

Road Safety Research Report 101

**Child–Parent Interaction in
Relation to Road Safety
Education: Part 1 – A Critical
Literature Review**

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December 2008

Department for Transport: London

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ISBN 978 1 906581 53 4

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EXECUTIVE SUMMARY

The purpose of this review was:

- to identify and provide a critical review of the research and literature concerned with parent-child interaction in relation to road safety education in order to inform the **Child-parent interaction in relation to road safety education** study completed in 2007; and
- to consider the published evidence for the effect of strategies that parents use in training their children to be safer road users and to consider ways of engaging parents in road safety education.

The term 'children' refers to the age group 0 to 18. The reason for this is that, although most research on child-parent interaction tends to focus on the 0 to 14 age group, some studies, mainly those concerned with teen drivers, include young people aged 16 to 18. The term 'parent' refers to any adult accompanying the child.

Methodology

The review was based on conventional systematic review methodology and guided by the Centre for Reviews and Dissemination guidelines on undertaking systematic reviews (NHS Centre for Reviews and Dissemination, 2001) and the Health Development Agency's *HDA Evidence Base Process and Quality Standards Manual for Evidence Briefings* (Swann *et al.* 2003).

The inclusion criteria stipulated that articles needed to address:

- formal and informal interaction between parents and children;
- ways in which parents influence their children to become safer road users;
- factors influencing risk and parents' perceptions of risk; or
- how parents' attitudes and behaviours towards their children's road safety are formed.

The search identified 27 studies and six reviews written up in 47 articles and reports, which were grouped under the following headings:

- reviews;
- pedestrian safety;
- walking buses;
- traffic clubs;
- cycling safety;

- parent-child interaction in the car; and
- teen driver safety.

The quality of each study and review was judged on the basis of transparency and systematicity. In addition, studies were assessed on the appropriateness of the study design and methods in relation to the objectives, how these were reported, the reporting of the intervention or the parent-child behaviour being investigated, and the generalisability of the findings.

A judgement of the level of effect was made based on the clarity and comprehensiveness of the findings and the appropriateness and quality of the methods. The evidence of effect for each study was classed as unclear, high, medium, low/no or harmful.

These outcomes were summarised as the following evidence statements, utilising the National Health Service's Centre for Reviews and Dissemination guidelines (NHS Centre for Reviews and Dissemination, 2001):

- **Sufficient (review-level) evidence:** clear evidence and conclusions from at least one high-quality intervention study or evaluation study, or from at least one appropriate high-quality study/review with no conflicting evidence between studies/reviews.
- **Some (review-level) evidence:** some evidence and/or conclusions from high-quality studies/reviews; or conflicting conclusions/findings among high-quality studies/reviews; or clear evidence/conclusions from at least one medium-quality study/review.
- **Insufficient (review-level) evidence:** no evidence or conclusions from high-quality studies; only some evidence and/or conclusions from low-quality studies/reviews.
- **No (review-level) evidence:** no evidence or conclusions available from studies or reviews.

Main findings

The review found that holding hands is the most common form of parent-child interaction when crossing roads. Observational studies suggest that there is some evidence that children accompanied by adults tend to rely on the adult for safety, and therefore tend not to demonstrate safe road behaviour. On the other hand, unaccompanied children seem to be more likely to do road safety checks than accompanied children. Interestingly, there also seems to be a lack of consistency in both adults' and children's road crossing behaviour. There is some evidence that brief and focused conversations between the parent and the child is associated with more disciplined road behaviour.

One intervention study suggests that ‘edutainment’ in the form of an educational video may not be effective, despite parents considering it a useful tool. However, the study had some methodological limitations, which should be taken into account. There is some evidence to suggest that an educational booklet using an error-avoidance perspective is effective in increasing traffic skills and traffic awareness, although there is insufficient evidence of the effect of traffic clubs. However, earlier evaluation studies suggest that traffic clubs are effective in promoting road safety. With regard to cycling safety, there is some evidence to suggest that parents’ perceptions of the local traffic environment are important factors in determining children’s cycling patterns.

Regarding parent–child interaction in the car, research shows that parents’ driving styles have an impact on teenagers’ car safety behaviour and, in particular, seat-belt use. This review demonstrates that parental monitoring and control influence their children’s safe driving. American studies have demonstrated that parents often lack awareness of teenage drinking and driving, and frequently deny their own child’s involvement in such activities. In addition, parental driving rules and the consequences of breaking the rules are not always clearly defined and are unambiguous. In the USA, driving agreements with a persuasive educational input have been found to be effective in encouraging parents to use the driving agreements, increase the frequency of driving instruction and implement driving restrictions.

This review found that there is a lack of good-quality research that considers both the physical interaction (such as holding hands) and the verbal interaction (instructing, encouraging problem-solving in the traffic environment) between parents and their children. In addition, there is a lack of research that compares child–parent interaction as pedestrians or as ‘other’ road users in different geographical environments or in different socio-economic circumstances. Although walking buses and traffic clubs have been evaluated, there is a need for rigorous good-quality evaluation of their effectiveness. No studies were identified that considered child–parent interaction as cyclists, particularly regarding the actual process of road safety interaction between the parent as a cyclist or as a pedestrian and the child as a cyclist. Considering the large amount of research into the effectiveness of cycle helmets, there is a paucity of understanding as to how negative attitudes to helmet use arise and how such attitudes might be influenced. Finally, there is an urgent need for good-quality studies on parent–child interaction and driving safety in the UK. The lack of such research means that it is difficult to draw any firm conclusions from existing research in relation to British circumstances. This review also highlighted a need for European studies on parents’ and teenagers’ expectations regarding driving safety and parental control, and the effectiveness of driving agreements in a European context.

A major gap identified by this review was the lack of research regarding road safety and children with disabilities. The findings suggest that inequalities associated with disability, children and road safety have not been addressed in any research studies.

In conclusion, this review identified a small number of relevant studies of varying quality. In most studies effect was determined through impact measures or descriptive analysis, rather than through outcome measures, such as morbidity and mortality. Importantly, research suggests that children, when in the company of an adult, rely on the adult for safety. The review found conflicting evidence regarding parents' understanding of their children's level of experience and ability, and regarding the effectiveness of traffic clubs and other similar interventions. Finally, there is limited knowledge of the association between verbal and physical interaction, and a lack of knowledge regarding road-crossing behaviour other than for parents and children as pedestrians. A major gap in this field is the lack of research into inequalities relating to the determinants of health.

1 INTRODUCTION

The national health policy *Saving Lives: Our Healthier Nation* (Secretary of State for Health, 1999) identified accidents as a priority area and children as a major target group. The road safety and casualty reduction strategy *Tomorrow's Roads Safer for Everyone* was published in the following year (DETR, 2000) and set a target for 2010 of:

a 50% reduction in the number of children killed or seriously injured [compared with the average for 1994–98].

The Task Force on Accidental Injury was set up in 2000 and included reducing child pedestrian casualties as one of the priorities for action (Accidental Injury Task Force, 2002).

The purpose of this review is to identify and provide a critical review of the research and literature concerned with parent–child interaction in relation to road safety. The report begins by providing the background to the review, including statistical information on child road casualties followed by an overview of the potential contribution of parents. It also provides the theoretical framework for the study. The report then sets out the review methodology before considering the evidence that is currently available. The final sections provide a discussion of the findings and recommendations for policy, practice and research based on the findings.

1.1 A note on terminology

The age range associated with the terms ‘children and early adolescents’ is conventionally up to the age of 16 years. However there is variation—some studies focus on the 0 to 14 age whereas others extend the age range up to 18 and these have been included, where relevant, within this review.

Although the term ‘parent’ is used throughout, it is taken to include all adults with care and control of children and others acting in *loco parentis*, such as older siblings.

2 EPIDEMIOLOGY OF CHILD ROAD TRAFFIC ACCIDENTS IN THE UK

Fatality rates for children in the UK are relatively low compared with other European countries and show a consistent downward trend over the last 20 years. Statham (2004) reported a reduction below the 1994–98 baseline in rates for fatal and serious injury in children of 16% for pedestrians, 47% for pedal cyclists and 32% for child passengers. However, unintentional injury remains the major cause of death and disability in children (Towner *et al.*, 2005), with 4,100 children killed or seriously injured in 2003 (Department for Transport, 2004). The DETR (2000) also noted that, although the overall record for child safety is good, child pedestrian injury rates are poor in comparison with other European countries.

White *et al.*'s *Statistical Review of Child and Early Adolescence (0-15 year olds) Accidents* (2001) identified a number of key differences in casualty patterns in relation to cause, age and gender. It also identified the 10–14s as the age group in which fatality rates were falling less steeply. The casualty rate among child pedestrians was 154 per 100,000 in 1998 compared with the pedal cyclist casualty rates of 60 per 100,000. Interestingly, the child passenger casualty rate has increased to 158 per 100,000. White *et al.* propose that this reverse trend may be due to an increase in car use for transporting children. As might be anticipated, younger children (the 0–4 age group) are over-represented in passenger casualties. In relation to the number of children killed or seriously injured in 2003, Statham (2004) reports that the majority (2,381) are pedestrians, followed by car users (885) and then pedal cyclists (595), with the greatest numbers in each instance being in the 12–15 year age group.

There are also clear gender differences. White *et al.* (2001) noted that casualties among girls are more likely to be incurred as a passenger than boys (52% female child casualties compared with 32% male). Conversely, casualties among boys are more likely to be as pedal cyclists or pedestrians than girls (25% and 8% of casualties being pedal cyclists, and 43% and 40% of casualties being pedestrian). More recently, Statham (2004) also noted more male child pedestrian and pedal cyclist casualties than female, but approximately equal **numbers** of casualties involving child car users. Over and above these specific differences, boys generally experience more road traffic casualties than girls, with a ratio of 3:2 in the five-year period 1994–98 (White *et al.*, 2001). The Department for Transport (2002) notes that about twice as many boys are killed or seriously injured on the roads than girls, with even more marked differences for pedestrians where boys outnumber girls by about five times. This may be indicative of different styles of parenting for girls and boys, particularly with regard to protection, supervision and exposure to risk. Although White *et al.* conclude that the difference cannot be explained by exposure in terms of travelling time or distance.

Fatality rates and serious and slight casualty rates for children all increase with age up to about the age of 12 and then remain constant (White *et al.*, 2001). Twelve- to fifteen-year-olds have twice the annual fatality rate of the 0–4 age group and three times the rate for serious and slight injuries. However, the Department for Transport (2002) notes that, although the figures are still higher for 12–15-year-old girls, in recent years the figures for fatalities and serious injuries are higher for boys in the 8–11-year-old group.

White *et al.* (2001) also identify a number of pertinent environmental factors which are summarised in Table 2.1. It is interesting to note that, although Hine (1996) found that heavy traffic volumes were associated with high levels of anxiety about road crossing and the parents’ perception of the greater need for accompaniment, White *et al.* noted that unclassified roads are particularly dangerous for pedestrians and driver/riders (including cyclists).

Table 2.1: Environmental factors and casualties (information derived from White <i>et al.</i> 2001)	
Environment	Groups for which there are relatively high casualty numbers
Speed limit greater than 30 mph	Child passengers Females more than males
Unclassified roads	5–7 year age group Driver/riders Pedestrians Males more than females
Single-track roads	Drivers/rider
One-way streets	Pedestrians 0–4 age group (passenger and pedestrian)
Junctions: Within 20 metres of a junction Roundabouts Crossroads T junction Y junction Staggered junction Private drive or entrance	Driver/rider Child passengers Passenger Passenger Driver/rider Pedestrians Driver/rider Pedestrians Driver/rider Pedestrians Driver/rider Pedestrians
Wet conditions and snow	Passengers

Child casualty rates are higher in the summer months and on Fridays and Saturdays. They are also highest between 8 and 9 o'clock in the morning during term time and also late afternoon and early evening, times that are associated with travel to school. One in four casualties in the 12–15 age group occur on journeys to and from school in contrast to 14.6% among 5–7-year-olds (Department for Transport, 2002). The Department for Transport (2005) notes that between 3pm and 4 pm, when children are leaving school, is the peak time for personal travel and that at 8.50am 21% of car trips in urban areas are taking children to school. White *et al.* (2001) also conclude that daylight is an important factor—particularly for the 12–15 year age group in which 24% of casualties happen in the darkness.

