((thrill\$ or sensation\$ or adventur\$) adj2 seek\$).mp.
33 ((swim\$ or sport\$) adj3 (alcohol\$ or drug\$ or illicit\$ or drunk\$ or drink\$)).mp.
34 ((drive or driving) adj2 (danger\$ or care\$ or attention\$ or unsafe\$ or risk\$ or speed\$ or drunk\$ or drink\$ or intoxicat\$ or influence\$ or alcohol or drug\$ or illicit\$ or stimulant\$ or cannabis)).mp.
35 or/16-34
36 exp preschool child/ or exp child/ or exp adolescent/
37 (young adj3 (female\$ or male or males or men or man or woman or women or women or people)).mp.
38 (youth\$ or juvenile\$ or teenage\$ or adolescen\$ or boy\$ or girl\$ or student\$ or pupil\$).ti.
39 exp child behavior/ or exp puberty/
40 or/36-39
41 and/15,35,40
42 limit 41 to (human and english language and yr=1985 - 2004)
43 (uk or united kingdom or GB or great britain or england or scotland or wales or ireland or ulster or britain).in.
44 42 and 43

Search Strategy: ASSIA (Cambridge Scientific Abstracts)

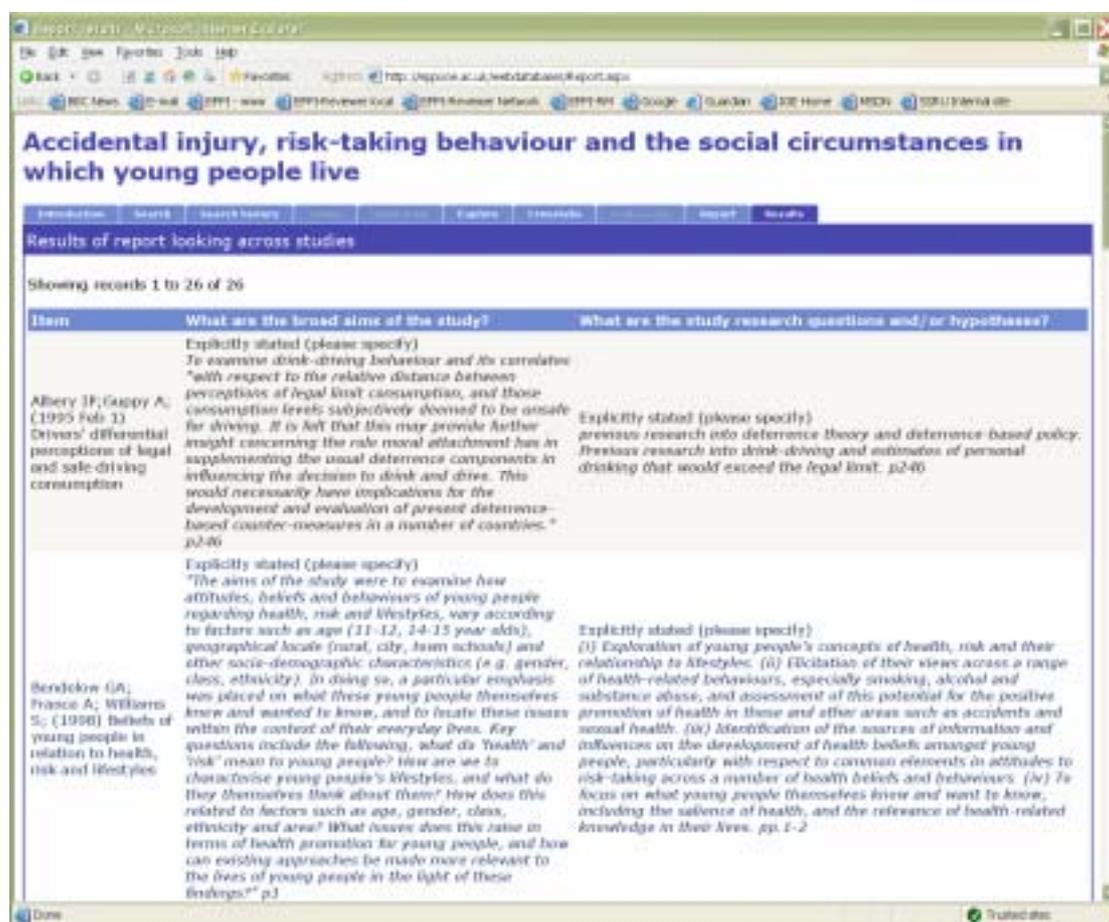
(de=(risks or (high risk) or (risk taking) or (risk preferences) or (risk reduction) or (binge drinking)) or TI=(risk* and (behav* or take or takes or taking or high or low or reduc* or assess* or perception* or perceive* or judge* or manage*)) or KW=(risk* and (behav* or take or takes or taking or high or low or reduc* or assess* or perception* or perceive* or judge* or manage*))) and (de=injuries or de=(accidents or (alcohol related accidents) or (crash recorders) or (fatal accidents) or (industrial accidents) or (road accidents)) or KW=((UNINTEN* or UNNECCES* or NEAR* or OCCUPATION* or WORK or DRUG* or OVERDOSE* or ACCIDENT*) and (HARM* or INJUR* or DEATH* or FATAL* or MORBIDITY or MORTALITY or BURN* or CRASH* or POISON* or DROWN*)) or TI=((UNINTEN* or UNNECCES* or NEAR* or OCCUPATION* or WORK or DRUG* or OVERDOSE* or ACCIDENT*) and (HARM* or INJUR* or DEATH* or FATAL* or MORBIDITY or MORTALITY or BURN* or CRASH* or POISON* or DROWN*)))

Search Strategy: ERIC (Cambridge Scientific Abstracts)

(TI=(risk* and (behav* or take or takes or taking or high or low or reduc* or assess* or perception* or perceive* or judge* or manage*)) or KW=(risk* and (behav* or take or takes or taking or high or low or reduc* or assess* or perception* or perceive* or judge* or manage*)) or de=(risk or (adventure education) or (risk management))) and (KW=((UNINTEN* or UNNECCES* or NEAR* or OCCUPATION* or WORK or DRUG* or OVERDOSE* or ACCIDENT*) and (HARM* or INJUR* or DEATH* or FATAL* or MORBIDITY or MORTALITY or BURN* or CRASH* or POISON* or DROWN*)) or TI=((UNINTEN* or UNNECCES* or NEAR* or OCCUPATION* or WORK or DRUG* or OVERDOSE* or ACCIDENT*) and (HARM* or INJUR* or DEATH* or FATAL* or MORBIDITY or MORTALITY or BURN* or CRASH* or POISON* or DROWN*)) or de=injuries or de=(accidents or (school accidents) or (traffic accidents) or (accident prevention)))

Appendix B: Introduction to the online database

Since systematic reviews aim to be transparent, and therefore summarise the data on which their findings are based, they usually contain tables in appendices which describe the outcome of data extraction and quality assessment. However, these can take up a great number of pages and, in the case of this review, presentation of even a limited sub-set of the data collected runs to more than 100 pages. Now that internet access is so widespread we have decided to place this information in an online database which can be searched via the web. Using this method, we have been able to present far more information than usual and give readers the opportunity to run their own reports using an interface to our data that is similar to the one we used when writing the review. As well as searching using dozens of categories or free-text terms, it is possible to 'explore' the categories, cross-tabulate areas of interest, run detailed reports and see full information about each study. An example screenshot is shown below.



The database is available at: <http://epi.ioe.ac.uk/webdatabases/Intro.aspx?ID=4>.

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

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