Beckett and Johnston (1997) explored the social pattern in families of children who had experienced a non-fatal road injury using a case-control study. They found that vulnerability was associated with illness in the household (maternal or other family member), maternal preoccupation, being more crowded, and not providing protection during play or play facilities.

Towner *et al.*'s (2005) review, *Injuries in Children Aged 0–14 years and Inequalities*, identified a number of factors associated with inequality—age, gender, socio-economic group, ethnicity and place.

The association between social deprivation and injury is well recognised. For example, Roberts and Power (1996) found that between 1989 and 1992 the death rate from injury for children in social class V was five times that in social class I. Over the period 1979–83 to 1989–92, motor-vehicle accident death rates declined by 30% and 39% in social classes I and II compared with 18% in social class V. The DETR (2000) also noted that children in the lowest socio-economic groups have five times the pedestrian fatality rates than those in the highest socio-economic groups. White *et al.*'s (2001) case study of Lothian found that children up to 11 years old from the most deprived parts of Lothian had six times the risk of pedestrian traffic casualty than more affluent children. The risk factors identified included being less likely to be driven and more likely to play on the street. Children from minority ethnic backgrounds are also more likely to be injured on the roads (DETR, 2000).

See Box 2.1 for the key variables included in the study.

Box 2.1: Key variables for inclusion in the study

- Gender males more vulnerable than females.
- Age increasing rates among older age groups.
- Social deprivation.
- Ethnicity.
- Diurnal, weekly and seasonal variation in casualty rates peak early morning and evening, weekends and August.
- Location:
 - area urban/suburban/rural; regional variations; and
 - specific unclassified roads, two-lane single carriageways, T,Y and staggered junctions, and pelican/puffin crossings.

3 PERCEPTIONS, BELIEFS AND ATTITUDES ABOUT SAFETY AND RISK IN THE TRAFFIC ENVIRONMENT

Towner *et al.* (2005) suggest that the existence of variations in road casualties signals considerable scope for prevention. However, the development of appropriate interventions will depend on a fuller understanding of the mechanisms leading to these differences and the characteristics of target groups. Fundamentally, variations may be attributed to an imbalance between children's exposure to different levels and type of risk and their capacity to manage risk successfully. Parents and other carers clearly have a central role in protecting children from hazards and also in developing their ability to be safer road users. This is recognised in Towner *et al.*'s (2005) three tiers of influence:

- proximate tier, which included the immediate conditions that result in exposure to hazard and children's abilities to manage hazards;
- intermediate tier, which includes childcare practices; and
- ultimate tier, which includes wider social, economic, political and cultural processes.

In an absolute sense, a key question concerns the level of exposure to risk faced by children. Notwithstanding the overarching responsibility to minimise risks within the environment, children, as they mature, still need to develop the ability to identify and respond appropriately to risk in order to become safe, independent road users.

Elliott and Baughan's (2003) survey of adolescent road-user behaviour drew on two previous qualitative studies. The Scottish Office Central Research Unit (1998) found two different types of risky road behaviours – common risk behaviours, such as running across roads or walking between parked cars, and extreme risk behaviour, including deliberately running out in front of parked cars (playing chicken) and holding onto vehicles while roller-blading. Campbell and Keegan (2000) also note such high-risk behaviour along with playing football in the street and other trends such as using mobile phones. Elliott and Baughan identified three distinct types of behaviour:

- unsafe road crossing practices;
- dangerous play in the road; and
- self-protective behaviour which involved some planning, for example wearing cycle helmets.

Younger groups (11–12 years) reported less unsafe road crossing and dangerous play than older (13–16 years) groups and more planned protective behaviour. Such

‘desirable’ behaviour was more common in females than males. ‘Undesirable’ road-use behaviour was more common in cases where respondents reported that they had been out with friends than in cases where they had reported that they had been out with adults. Those who reported ‘unsafe’ behaviour were well aware of the risks they incurred and the more often they engaged in the behaviour, the more accurate their perception appeared to be. Those in rural areas reported more dangerous playing and more planned protective behaviour.

Towner *et al.*’s review found a number of factors associated with the increased risk of injury as children get older. These include developmental factors, such as physical development, motor co-ordination, perceptual development, and cognitive and intellectual development. Increasing levels of independence and freedom, exposure to different environments and lower levels of supervision also contributed. Immature behaviour and risk taking in adolescence were additional factors. In relation to gender, in addition to possible innate differences such as rates of physical development, motor co-ordination, spatial ability, cognition and intellectual development, Towner *et al.* (2005) identified other variables that could be linked to differences in socialisation. These include differences in behaviour, including risk taking and peer pressure, different types of play and exposure to different environments, different levels of supervision and different levels of independence and freedom. The report recognised that social deprivation and culture and ethnicity are inextricably linked. It notes a paper by Christie (1995) which suggests that there may be differences in the way non-white parents perceive risk. Key factors in relation to the effect of socio-economic status and ethnicity in relation to inequality in childhood injury include differences in exposure to hazardous environments and the ability of parents and carers to supervise children. However, the report draws on a review by Thomson *et al.* (2001) which suggests that, despite structural factors, it is possible to identify specific ‘ethnic’ factors associated with risk and these are supervision, socialisation and opportunities to learn. Furthermore, Thomson *et al.* note that recent immigrants’ lack of familiarity with the road environment may disadvantage them in acting either as role models or teaching their children about road safety. In Towner *et al.*’s report, ‘place’ is seen as where these various structural factors and human agency interplay.

3.1 Restriction and control

A number of authors (Mullan, 2003; Dixey, 1998; Hillman *et al.*, 1991) have commented on greater restrictions placed on children’s independent travel because of parental concern about safety. The Department for Transport (2005) identified concerns about traffic danger as parents’ main reason for accompanying children aged 7–10 years to school, followed by fear of assault or molestation. Further, between 1992/94 and 2002/03 the proportion of school trips by car increased from 30% to 40%, and trips on foot decreased from 61% to 52%. Paradoxically, this lack of experience in real roadside situations restricts the development of those skills and competences which children need to be able to become safer, independent road

users. Jones *et al.* (2000) also found that ‘accompanied travel to school and for leisure purposes was everywhere the norm’. They also note that children were less likely to travel unaccompanied in urban areas than in suburban or rural areas where, even in the dark, it was more common for children to travel alone. Girls reported greater levels of parental supervision than boys, and both groups appeared to be striving for greater independence.

The DETR (2000) make the point that children are more likely to be injured if they go out without adults before they have developed good road sense. In order to exercise appropriate levels of supervision and accompaniment, parents need to make fine judgements about the level of risk and their child’s capacity to consistently cope with that risk. Ampofo-Boateng and Thomson (1991) found that 5–7-year-olds had poor skill in identifying dangerous road-crossing sites and were reluctant to deviate from the most direct routes – even when these were dangerous. Even if children know how they should cross, their inability to make judgements about risk still makes them very vulnerable. By the age of 11 children had acquired good skill in making these judgements. Tabibi and Pfeffer (2003) also noted an improved ability to distinguish safe and dangerous crossing sites with age. Additionally, they commented on the ability to resist interference from irrelevant stimuli which also increased with age. This reduced the time taken to identify safe and dangerous crossing sites. They conclude that attention is needed for quick and accurate identification of road-crossing sites.

A study of parental attitudes to road safety education (ODS Ltd with Market Research UK Ltd, 2004) found parents to have high levels of confidence about their children’s capability and to see the main risk being drivers rather than their children’s behaviour. However, they were also aware that road safety awareness and skills deteriorated in teenagers and when children were among a group of friends.

3.2 Education

The study of parental attitudes to road safety education (ODS Ltd with Market Research UK Ltd, 2004) found that parents see themselves as being responsible for developing their children’s road safety awareness and skills. Parents were more likely to reinforce road safety messages with younger children rather than teenagers who they felt might react against too much advice. The most common approach is to provide a good example in real-life situations. Parents claimed to improve their behaviour when using the roads with their children. At the same time the report found that 20% of parents would not be able to give correct advice about particularly risky situations. The study concluded that there is a need for more research about child–parent interaction in real-life road- and travel-related situations. Clearly, to be effective educators, parents will require an understanding of their children’s needs and the ability to use appropriate methods. They will also need to achieve consistency and balance between educating by example and more explicit forms of education.

This report considers the published evidence for the effect of strategies that parents use in training their children to be safer road users and considers ways of engaging parents in road safety education.

3.3 Theoretical perspectives

Psychosocial models such as the Health Action Model (Tones and Green, 2004) provide a useful organising framework for the various influences on health-related behaviour. Although generally used to analyse the more proximal determinants of behaviour, such as the factors influencing children’s road-crossing behaviour, it could equally apply to the factors influencing parental decisions about:

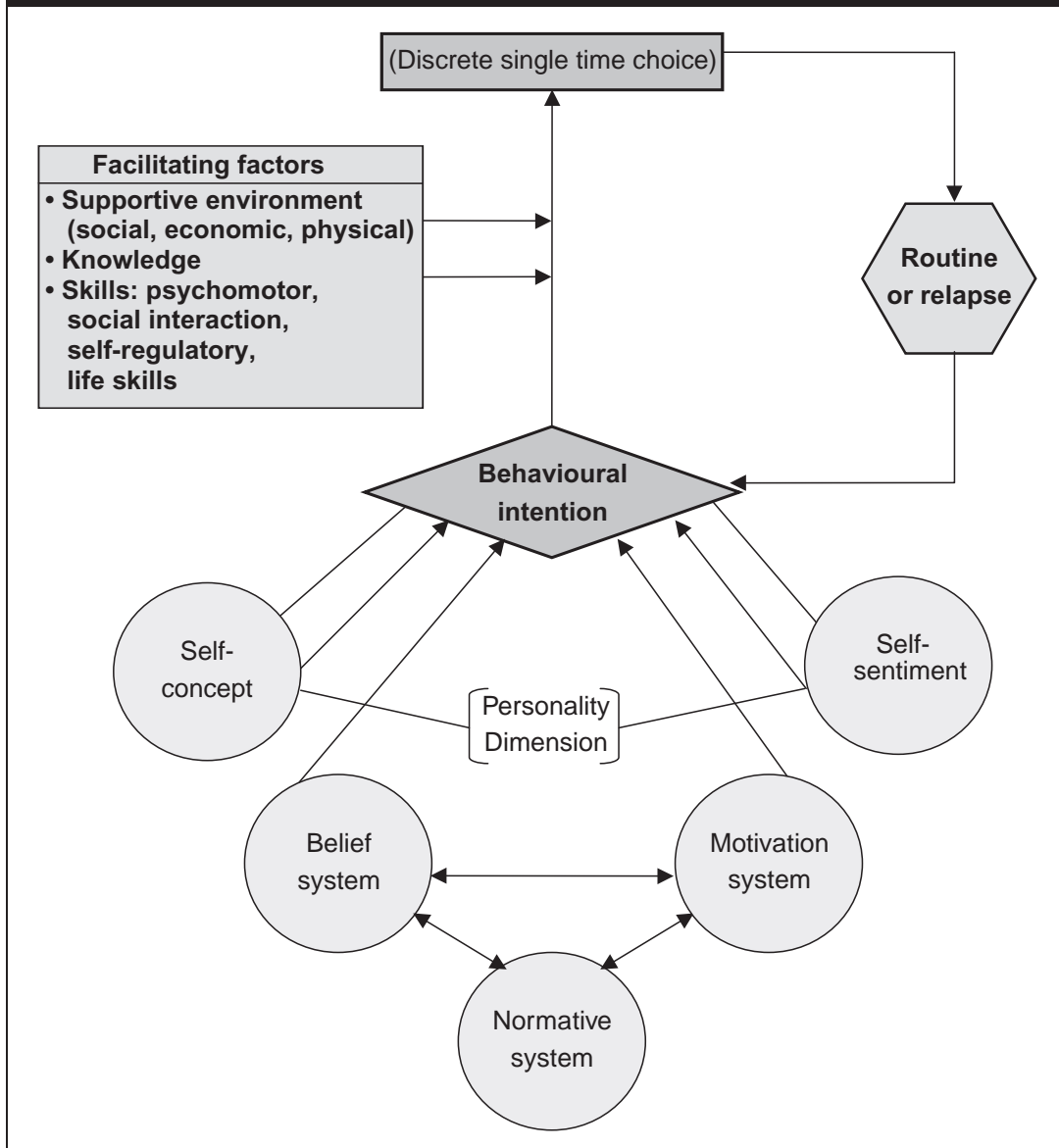
- accompanying their children;
- the amount of independence they allow;
- whether they educate their children about road safety; and
- at what age and how they educate their children about road safety.

An overview of the Health Action Model is represented in Figure 3.1. The intention to carry out a particular behaviour is the product of three interacting systems: the belief system, the motivational system and the normative system. Within each of these systems there will be a range of positive and negative influences. For example, within the belief system, young people may believe that crossing between parked cars is risky, but at the same time may not believe that they will be injured by doing it on a particular occasion. They may also believe that they will be disapproved of by their peers for not crossing. The belief that one is capable of carrying out a particular behaviour (so called self-efficacy belief) is also important. Motivational factors, such as being in a hurry or not wishing to appear ‘chicken’ in front of friends, may conflict with the motivation not to be injured. Further, perceptions about norms in relation to road use and the opinions of parents and peers will exert an influence.

The summation of all these various influences, along with more general factors such as self-concept, self-sentiment and personality factors, will produce a behavioural intention. Whether an individual is capable of carrying out that behaviour will depend on their own personal skills and knowledge, and the existence of a supportive environment. Their experience of carrying out the behaviour in question will operate in a feedback manner and influence whether the behaviour becomes routine.

It is clear from a Health Action Model analysis that the development of a consistent and safe road-use behaviour requires the development of knowledge about safe road use, beliefs about the net positive outcomes of adopting safe road-use behaviour and motivation to comply with good practice. Perceptions about normative influences and particular that of significant people, such as family and peers will also have

Figure 3.1: Health Action Model (source: Tones and Green, 2004)



an important effect. The development of appropriate skills, awareness and judgement is fundamental to being able to carry out behaviours and the level of skill needs to be appropriate to the level of risk. It is likely that the interplay of determinants will be different for safe road-crossing practices, planned self-protective behaviour and dangerous play. Applying the model to the parents' role in accompanying or supervising their children, or as educators, would indicate that whether and how they approach the task will also be the product of relevant beliefs, motivation and normative factors, along with their skills.

Although the determinants of behaviour and the learning needs of individuals and groups can be identified using the Health Action Model, insight into the learning process associated with the acquisition of health behaviour requires recourse to theory such as the Social Learning Theory and its subsequent extension as the

Social Cognitive Theory (Baranowski *et al.*, 1997). A major tenet of this theory is that people gain experience and understanding which shape their behaviour through observation. The modelling role of parents will therefore make a significant contribution to children's learning about road use and their development of traffic competence – whether parents are aware of it or not and whether the example they set is good or bad. The actual consequences of behaviour and the anticipated consequences in terms of 'reward' or 'punishment' are also important influences. These may range from approval or disapproval of parents or peers through to the experience of injury or near miss. Vicarious reinforcement can occur from observation of the consequences other people experience as a result of carrying out certain behaviours. A further important influence is perceived self-efficacy, which is concerned with judgements about how well one is able to carry out the actions needed to cope within specific situations. Self-efficacy is a critical determinant of self-regulation, which in turn is influenced by the amount of external control imposed on the individual. While observational learning can contribute to some extent to the development of these latter two constructs, it will be enhanced by practical experience in real situations.

4 METHODOLOGY

The purpose of this review was:

- to identify and provide a critical review of the research and literature concerned with parent-child interaction in relation to road safety in order to inform the **Child-parent interaction in relation to road safety education** study completed in 2007;¹ and
- to consider the published evidence for the effect of strategies that parents use in training their children to be safer road users and to consider ways of engaging parents in road safety education.

The term ‘children’ refers to the age group 0–18. The reason for this is that, although most research on child-parent interaction tends to focus on the 0–14 age group, some studies, mainly those concerned with teen drivers, include young people aged 16–18. The term ‘parent’ refers to any adult accompanying the child.

4.1 Identification of the literature

An extensive and systematic search was conducted to identify the relevant literature. The review was guided by the Centre for Reviews and Dissemination guidelines on undertaking systematic reviews (NHS Centre for Reviews and Dissemination, 2001), and the Health Development Agency’s *Evidence Base Process and Quality Standards Manual for Evidence Briefings* (Swann *et al.*, 2003).

Electronic searches were conducted on the following databases and websites:

- AA Foundation.
- Academic Search Elite.
- Applied Social Sciences Index and Abstracts (ASSIA).
- Brake.
- Campbell Collaboration.
- Centre for Reviews and Dissemination.
- Child Accident Prevention Trust (CAPT).
- ChildData.
- Child Health Promotion Research Unit (Australia).
- Cochrane Database of Systematic Reviews.

1 It should therefore be noted that the systematic review was completed **before** the fieldwork for the main study commenced.

- Cochrane Library.
- CSA (Cambridge Scientific Abstracts).
- Cumulative Index to Nursing and Allied Health Literature (CINAHL).
- Department for Transport.
- Department of Health.
- EBSCO.
- ERIC (Education Resources Information Centre)
- Health Promis: HDA Evidence Base briefing documents; Topic.
- Health Education Board for Scotland (HEBS).
- Kids and Traffic.
- Medline.
- National Electronic Library for Health.
- Pre-CINAHL.
- PsycARTICLES.
- PsycINFO.
- Pubmed.
- Royal Society for the Prevention of Accidents (RoSPA).
- Social Services Abstracts.
- Sociological Abstracts.
- Sustrans Sustainable Transport (including Safe Routes to Schools).
- Transport Research Laboratory (TRL).
- World Health Organisation (WHO).

In addition, reference lists were searched manually and experts in the field were consulted. The search strategy is illustrated in Figure 3.1. Full details of the search strategy process are shown in Appendix 1.

The following inclusion criteria were used:

- Any language (although this was limited to the databases that were searched).
- Articles between 1990 and 2005.
- Formal and informal interaction between parents and children.
- Ways in which parents influence their children to become safer road users.

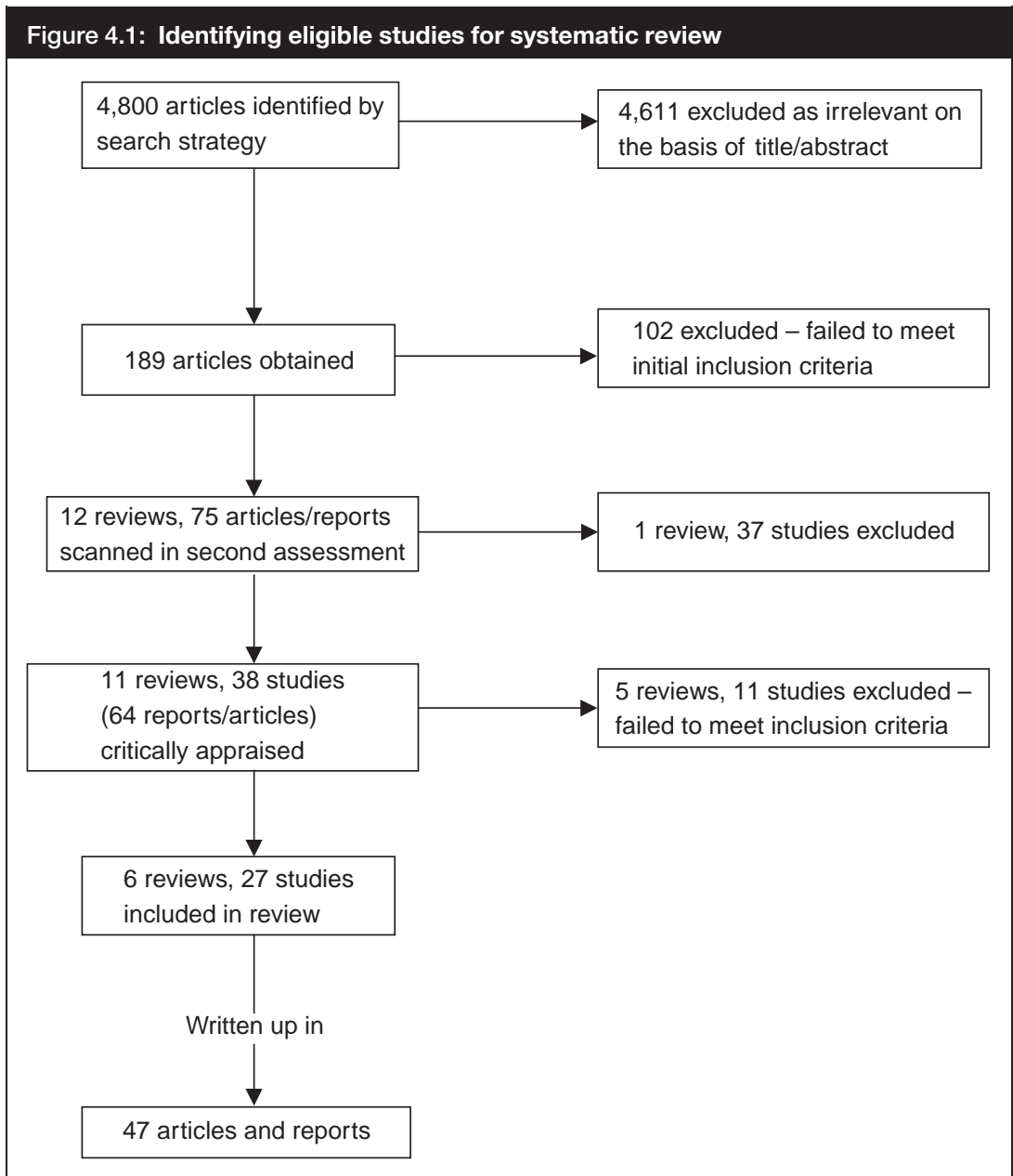
- Factors influencing risk and parents' perceptions of risk.
- How parents' attitudes and behaviours towards their children's road safety are formed.

This provided a broad-based search, which identified a wide range of studies as follows:

1. Reviews (systematic literature reviews, literature overviews).
2. Observational studies.
3. Surveys.
4. Intervention studies.

Of the 4,800 article titles and abstracts identified through the search and were scanned, 189 articles, reports and book chapters were retrieved for initial assessment (see Figure 4.1). These were scanned using the broad inclusion criteria and 102 papers were excluded, leaving 87 articles, reports and book chapters. These consisted of 12 reviews and 75 articles and reports dealing with parent-child interaction. A second assessment on the basis of question three in the data extraction form (Section A2.1 in Appendix 2) was conducted. One review and 37 studies were excluded, which left 11 reviews and 38 studies written up in 64 reports and articles. The data from these studies were extracted and critically appraised using the data extraction forms (Sections A2.1 and A2.2 in Appendix 2), which had been developed using guidelines from the HDA and CRD (NHS Centre for Reviews and Dissemination, 2001; Swann *et al.*, 2003). All studies were appraised by one reviewer (MC). Those included after the second appraisal were also appraised independently by one of three other reviewers (CN/JG/RA). Disagreements were resolved through discussion or by deferring the study to a third party. There was no blinding of authorship of retrieved papers. This process identified 27 studies and 6 reviews written up in 47 articles and reports, which were grouped under the following headings:

1. Reviews.
2. Pedestrian safety.
3. Walking buses.
4. Traffic clubs.
5. Cycling safety.
6. Parent-child interaction in the car.
7. Teen driver safety.



4.2 Assessment of the quality, strength of the evidence and generalisability

The quality of the reviews was appraised according to the HDA Evidence Base methodology (Swann *et al.*, 2003) in terms of transparency, systematicity and relevance to the topic. This included a judgement on the comprehensiveness of the search strategy, the assessment of the quality of included studies and how the data were presented. This enabled a decision to be made regarding whether the review was of suitable quality and relevant to be included in this review, or whether or not it could be used to inform the wider discussion.

The quality of each study was also judged on the basis of transparency and systematicity. In addition, the studies were assessed on the appropriateness of the study design and methods in relation to the objectives, how these were reported (were there major flaws or gaps), the reporting of the intervention or the parent child behaviour being investigated, and the generalisability of the findings. Using this assessment the quality of the review/study was judged to be as follows:

- **High** all criteria were satisfied.
- **Medium** The review satisfied most of the criteria for comprehensiveness of search strategy, but failed to meet all of the remaining criteria. This included overviews and reviews that had not conducted full or comprehensive searches across expected sources. The studies satisfied most of the criteria but there were flaws or lack of information on one or more of the criteria.
- **Low** The review had a range of shortcomings across all criteria, although it was still considered relevant to this review on parent child interaction. The studies had major flaws in transparency, study methods and gaps in the reporting of the intervention, parent child interaction, or findings.

Features of generalisability included:

- characteristics of participants, drop-out rates, geographical and cultural considerations, and whether the selected participants were representative of, or resembled, the intended target group;
- characteristics of the activity, intervention, parent child interaction, the setting, the duration of the activity or intervention, and any other relevant features that may have had an impact on acceptability; and
- the clarity of the study design and study methods.

4.2.1 *Evidence statements*

Owing to the wide range of study designs included in this review, it was not possible to make judgements about the effectiveness on the basis of the extent of significant outcomes. Instead a judgement of the level of effect was made based on the clarity and comprehensiveness of the findings and the appropriateness and quality of the methods. The evidence of effect for each study was classed as being unclear, high, medium, low/no or harmful.

These outcomes were summarised as the following evidence statements, utilising the NHS Centre for Reviews and Dissemination guidelines (NHS Centre for Reviews and Dissemination, 2001):

- **Sufficient (review-level) evidence:** clear evidence and conclusions from at least one high-quality intervention study or evaluation study, or from at least one

appropriate high-quality study/review with no conflicting evidence between studies/reviews.

- **Some (review-level) evidence:** some evidence and/or conclusions from high-quality studies/reviews, or conflicting conclusions/findings among high-quality studies/reviews, or clear evidence/conclusions from at least one medium-quality study/review.
- **Insufficient (review-level) evidence:** no evidence or conclusions from high-quality studies, only some evidence and/or conclusions from low-quality studies/reviews.
- **No (review-level) evidence:** no evidence or conclusions available from studies or reviews.

It should be noted that due to the breadth of this review there was some risk of reviewer bias in terms of the inclusion and exclusion of studies and when making judgements about the evidence. This was addressed by two of the reviewers working closely together on the literature search, and two reviewers independently reading all the articles. Studies were not excluded on the basis of quality criteria but only on the basis of whether or not they met the inclusion criteria. However, a small number of studies that were published pre-1990 and therefore fell outside the inclusion criteria were included nonetheless because they were considered to be in some way ‘unique’.

5 REVIEWS OF PARENT–CHILD INTERACTIONS

In 2003 the Scottish Executive commissioned ODS Ltd and Market Research UK Ltd to conduct research into parental attitudes to road safety education in Scotland (ODS Ltd with Market Research UK Ltd, 2004). The study included two age groups: 7–13-year-olds and 14–18-year-olds. The study included a literature review of existing research on parental attitudes to road safety education and parental influence on children’s road safety education, in addition to a large-scale survey of parents and interviews with key stakeholders. The literature review was a broad-based overview of current and recent research, mainly in Scotland. The review covered the following areas: factors that may influence accident rates among children; parental involvement in road safety education; and the nature of educational initiatives and their impact on parents. The report concluded that family structure, levels of deprivation and social exclusion, neighbourhood design, age, ethnicity and sex have a bearing on child accident pedestrian rates. With regard to children’s and parents’ awareness of risk, the review found that child development needs to be taken into account and should influence approaches to road safety education. Although young children aged 5 to 10 have good concepts of danger, they are less capable of distinguishing when a situation is actually dangerous. In addition, parents often overestimate what their children are capable of performing in the road environment. On the basis of the literature, the authors stated that children’s road safety skills can be developed through on-road informal training. Despite studies investigating children’s road safety skills, the report also found gaps in knowledge about parents’ attitudes to road safety education. However, research has highlighted that adopting the optimum method for parent education is important given the influence of a child’s observational skills and the parent acting as a role model. Many such schemes are known in Scotland, England, Australia and Singapore, but most of these schemes lack the benefits of rigorous evaluation.

In addition to the Scottish Executive review, five reviews were identified that considered child–parent interaction. Of these, one was a Health Development Agency evidence briefing (Millward *et al.*, 2003) concerned with the prevention of unintentional injury in children and older people, two were systematic reviews (NHS Centre for Reviews and Dissemination, 1996; Duperrex *et al.*, 2005), and two were overviews (RoSPA 2002; Williams *et al.*, 2002). None of the reviews were specifically concerned with child–parent interaction, but they all included sections that related to the topic. In addition, Simons-Morton and Hartos (2003) reviewed the findings from their research on young drivers and their parents.

One of the systematic reviews had reviewed the effectiveness of interventions intended to prevent unintentional injuries in children and young adults (NHS Centre for Reviews and Dissemination, 1996), while the other (Duperrex *et al.*, 2005) was a Cochrane review of safety education interventions for pedestrians to prevent injuries. In total, the two reviews included 27 studies of which one overlapped.

Therefore, of the 26 studies, seven studies (three randomised controlled trials, four non-randomised controlled trials), which included a total of 5,193 participants and 13 countries, were relevant.

The two overviews were concerned with road safety interventions for disabled children and adults (Williams *et al.*, 2002), and parent–teenage driver agreements (RoSPA, 2002). Williams *et al.* (2002) identified five intervention studies for children with learning difficulties and two for children with vision impairments with or without learning difficulties. However, only three of the studies which targeted children with learning difficulties, involving a total of 95 children and young people, included parents. The RoSPA (2002) report provides a description of 31 websites offering advice to young drivers and/or giving an example of a teen–parent driving contract in addition to a brief review of three related American studies.

The findings are summarised as follows:

- There is insufficient and conflicting review-led evidence that children’s traffic clubs are effective in increasing knowledge about road safety, improving children’s safe roadside behaviour or reducing casualties among child pedestrians.
- There is some evidence that the observed behaviour of young children (3–7-year-olds) can be improved by indirect education by parents or parent volunteers. However, there is insufficient evidence that such training reduces injury.
- There is almost no evidence regarding any form of child–parent interaction in the road environment and children with physical disabilities or learning difficulties. On the basis of one review there is some evidence that roadside training with young people with learning difficulties is more effective than either classroom training or no training.
- There is some review-level evidence that simple motivational strategies, such as an information video, can motivate parents to impose greater control on their teen drivers and adopt driver agreements.
- There is some research evidence that graduated licensing programmes result in reduced rates of teen risky driving behaviours, crashes, violations and total driving time.

5.1 Strength of evidence

The main problem with all the reviews identified was that they did not focus on parent–child interaction specifically. The review on preventing unintentional injuries in children and young adults (NHS Centre for Reviews and Dissemination, 1996) was of medium quality because, although it provided data on aims and objectives and outcomes of the studies, it did not give sufficient information on the

interventions included nor on research methodology. In addition, it was difficult to make a judgement about the quality of the studies included as there was little or no mention of blinding or attrition rates. The reliability of the content was therefore medium and the evidence presented was also judged as medium. The authors noted that there was a lack of high-quality research in this area. The quality of the Cochrane review on pedestrian safety education (Duperrex *et al.*, 2002; Duperrex *et al.*, 2005) was medium to high, although the authors noted that the quality of the papers included was generally poor. None of the included trials assessed the effect of safety education on the occurrence of pedestrian injury. The review concluded that, although there was some evidence of effect on observed behaviour, it is difficult to predict in what way behaviour change translates into a reduction in injury.

The Health Development Agency evidence briefing on the prevention and reduction of accidental injury in children and older people (Millward *et al.*, 2003) is in itself already a review of reviews and notes the current strength of evidence. The briefing concludes that:

‘More evidence is needed to demonstrate links between enhanced pedestrian skills and injury prevention; more evidence is needed to demonstrate the link between traffic clubs and casualty reduction; more rigorous research combining educational and environmental measures is needed; research is needed to examine the appropriateness of off-road skills training for younger cyclists aged 6/7; health outcomes were not used in studies focusing on pedestrian skills training just one traffic club study used mortality/morbidity data.’ (Millward *et al.*, 2003; p. 19)

The review of road safety training of disabled adults and children only identified three studies focusing on children and young people. The review is of medium quality because very little information is given on the study design or methodology despite the interventions being described in detail. The RoSPA review (RoSPA, 2002) was judged to be of medium to low quality due to the lack of detail about the interventions and the study design. However, it should be noted that the purpose of the review was to provide a broad summary of parent driver agreements and to signpost the reader to further information on the internet. Finally, the only review to focus on parent child interaction (Simons-Morton and Hartos, 2003) provides limited review evidence as the only research included had been conducted through the authors’ research programme. The review itself is of high quality and the reliability of content is high. However, no attempt has been made to include research from other sources. The review concludes that there is some evidence to suggest that graduated licence agreements have an effect on risky driving behaviour, and that a brief motivational intervention in conjunction with the commencement of teen driving can persuade parents to adopt driving agreements and assert greater control on their teenagers’ driving.

5.2 Generalisability of findings

A small number of interventions in the six reviews are relevant to this literature review. It is not possible to make the same judgements about the quality, reliability and generalisability of the findings in the evidence briefing (Millward *et al.*, 2003) as in the other five reviews, as it is a review of reviews and therefore sets out to summarise findings and draw generalisable conclusions in the same way as this review. The evidence is summarised in the previous section. It should be noted that the report does not comment on the quality of the reviews or the generalisability of the findings, but states that it is based on ‘a number of robust reviews’. The strengths of the CRD review (NHS Centre for Reviews and Dissemination, 1996) are that the age group is homogenous (3–5-year-olds), the studies were conducted in the UK (and therefore culturally relevant), and the samples were, in the main, large. However, the generalisability is weakened by a lack of information on the study design and methodology, and the fact that several of the articles are by now quite old. Consequently, some of the conclusions drawn may not be as relevant in today’s road environment as 10 to 25 years ago.

The Cochrane review (Duperrex *et al.*, 2002; Duperrex *et al.*, 2005) had made every effort to minimise selection bias, including searching for articles in several languages other than English. However, the authors noted that one of the limitations of the review was the potential selection bias, particularly regarding road safety, as much of the research evidence is published in the grey literature rather than in peer-reviewed journals. Many of the identified articles were of poor quality and had major methodological weaknesses. In addition, several of the studies had been conducted more than 20 years ago, which could leave their relevance to current road safety issues open to question.

It is not possible to draw generalisable conclusions from three studies included in the review of road safety and disability (Williams *et al.*, 2002). The studies are very small and there are major omissions regarding methodology and study design. However, as the only review identified on road safety and disability, it provides a valuable insight into where further research should be conducted.

The generalisability of the findings from the teen driving reviews (RoSPA, 2002; Simons-Morton and Hartos, 2003) only remains questionable because the cultural differences in driving practice between the USA and UK (Europe) have not been addressed. Although the two reviews are not systematic reviews, and it is therefore not possible to judge the quality of the studies included, the findings from the reviews, together with the findings from the articles considered in Section 8, provide comprehensive and potentially generalisable results regarding the control of teenage driving.

6 PEDESTRIAN SAFETY

Child pedestrian safety has been of interest to researchers for a considerable length of time. A variety of areas have been explored, such as parents' perceptions of risk and parental interaction with their children in the traffic environment. In addition, a range of interventions have been evaluated, including 'walking buses' and 'traffic clubs'.

6.1 Pedestrian safety

This review identified 12 studies that considered pedestrian safety in relation to children. Further details about the interventions are found in Appendix 3. The studies consisted of five observational studies (van der Molen 1982; Yoshida and Gakuin 1996; Lewis *et al.*, 1999; MacGregor *et al.*, 1999; Dunbar *et al.*, 2002; Zeedyk and Kelly, 2003), four surveys relating to parents' perceptions of risk and children's safe road behaviour (Antill, 1991; Owen and Patterson, 1991; Roberts, 1995; Lam, 2000), two evaluation studies of educational tools (Wood *et al.*, 2003; Zeedyk and Wallace, 2003), and one intervention study of roadside training (Thomson *et al.*, 1998).

6.1.1 Observation studies

A total of 532 children with 264 parents were observed and included in the five observational studies. In one study (Dunbar *et al.*, 2002) parents were invited to participate in the study, but were not told how the observation was to be undertaken. Yoshida and Gakuin (1996) observed 1,076 school runs over a three-month period, but only included 17 parent-child pairs based on strict inclusion criteria in the final analysis. MacGregor *et al.* (1999) observed children's road crossing behaviour over a two-month period. The observations were complemented by interviews with 30 parents of children aged 5-12 who were not necessarily parents of the children observed. In four of the studies the observation was concerned with parent-child interaction (van der Molen, 1982; Yoshida and Gakuin, 1996; Dunbar *et al.*, 2002; Zeedyk and Kelly, 2003), while only children's road crossing behaviour was observed in MacGregor *et al.*'s (1999) study. Observations included children who were accompanied by an adult, with other children, or alone and were walking, running, skateboarding, in-line skating or cycling.

6.1.1.1 Methods

The settings in the observational studies were also variable. Two were conducted in the UK, one in the Netherlands, one in Canada and one in Japan. In one of the British studies a researcher met the parents and children at the university campus car park and suggested a walk across and along a busy two-lane road to a shop. She then made an excuse of a further errand and asked the parent and child to meet her at the

department, where the map communication exercise would take place. The whole child–parent interaction was video and tape recorded (Dunbar *et al.*, 2002). Two other studies also used video-recording to record their observations. van der Molen (1982) in the Netherlands used video-recording as a tool during nine observations of one busy unsignalised road crossing, while Yoshida and Gakuin (1996) used three video cameras from the fifth floor of an apartment block to record drivers' actions when taking their children to a pre-school. Additional data, such as the sex of the driver and the car number plate, were recorded on audio tape in order to match observations over time. Only child–parent pairs that were observed more than 10 times in the same right-hand drive car with only one child exiting the car were included in the study. Two studies chose to use observer monitoring of specific elements of road-crossing behaviour (MacGregor *et al.*, 1999; Zeedyk and Kelly, 2003). MacGregor *et al.* (1999) in Canada included children who were walking, running, skateboarding, in-line skating or cycling in the recording. Both studies had two observers gathering data. In one of the studies reliability was addressed by checking inter-observer agreement on three separate occasions (Zeedyk and Kelly, 2003).

6.1.1.2 Findings

The observational studies demonstrated a number of significant findings. In all studies holding hands was the most common road-crossing interaction between the parent and child. Children accompanied by adults, however, tended to rely on the parent for safety. Whereas parents provided good role models by mostly stopping at the curb and looking both ways, the accompanied children tended not to check for traffic. Yoshida and Gakuin (1996) observed that even when the parent driver checked the road, the child would run without necessarily taking notice of the parent's behaviour. Parents frequently did not stop their child from running across the road despite not necessarily being able to judge whether or not the child had checked the road first, and many parents remained in their cars while the child crossed the road. Their most significant finding was that hardly any of the observed parents or children demonstrated consistency in their road-crossing behaviour.

MacGregor *et al.* (1999) observed that children who were unaccompanied were more likely to do safety checks at the curb. Observations also suggested that older children and boys were less likely to stop at the curb and that children were more likely to do a visual search of the road at a non-signalised crossing than at a signalised crossing. When all aspects of safe road crossing (looking left and right before crossing, looking behind while crossing) were considered, only 6% of children at non-signalised crossings and 3% of children at signalised crossings displayed proper visual search behaviour. Although parents generally were observed setting a good example in road-crossing behaviour, adults rarely made use of the road-crossing event to give oral instructions or to encourage children to press the button for the lights (Zeedyk and Kelly, 2003). However, only two studies recorded oral instruction giving (Dunbar *et al.*, 2002; Zeedyk and Kelly, 2003) and therefore

it may be difficult to conclude how generalisable these findings are. Finally, Dunbar *et al.* (2002) found that brief and focused conversations between the parent and the child were associated with more disciplined road behaviour. This evidence was established by demonstrating a strong correlation between conversation length and the non-verbal activity of road crossing, particularly with regard to two aspects: child recklessness and child dependence. Brief instructions tended to be given to children who were less reckless and more dependent.

6.1.1.3 Quality of studies

Accepting the inherent problems of observational studies, the overall quality of the five studies was high. However, the number of observed individuals generally was quite small, ranging from 44 (Dunbar *et al.*'s (2002) exploratory study) to 208 (MacGregor *et al.* 1999), although Yoshida and Gakuin's study (1996) initially included 1,076 samples of school runs. In addition, MacGregor *et al.* (1999) only observed the road-crossing behaviour of children whether or not they were accompanied by adults, rather than specifically the interaction between parents and children. Because of the high quality of the studies, the findings from these studies are probably generalisable. However, the generalisability of two of the studies may need to be treated with some caution due to the age of the study (van der Molen, 1982) and potential cultural differences (Yoshida and Gakuin, 1996). Three studies used video-recording as a tool to record road-crossing behaviour (van der Molen, 1982; Yoshida and Gakuin, 1996; Dunbar *et al.*, 2002). MacGregor *et al.* (1999) expressed concerns about child safety and confidentiality regarding video-recording and therefore decided to use two observers to record road-crossing behaviour. In the case of Dunbar *et al.*'s study, parents were invited to participate and therefore could opt out of the study at any time. van der Molen's study was conducted 14 years prior to the other four observation studies when ethical concerns about video-recording without consent may not have been raised. Yoshida and Gakuin (1996) noted that, because the observer (with video cameras) was not spotted from street level, the observer's presence would not have influenced the actions of the subjects and was therefore appropriate as a 'natural observation method'.

6.1.2 Pedestrian surveys

Four studies were identified that had conducted surveys in relation to parent-child interaction (Antill, 1991; Owen and Patterson, 1991; Roberts, 1995; Lam, 2000), involving interviews with a total of 1,966 parents. Only one study interviewed children ($n = 32$) as well as parents (Owen and Patterson, 1991), and set out to investigate the relationships between the road safety knowledge of pre-school children and parental approaches to road safety education. In this study, 32 four-year-olds were interviewed using pictures of safe and unsafe pedestrian activities to identify the children's road safety knowledge. Following this stage, the children were asked to explain their regular behaviour as pedestrians, passengers and bike riders and to identify the sources for their knowledge. In the second part of the

study, mothers were interviewed to identify their attitudes and practices towards their children's road safety. Two of the studies that only included parents used face-to-face interviews (Antill, 1991; Roberts, 1995), while Lam (2000) engaged professional telephone interviewers to make contact with the parents.

6.1.2.1 Methods

Sampling varied considerably between the four surveys. Two of the studies conducted in Australia (Antill, 1991; Owen and Patterson, 1991) invited parents of pre-school children to participate in interviews. Antill (1991) utilised the principal of the school as a 'gatekeeper' to access the parents, while Owen and Patterson (1991) did not make it clear how they actually went about gaining access to participants. Lam (2000), in another Australian survey, contacted parents directly on the telephone. If they were not in, a minimum of six attempts were made or, if an answering machine responded, a message was left asking them to call. Roberts (1995) scanned the coroner's records and hospital in-patient records in Auckland, New Zealand, for study cases and parents were contacted for an interview. The parents of fatal cases and of controls were interviewed in their own homes, while parents of hospitalised children were interviewed in the hospital.

6.1.2.2 Findings

The findings from the survey interviews illustrate a range of factors associated with parents' perceptions of risk and safe road use and actual behaviour. The interviews corroborated findings from other research showing that parents saw themselves as the main road safety educators for their children. However, there seemed to be a disparity between parents believing that they themselves were safe road users (pedestrians and drivers) and their actual behaviour. Lam (2000) found a significant correlation between parents' safe road behaviour while accompanying children and the age of the child and their own risk perception of the road environment. In contrast, parents claiming to be safe drivers and safe pedestrians drove through orange lights and exceeded speed limits and did not use pedestrian crossings when not accompanied by their child (Antill, 1991). This study suggested that parents' perceptions of the level of problems facing the child in the street were significantly related to the familiar road environment. In other words, parents made their judgements on the basis of their familiar surroundings. Owen and Patterson (1991), on the other hand, found that parents' perceptions of their children's ability and their own personal experience of trauma was the main influence with regard to their attitudes and practice towards road safety. Interestingly, although all parents reported teaching their children road crossing rules, many had a less protective attitude towards cycling than towards walking. Finally, adult accompaniment walking to school was associated with a greatly reduced risk of road traffic injury (OR 0.31, 95% CI, 0.07 to 1.49) (Roberts, 1995). In the only study to include interviews with children, children demonstrated a substantial knowledge of pedestrian road safety issues. Holding hands with the accompanying adult was

identified as safe behaviour, although less than a third of the children described hand-holding as a means of keeping safe when talking about their own road safety behaviour. Many children described how they crossed the road when ‘it was okay’. Being ‘okay’ was, however, associated with the absence of cars in the road, rather than a judgement of safe distance (Owen and Patterson, 1991).

6.1.2.3 Quality of studies

The quality of the studies was generally medium, partly due to the limitations of the study design. Lack of systematicity, clarity regarding methodology and weaknesses regarding reliability were also factors that impacted on the quality of the studies. Consequently, generability of the findings was limited. Antill’s (1991) study was large and data rich, and the main limitations lay in the reporting of the findings. However, the findings are probably generalisable and the study would benefit from being repeated in other cultural environments. On the other hand, Robert’s (1995) study of the effects of adult accompaniment claimed to have high reliability of content, but because ethical concerns could be raised about the recruitment methods, reliability could also be questioned. Likewise the study did not consider the wider contributing factors to road traffic accidents, which meant that generalisability was limited.

6.1.2.4 Intervention studies

Three intervention studies were identified. Two studies evaluated educational tools to encourage pedestrian safety (Wood *et al.*, 2003; Zeedyk and Wallace, 2003). One study involved 120 families (Zeedyk and Wallace, 2003) and the other 1,027 parent-child pairs at the first stage, with 521 (27%) completing datasets at the second stage of the study (Wood *et al.*, 2003). The third study, a randomised controlled trial (balanced for gender, otherwise randomised) involving 60 children aged five, evaluated the possibility that parent volunteers from the local community might be capable of using practical training methods to promote children’s pedestrian competence (Thomson *et al.*, 1998). In this study, volunteer parents received training so that they could provide training and guidance for groups of children on the safe ways to cross the road. Six sessions lasting 30 minutes were run with the children; four on a table top model at school, and two at the roadside. The trainer’s role was to guide the child’s reasoning so that they could work out for themselves errors in their judgements. Zeedyk and Wallace (2003) in a controlled before and after study evaluated the impact of an ‘edutainment’ video in determining whether the video had an impact on either children’s knowledge or parents’ awareness of pedestrian skills. The video was a recording of a 67-minute live performance on stage by a popular Scottish children’s entertainment group, composed of songs, rhymes and humorous skits and designed to reinforce basic road safety messages. The final study, a non-randomised controlled trial (Wood *et al.*, 2003) evaluated the effectiveness of a training booklet in encouraging the development of traditional traffic skills and in enhancing the impact of such training

on the child's everyday behaviour. In this study parents were sent an activity booklet which was intended to provide parents with materials that would raise their awareness of pedestrian risks to the child, support their teaching of traffic skills, alert them to the need to create consistently safe approaches to traffic hazards in their child, support them in drawing the child's attention to the social interactive nature of road safety, and sensitise them to the special problems faced by child road users.

6.1.2.5 Methods

All three studies utilised schools as their sampling frame. Zeedyk and Wallace (2003) sent invites to the parents of children at five primary schools in Scotland. The first 120 parents who responded were included in the study. Those in the intervention group received the video at the beginning of the study, while those in the control group received it at the end. Children were interviewed at school, while parents completed their questionnaires either in their child's school or at home, with one month between the first and the second measurement. Return rates were 91% for the intervention group and 83% for the control group at post-test. Wood *et al.* (2003) sent their resource pack to participating children and their parents from 29 schools of mixed socio-economic groups and both urban/rural areas in Kent and West Sussex. The resource pack included a booklet, activity sheets, the child's judgement task and a checklist reminding parents of deadlines for returning the activity task sheets. The parents were asked to re-test their child after about four weeks, and a third assessment after approximately two months. Thompson *et al.* (1998) recruited children aged five from primary class one of three Glasgow schools. Two were located in large housing schemes with social and economic deprivation, and one was an inner-city school in a mixed ethnic neighbourhood. The children were individually pre-tested at a set of roadside locations on two separate occasions in order to establish a baseline level of skills. These tests were repeated immediately after the training finished, and again 40 days later to establish the long-term effects of the training. The tests used were the same as the authors had used in two previous studies.

6.1.2.6 Findings

The findings suggest that video as an educational tool had little effect. Although the parents considered the video a useful and effective educational tool, no change in children's road safety knowledge was found. Neither did the video seem to influence parents' views on road safety. On the other hand, an educational booklet for parents, which used an error-avoidant perspective, demonstrated a significant increase in traffic skills and traffic awareness (girls improving more than boys). Although not significant, there was a movement from damage-avoidance to error-avoidance. Most parents thought the booklet was useful and easy to follow, although two-thirds of the children sometimes did not understand the pictures. Roadside training by volunteer parents for groups of children led to significant improvements in children's road

safety behaviour. Overall, the trained group showed significantly greater improvements than the control group. There was also a significant main effect of gender ($F [2,112] = 6.12, p < 0.02$) due to boys constructing more safe routes than girls. These changes were maintained over two months after the end of the programme.

6.1.2.7 Quality of studies and the evidence

The three studies were all well conducted. However, the quality of the evaluation of the 'edutainment' video was judged to be medium due to a lack of some data and flaws in the systematicity and clarity of the methodology. Because of this, generalisability of the findings was difficult to judge. There was no evidence to suggest that 'edutainment' is effective. The quality of Wood *et al.*'s (2003) evaluation of an activity booklet was high. The report provides a full and detailed description of the methods and the evaluation process they undertook, and the reliability of the content is therefore also high. One of the strengths of the study was the extensive piloting of the booklet, and the research tools before the main evaluation. The authors also point out that the extreme weather conditions (rain and flooding) that they happened to experience halfway through the evaluation may have affected how possible it was for parents to carry out some of the associated activities. The evidence of the effectiveness of the intervention is high. The quality and reliability of content was judged to be high in Thompson *et al.*'s (1998) evaluation of the effectiveness of volunteer trainers in promoting road safety, and the systematicity and clarity of methods were equally high. However, the generalisability of the findings remains unclear due to the small size of the study and the labour intensiveness of the intervention. The main difficulty with the intervention is that, not only does it require recruitment and training of parent volunteers, but it also requires being able to retain those volunteers. On the other hand, the authors note that:

'It appears that parents from vulnerable communities are capable of making a fundamental contribution to children's road safety education, provided they themselves have been properly trained for the job and fully understand what they are trying to achieve.' (Thompson *et al.*, 1998; p. 489)

In terms of the actual intervention, the evidence is high regarding its effectiveness. However, due to the limitations of the study the actual applicability may need to be treated with some caution.

6.2 Traffic clubs

Only one study was identified that evaluated the effectiveness of traffic clubs in improving the road safety knowledge and behaviour of three-year-old children and the control and supervision exercised over those children by their parents (West *et*

al., 1993). It should, however, be noted that traffic clubs were included in one of the reviews (NHS Centre for Reviews and Dissemination, 1996) described in Section 5. The study, which involved approximately 1,600 children aged between three-and-a-half and four and their parents in two separate surveys 12 months apart, was conducted in two regions in England. The intervention, based on a successful Scandinavian model, entailed sending an invite to all children on their third birthday along with the first Traffic Club book. The books were designed to involve parents in the process of training their children and included exercises that could be used to monitor the child's progress. The club was free and children who joined continued to receive further books every six months up to the age of five.

6.2.1 *Methods*

The two selected areas were designated as 'experimental region' and 'control region'. Families were recruited using standardised procedures based on census information on postal areas. The interviews with children and their parents, lasting about 25 minutes, were conducted in their own homes. In the first survey, due to some overspill in children's ages, a total of 1,032 children were included (I = 459; C = 573), while in the second interview 1,601 children and their parents were interviewed. The parents were asked about the child's actions in the road environment (use of bicycle, playing in the street, crossing the road), parent-child interaction when crossing the road, use of restraints in the car, and the parent's attempts to train the child in road safety. The children were asked their knowledge of objects in the road environment and where it was safe to play, and their behaviour on the road and pavement.

6.2.2 *Findings*

There were no detectable effects of the traffic club on children running into the road or crossing the road by themselves. The traffic club did appear to reduce the incidence of running on ahead (chi square = 18.2, $p < 0.001$) and increase the prevalence in the number of children stopping at the pavement when called. However, this apparent change may mostly have been due to a substantial decrease in the control group rather than an increase in the intervention group. There was also a significant change in the intervention group in the children recognising roads. However, there was no major change in the knowledge of what to do when crossing the road. Finally, the traffic club appeared to increase the extent to which parents attempted to teach their children about road safety. In conclusion, although there did not appear to be any evidence that parents and children from different socio-economic groups reacted differently to the traffic club, there was evidence of strong socio-economic group and sex differences in road safety knowledge and behaviour. Boys demonstrated greater knowledge of roadside objects, while girls showed a greater tendency towards behaving safely. Parents from manual socio-economic groups were less controlling regarding their children's road behaviour, and their

children showed less knowledge of roadside objects and awareness of where it would be safe or dangerous to play.

6.2.3 *Quality of study and effectiveness*

The quality of the study and reliability of content was judged as high, and systematicity and clarity of methodology was also high. However, due to the limitations of the study design (interviews rather than observation), generalisability remains unclear and the evidence is only partial. Another limitation of the study may have been the large number of dependent variables. The authors also noted that the effects of socio-economic groups were in an order of magnitude greater than those attributable to the traffic club. Consequently, there were factors which influenced the behaviours of children and parents that were not addressed through the traffic club.

6.3 **Walking buses**

Three studies were identified that evaluated the success of walking buses (Kearns, 2001; Wong *et al.*, 2004; Collins and Kearns, 2005) involving 21 volunteer parents and 52 children (Kearns, 2001), 12 key stakeholders (Wong *et al.*, 2004), and 23 school representatives and 22 walking bus coordinators (Collins and Kearns, 2005). In addition, Wong *et al.* (2004) reviewed pedestrian injuries for children aged 5–10 between 2000 and 2003 for the area. All three evaluations were conducted in the Auckland area in New Zealand. The walking bus concept taps into both parental concern about road safety and how prepared they were to act, and children's willingness to walk. It offers children the opportunity to walk safely to and from school with adult volunteers to accompany them.

6.3.1 *Methods*

All three studies used interviews to access information. However, methods of recruitment varied between them. Wong *et al.* (2004) emailed key stakeholders requesting a face-to-face interview, while Collins and Kearns (2005) faxed or telephoned the principals of the schools to gain access to the parent coordinators who were then interviewed over the telephone. Kearns (2001), as a parent participant and board member, conducted a survey (parents were asked to fill in a questionnaire) regarding their use of the walking bus and, secondly, an observation with informal interviews with the children and parent volunteers.

6.3.2 *Findings*

Collins and Kearns (2005) found that a significant number of car journeys were saved as a result of the walking bus initiative. However, an analysis of the locations and socio-economic characteristics of the participating schools showed that walking bus initiatives were clustered around the least deprived areas and were almost absent

from areas with the most deprivation. Interestingly, participating parents listed a range of benefits, such as the promotion of children’s social and physical well-being, getting to school safely, better for the environment and less stress. Such multiple benefits were mentioned by the other studies as well. On the negative side, all three studies identified the problem with recruiting and maintaining volunteers. Finally, Wong *et al.* (2004) found no evidence of differences in the rates of child pedestrian injuries or hospitalisation between 2000 and 2003.

6.3.3 *Quality of studies and evidence*

Overall, the quality of the three studies was either low (Kearns, 2001; Wong *et al.*, 2004) or medium (Collins and Kearns, 2005), with low or medium reliability of content and fairly poor systematicity and clarity of methodology. Given the limitations of the study design, lack of clarity regarding methodology and the gaps in data, the generalisability of these findings is unclear, despite those interviewed clearly claiming to like the intervention. On the basis of these three studies, the evidence of effectiveness of walking buses therefore remains unclear.

6.4 **Summary of findings**

Table 6.1 provides further detail regarding the main results.

- There is sufficient evidence that parents believe it is mainly their role to teach their children road safety.
- There is sufficient evidence that holding hands is the most common form of parent–child interaction when crossing roads.
- On the basis of three observational studies, there is some evidence that children accompanied by adults tend to rely on the adult for safety, and therefore tend not to demonstrate safe road behaviour.
- There is some evidence that unaccompanied children are more likely to do road safety checks than accompanied children.
- On the basis of one Japanese study, there is some evidence that there is a lack of consistency in both adults’ and children’s road crossing behaviour.
- Based on one high-quality observational study, there is some evidence that brief and focused conversations between the parent and the child is associated with more disciplined road behaviour.
- There is insufficient evidence to demonstrate an association between parents’ perceptions of children’s ability to manage the road environment, their own road behaviour and their perceptions of risk.
- On the basis of observational studies, there is insufficient evidence to demonstrate that parents’ oral instructions are effective in increasing road safety

behaviour. However, one intervention study suggests that trained adults can provide effective roadside safety training for children.

- There is no evidence that ‘edutainment’ in the form of an educational video is effective, despite parents considering it a useful tool.
- On the basis of one high-quality study, there is some research evidence to suggest that an educational booklet using an error-avoidance perspective is effective in increasing traffic skills and traffic awareness.
- Based on one medium-quality evaluation study, there is insufficient evidence of the effect of traffic clubs. However, earlier evaluation studies suggest that traffic clubs are effective in promoting road safety.
- There is insufficient evidence regarding the effectiveness of walking buses.

6.5 Gaps in the knowledge base

- There is limited knowledge on the basis of observational studies of child–parent interaction as pedestrians regarding road safety. In particular, there is a lack of good-quality research that considers both the physical interaction (such as holding hands) and the verbal interaction (instructing, encouraging problem-solving in the traffic environment).
- There is a lack of high-quality observational studies, which include parents and children in all aspects of road use, rather than simply as pedestrians.
- There is a lack of research that compares child–parent interaction as pedestrians or as ‘other’ road users in different geographical environments or in different socio-economic circumstances.
- There is a lack of good-quality evaluation of the effect of walking buses.

Table 6.1: Pedestrian safety study design and quality of study

	Aims/objectives of study	Study design/sampling	Methods
Pedestrian safety			
Observation			
Dunbar <i>et al.</i> , 2002	To examine children's ability to maintain task focus To identify features of successful interactions	Observation Part of a larger study; selection on the basis of questionnaire sent to > 1,000 parents; sample balanced for sex, traffic experience, level of parental education, urban, suburban, village schools	Parents and children were video and tape recorded while crossing and walking along a busy road
MacGregor <i>et al.</i> , 1999	To identify gaps between parental expectations of children's ability and their actual road-crossing behaviour	Observation Parents solicited outside swimming pool and large city park Target age for children: 5–12	Two recorders recorded behaviour from positions with clear view of crossing
van der Molen, 1982	To determine the extent to which children show ideal road-crossing behaviour; how well adults set an example of the desired behaviour when accompanying children; to what extent children are protected by adults when crossing	Observation Pedestrians not identified individually 'Groups of adults and children' observed	Road crossing at busy junction was video recorded from second floor of corner building
Yoshida and Gakuin, 1996	To identify parent–child interaction between car and school	Observation 1,076 samples of school runs filmed Based on criteria: same car, same sex of driver Right-hand drive car Only one child to exit car and cross the street; adult accompanying child generally the driver Occasions above repeated > 10 times	Video recorded from fifth floor of apartment block opposite the school November 1993 to March 1994
Zeedyk and Kelly, 2003	To monitor road-crossing behaviour To document behaviours of adult–child pairs as they made use of pelican crossing (unconscious modelling) To what extent adults use the road-crossing event as an opportunity to teach children directly about pedestrian skills	Observation Only single parent–child pairs who crossed road and were not blocked from view at any point were recorded	Single child–parent pairs were observed crossing road from 2 m either side of crossing. Only pairs who were completely visible during entire crossing were included Observations lasted 30 minutes in the morning and afternoon over two weeks

Main results	Generalisability/quality of study	Other comments
<p>Disciplined road behaviour associated with brevity in conversation Younger children, girls greater dependence; boys greater recklessness More educated parents more control</p>	<p>The quality of the study is high. The findings are probably generalisable despite the exploratory nature of study</p>	<p>Exploratory study; small number of children observed</p>
<p>Older children less likely to stop at curb ($p < 0.057$) Children more likely to do visual search at non-signalised crossing ($p < 0.05$) Unaccompanied children more likely to conduct safety check than accompanied children</p>	<p>The quality of study is high/medium; small number of parents; not necessarily the parents of the children observed Findings are probably generalisable</p>	<p>Intended to videotape children, but concerns about safety and privacy changed this Very detailed description of observation exercise</p>
<p>Accompaniment not always complete Children showed no awareness of actively participating in road-crossing task Adults mostly set good example (head movements), but only 25% stopped at pavement, 47% at island Only significant difference: adults make more head movements and run less ($p < 0.0001$)</p>	<p>The quality of the study is high. Reliability of content is high. Due to the age of the study, generalisability of findings may be limited</p>	<p>Purely observational; errors could have been made Authors note that individuals could have been observed more than once Quite old study</p>
<p>High inconsistency rates in: child checking before crossing; driver checking left/checking left for child before crossing; driver opening door for child; driver accompanying child across road; signalling when parking or departing Children more likely not to look in any direction when with parent Children frequently running across the road, without being stopped by parent</p>	<p>A high-quality study, where cultural differences may limit generalisability</p>	<p>Very detailed description of observations; translated from Japanese</p>
<p>98% who chose to cross the road stopped at the curb 81% waited for green man 76% held hands (significantly more likely to hold hands with girls) 50% walked (not ran) across road 6% gave oral instruction Pressed button: p: 70%; c: 21%; no 9% Looked both ways: p: 91%; c: 0%; no: 9%</p>	<p>A high-quality study, with high reliability of content. Despite limitations of study design, cultural relevance suggests the findings are generalisable</p>	<p>Limitations to study design; only single child-parent pairs observed</p>
<p>(continued)</p>		

Table 6.1: (continued)

	Aims/objectives of study	Study design/sampling	Methods
Surveys			
Antill, 1991	To provide information on: parents' concerns about road safety, the safety of the local environment; parents' road safety attitudes and behaviours; what parents teach children with regard to road safety and the effects on children; parents' knowledge and understanding of young children's limitations in the traffic environment; and parents' willingness to participate in road safety programmes	Survey Cross-section of schools across Sydney; school principals requested volunteers	Interviews with parents lasting approximately 45–60 minutes. Participants were given story book and read-along tape
Lam, 2000	To investigate factors associated with parental safe road behaviour as a pedestrian with their young children	Cross-sectional survey Stratified random sample from 3 metropolitan areas, according to the population distribution of 5–14- year-olds Sample selected by telephone contact method of a random digit dial	Telephone interviews conducted by professionally trained interviewers Response rate: 77%
Owen and Patterson, 1991	To investigate the relationship between road safety knowledge of pre-school children and approaches towards road safety education reported by families	Survey Parents of pre-school children invited to participate with their children	1. Using drawings of safe/ unsafe pedestrian activities, children interviewed about specific contexts to identify their road safety knowledge 2. Children explained their regular practices as pedestrians 3. Mothers interviewed to identify their attitudes and practices towards their child's road safety
Roberts, 1995	To quantify the effect of adult accompaniment on the risk of pedestrian injury on school–home journey	Survey Case control study	Study cases: all children aged 5–15 who were admitted to hospital or killed as result of pedestrian–motor vehicle accident Controls: random sample from schools matched by sex and age

Main results	Generalisability/quality of study	Other comments
<p>Road accidents perceived as greatest threat to child safety Significant differences ($p < 0.05$): boys taught more often than girls to cross at pedestrian crossing; older parents taught children not to run on street to retrieve pet/toy less often than younger parents; young children taught less often about bike safety; older children taught more about seat belts and to ride bike safely, less often to identify road signs or traffic lights than younger children; perceptions of problems facing child in street significantly related to familiar road environment; parents generally demonstrated safe attitudes and claimed to be safe drivers, although they drove through orange lights, exceeded speed limit, and did not use pedestrian crossings when not with child</p>	<p>A medium- to high-quality study, with medium content reliability. Due to some limitations of study design and potential cultural differences, findings are probably generalisable</p>	<p>A large, data rich study, which could be repeated in the UK Generalisability of findings to UK circumstances would need to be considered</p>
<p>Significant correlation between parental safe road behaviour, while accompanying children, age of child, and their risk perception of road environment 50% reported to practice safe road behaviour 'most of the time' and 'always'</p>	<p>A medium-quality study, with lack of clarity regarding methodology Generalisability of findings is difficult due to a lack of some methodological information Underpowered study due to lower than expected response rate</p>	<p>Authors note the risk of 'social desirability' in parents' responses</p>
<p>Children demonstrated substantial knowledge of pedestrian road safety issues Parents reported teaching road safety: aware of need to use seat belts and more relaxed about cycling/helmet use Mothers usually accept responsibility for road safety education (corroborated by children) Influences on parents' attitudes/practice: perceptions of child's abilities and personal experience of trauma</p>	<p>A medium- to low-quality study, with lack of systematicity and clarity regarding methodology Generalisability is not clear due to weaknesses in the reporting of the findings and lack of methodological clarity</p>	<p>A small qualitative study, with gaps in methodology and data</p>
<p>Adult accompaniment associated with greatly reduced risk of injury (OR 0.31, 95% CI, 0.07 to 1.41)</p>	<p>A medium-quality study, with high reliability of content and clarity of methodology Findings are not generalisable due to limited study design</p>	<p>Although parents consented to the interviews, there are some ethical concerns about the study Very limited consideration of wider contributing factors to road traffic accidents</p>
<p>(continued)</p>		

Table 6.1: (continued)

	Aims/objectives of study	Study design/sampling	Methods
Intervention studies			
Thomson, <i>et al.</i> , 1998	To identify the child's ability to find safe crossing sites and construct safe routes through traffic with the help of parent volunteers	Randomised controlled trial, balanced for gender and school Sample frame: schools located in high-risk accident areas	Parent volunteers trained in school, children trained in small groups Children tested two weeks before intervention, immediately after, and 40 days after Children asked to describe and point to the recorder on site their preferred route
Wood <i>et al.</i> , 2003	To test the proposition that: using an educational booklet for parents will encourage the development of traditional traffic skills; and using error-avoidance perspective will enhance the impact of such training on a child's behaviour	Non-randomised controlled trial Parents in 29 schools of mixed SEG contacted; 38% agreed; 27% of agreeing parents returned all three datasets	Parents were asked to provide the following data: background information; assessment of child's traffic skills, comprehension and awareness three times; assessment of child's judgement twice and general comments on leaflet, activities and concerns about road safety
Zeedyk and Wallace, 2003	To determine whether video had an impact on children's knowledge or parents' awareness of pedestrian skills To assess effectiveness of approach towards tackling road safety	Non-randomised control study Invitations were sent to parents of children in Primary 1 at five local schools Participants randomly assigned to intervention/control	Sub-sample submitted structured weekly diary to record video-viewing behaviour Children interviewed at school; parents completed questionnaire either at child's school or at home Time between measurements: 1 month
Traffic clubs			
West <i>et al.</i> , 1993	To investigate the effectiveness of a traffic club in improving road safety knowledge and behaviour of three-year-old children and parental supervision and control	Non-randomised controlled trial, group allocation Sample selected using standard procedures based on census information of postal areas, taking into account social class; urban/rural balance Unclear how participants were recruited	Interviews, lasting approximately 25 minutes, conducted in respondents' homes

Main results	Generalisability/quality of study	Other comments
<p>Significant: Main effect of training and test phase (F [1, 56] = 14.64, $p < 0.001$; F[2, 112] = 9.14, $p < 0.001$) Interaction between training and test phase (F [2, 112] = 13.80, $p < 0.001$) Main effect of gender (F [1, 56] = 6.12, $p < 0.02$)</p>	<p>Quality of study high, reliability of content, systematicity and clarity of methodology high, although article at times confusing Findings are generalisable, but note comments</p>	<p>Parent volunteers blinded to I/C Authors state: 'It appears that parents from vulnerable communities are capable of making a fundamental contribution to children's road safety education, provided they themselves have been properly trained for the job and fully understand what they are trying to achieve.' But intervention requires the recruitment, training and retaining of a sufficient number of volunteers</p>
<p>Significant: Improved traffic skills with age (F = 17.24, d.f. = 2,754, $p < 0.001$) Effect of age on some traffic awareness scores (F = 7.55, d.f. = 2,823, $p < 0.005$) Children from rural areas significantly poorer at remembering to stop at kerb; more likely to be categorised as damage-avoidant ($\chi^2 = 10.97$, d.f. = 2, $p < 0.005$) Girls more likely to be categorised as error-avoidant, boys more likely to be transitional</p>	<p>Quality of study high; reliability of findings high; systematicity and clarity of methodology medium to high (some lack of clarity in reporting, rather than in actual methodology) The intervention, methods and findings are generalisable Evidence of effectiveness is high</p>	<p>Extensive piloting of booklet before main evaluation. The changes after pilot took into account: parental opportunity for decision making; temporal structure; participant workload/commitment; child support/incentive Extreme weather conditions (rain and flooding) affected the implementation of associated activities</p>
<p>No evidence that video was an effective educational tool for parents or children No change in children's knowledge was found as a result of video Parents considered video as an effective educational tool; did not appear to influence parents' views on road safety</p>	<p>The quality, reliability of content, systematicity and clarity of methodology judged as medium due to some weaknesses in study design and lack of certain data The generalisability of findings remains unclear as a consequence, and the small sample size</p>	<p>Those in control group received video at end of study Weakness of study in part explained by exploratory nature of study</p>
<p>Significant: Appeared to reduce incidence of running on ahead ($\chi^2 = 13.9$, $p < 0.01$) Increase in teaching about how to behave near traffic ($\chi^2 = 6.0$, $p < 0.01$) Increase ability to recognise roads ($\chi^2 = 7.9$, $p < 0.005$) Evidence of strong socio-economic group and sex differences in road safety knowledge and behaviour Favourably received</p>	<p>High-quality study, with high reliability of content and high systematicity plus clarity of methodology The findings are probably* generalisable Findings suggest that effectiveness of intervention is medium</p>	<p>* Authors note that a limitation of the study design was to rely on interviews rather than on observation: 'Study reinforces the view that there is a dissociation between safe behaviour in traffic and knowledge or skill. It points to the importance of attitudes and motivation as the critical source of individual differences in accident risk.' (p. 617)</p>
(continued)		

Table 6.1: (continued)

	Aims/objectives of study	Study design/sampling	Methods
Walking buses			
Collins and Kearns, 2005	To create a regional snapshot that would estimate the number of children and parents involved in the walking bus; calculate the number of car journeys saved; identify the benefits and challenges encountered by schools and parents plus the long-term viability	Survey Sampling not clear Participants contacted via telephone or fax	45 telephone interviews, lasting 25–40 minutes, conducted
Kearns, 2001	To assess the success of the walking bus	Survey + observation of one Walking Bus initiative 16 parents accessed through participating children 2 x participant observation, including dialogues Key informant interviews	Questionnaire to parents Observation and dialogue with children Interviews with key informants
Wong <i>et al.</i> , 2004	To assess extent to which walking buses have positive impact on child pedestrian safety To identify perceptions of key stakeholder groups of risk and value of walking buses as they relate to child pedestrian safety Assess the impact of walking buses on child pedestrian safety	Survey Analysis of national data Systematic literature review A list of 10 key stakeholders drawn up; requested interview – 8 agreed; additional 4 interviews on main risk factors on child pedestrian injury plus how walking buses can ameliorate risk factors Land Transport Safety Authority (LTSA) data of reported pedestrian injuries involving children aged 5–10, 2000–03 New Zealand Health Information Services (NZHIS) data for children 5–10 hospitalised following pedestrian injury 2000–03	Face-to-face interviews

Main results	Generalisability/quality of study	Other comments
<p>54 walking bus routes in operation at 29 schools, serving approximately 746 children a day Estimated for each day of operation: 429 car journeys saved The areas at greatest risk are the least served Schemes are very popular</p>	<p>Quality of study & reliability of content judged as medium. Systematicity and clarity of methodology also medium due to lack of required information Generalisability is difficult, due to study design and sample selection Evidence of effect is unclear</p>	<p>Community involvement lower in low-decile /high Maori enrolment</p>
<p>Considered enhancement to child safety Average use: 12.5 months; 6.7 trips a week 7 parents reported use on rainy days Main benefits: 1. parents – time saved; no hassle driving/finding car park; knowing children are safe 2. children – fitness/good health; mixing with other children; extra independence Key informants: retaining volunteers can be problematic; multiple benefits for children; symbolic importance; role of school vital Evidence of effect is unclear</p>	<p>Quality of study judged as medium to low due to a lack of clarity of methodology, reliability of content and study design Not possible to generalise on basis of findings</p>	<p>Exploratory study, small sample, author notes 'self-interest'</p>
<p>No evidence of difference between rate of child pedestrian injury /hospitalisation 2001–03 Some concern that walking buses engender false sense of safety as children become more dependent on decisions made by adult supervisors Perceived increased safety, reduced traffic congestion Recruitment and retainment of volunteers main barriers</p>	<p>Quality of study judged as medium to low due to a lack of clarity of methodology and reliability of content It is not possible to generalise on the basis of findings Evidence of effect is unclear</p>	<p>Walking bus initiatives are popular and would benefit from high-quality robust evaluation</p>

7 CYCLING SAFETY

Cycling safety in terms of parent-child interaction has not received the same attention as pedestrian safety. In fact it would seem that most studies which have involved children as cyclists have evaluated some aspect of cycle helmet use (Towner *et al.*, 2002).

This review identified five studies involving a total of 441 parents and 1,814 children, which considered aspects of road safety and the interaction between parents and their children as cyclists. All five studies were surveys and none of them were conducted in the UK. Two were conducted in the United States (Miller *et al.*, 1996; Peterson *et al.*, 1997), two in Sweden (Berg and Westerling, 2001; Johansson and Drott, 2001) and one in the Netherlands (Morrongiello and Major, 2002). Three of the studies assessed children's attitudes towards the use of cycle helmets, and parental influence on cycle helmet use (Miller *et al.*, 1996; Peterson *et al.*, 1997; Berg and Westerling, 2001). One study considered the influence of safety gear on parents' perceptions of injury risk and their tolerance of children's risk taking (Morrongiello and Major, 2002), and the fifth study analysed the relationship between traffic hazards, parents' perceptions of their child's traffic situation and any actions taken by parents to cope with such hazards (Johansson and Drott, 2001). Further details about the interventions are found in Appendix 3.

7.1 Methods

The five studies used a range of different recruitment methods. Morrongiello and Major (2002) approached parents who were on a university register of individuals who were interested in taking part in child development research, while Miller *et al.* (1996) used waiting rooms to approach parents whose children were patients in paediatric practices in Chicago, and Johansson and Drott (2001) contacted parents of children who had been admitted to the Department of Paediatric Surgery in Uppsala for traffic accidents and abdominal pain. Berg and Westerling (2001) contacted all pupils aged 12-15 in Bålsta and Enköping in Sweden, while Peterson *et al.* (1997) chose to randomly select mothers of second and eighth grade children in the local comprehensive schools.

Likewise the procedures were quite variable between the studies. Petersen *et al.* (1997) used vignettes depicting different situations in which a child would not want to wear their helmet, and probed for their reactions using four levels of child resistance to wearing the helmet: the child leaving the house without a helmet; a particular excuse given by the child; what the final outcome would be of the situation; and what they would do if the child continued to refuse to wear the helmet. Morrongiello and Major (2002) interviewed mothers on the telephone about seven different activities, including cycling, and asked them to rate the extent of permissible risk-taking by their child for each activity based on a safety gear

condition and a non-safety gear activity. Johansson and Drott (2001), on the other hand, interviewed parents whose child had been admitted to hospital in their own home. After the completion of the one-hour interview, the interviewer with the parents sketched a map of the home and the surrounding traffic environment, marking out the child's regular movements in the streets. Traffic intensity was estimated for each of these streets. Miller *et al.* (1996) asked parents to fill in a three-page questionnaire in the doctor's waiting room while their child was interviewed. Parents were asked about helmet ownership, the likelihood of childhood bicycle head injury, the perceived effectiveness of helmets, knowledge of serious bicycle injury and seat-belt use. Children were asked about their cycling behaviour and helmet use. Berg and Westerling (2001) simply stated that children filled in questionnaires on the use of bicycle helmets, attitudes towards helmets, the involvement of parents and school, and intended future use of a helmet.

7.2 Findings

A small number of significant findings were identified in these studies. The two studies that considered children's attitudes to helmet use (Miller *et al.*, 1996; Berg and Westerling, 2001) found that parents were the most important influence on children's use of cycle helmets, but that parental involvement also decreased with children's age. The most common reasons among children for not wearing a helmet were: the helmet being uncomfortable or ugly; 'forgot'; and 'not needed'. However, Berg and Westerling (2001) found a discrepancy between what the children believed were the reasons for stopping and the reasons for actually stopping wearing the helmet. The two studies also found that helmet use was significantly higher among children with strict rules. In the American study, helmet ownership was significantly higher where parents had higher education, reported wearing seat belts, owned a helmet and perceived that helmets were effective in preventing injury (Miller *et al.*, 1996). In the second Swedish study, inner-city children made most use of the bicycle for play, while suburban children used their bicycle mainly for transport to go to school and to visit friends (Johansson and Drott, 2001). Interestingly, the interviews showed that, for parents, the local traffic environment was an important factor in determining the purpose for and level of their children's bicycle use, thus echoing findings from Antill's (1991) survey of parent's perceptions of pedestrian safety.

In the only study to consider maternal methods for enforcing helmet usage in children, mothers were more likely to command, discuss with or persuade children regarding the need to wear a helmet than to use consequences as a technique. Mothers also asserted more powerful techniques for children when they were at greatest risk (Peterson *et al.*, 1997). In contrast, Morrongiello and Major (2002) found that mothers who believed that their children had a high level of experience with the activity allowed them greater risk-taking even when not wearing safety gear, and that wearing a cycle helmet resulted in substantial increases in permissible risk-taking. Parents also had more confidence in cycle helmet efficacy than previously thought.

7.3 Quality of studies and evidence

The quality of the studies was generally medium, partly due to the limitations of the study design. However, the quality of Berg and Westerling's (2001) study was judged to be high. The survey provides findings with high reliability of content, and the systematicity and clarity of the methodology is also high. The findings provide medium evidence of effect. Although the study is of high quality, the generalisability of the findings needs to be treated with some caution due to cultural differences and differences in attitudes to safety between Sweden and the UK. The remaining four studies were small scale (Peterson *et al.*, 1997; Johansson and Drott, 2001; Morrongiello and Major, 2002) and/or acknowledged a potential sample bias (Miller *et al.*, 1996; Morrongiello and Major, 2002). Although the systematicity and clarity of the studies was either medium or high, reliability of content and generalisability of the findings remained questionable to low due to the small sample sizes, sampling bias and potential cultural differences. In conclusion, the findings from these studies provide medium (Miller *et al.*, 1996; Peterson *et al.*, 1997; Morrongiello and Major, 2002) or unclear (Johansson and Drott, 2001) evidence of effect.

Table 7.1: Cycling safety study design and quality of study

Cycling safety	Aims/objectives of study	Study design/sampling	Methods
Berg and Westerling, 2001	To study attitudes to and use of bicycle helmets among school children To determine whether these attitudes are associated with the involvement of parents and the school in bike safety	Survey All pupils aged 12–15 in two municipalities Not stated how they were recruited	Not clear how questionnaire was distributed

7.4 Summary of findings

Table 7.1 provides further detail regarding the main results.

- There is sufficient evidence that parents are an important influence on young children’s use of cycle helmets.
- There is some evidence to suggest that parents’ perceptions of the local traffic environment are important factors in determining children’s cycling patterns.
- There is some, but conflicting, evidence regarding parents’ understanding of their children’s level of experience and level of risk.

7.5 Gaps in knowledge

- There is a lack of high-quality rigorous research regarding child parent interaction as cyclists.
- There is a lack of knowledge about the actual process of road safety interaction between the parent as a cyclist or as a pedestrian and the child as a cyclist.
- There is a lack of understanding with regard to how negative attitudes to helmet use arise and how such attitudes might be influenced.

Main results	Generalisability/quality of study	Other comments
<p>27% of 12-year-olds and 1% of 15-year-olds wore helmets 60% stopped because helmet was ugly, silly, uncomfortable, inconvenient Discrepancy between what children believed to be reasons for stopping and reasons for actually stopping Majority believed it was important to wear helmet Parental rules considered important by 80% at intermediate level and 63% at upper level 55–76% thought parents, friends and older pupils were an important influence Involvement of parent decreases with age of child 84% of those using helmets had parents telling them to Greatest influence: parental rules, age, attitudes (parameter estimates significant at $p < 0.05$)</p>	<p>High-quality study despite some lack of significant information on methodology Reliability of content is high It may be possible to generalise findings, however, see comments</p> <p>Owing to study design, and the fact that findings are based on pupils’ perceptions, evidence of effect is limited (medium)</p>	<p>Swedish attitudes to road safety may differ from attitudes in the UK because of differences in culture etc. Authors state: ‘An important base for understanding helmet habits among school children would be a better understanding of how negative attitudes arise and how to influence such attitudes.’ (p. 221)</p>
(continued)		

Table 7.1: (continued)

Cycling safety	Aims/objectives of study	Study design/sampling	Methods
Johansson and Drott, 2001	To analyse the relation between traffic intensity and traffic hazards in the local traffic environment, the parents' view of their child's traffic situation, and actions taken by parents to cope with these hazards	Survey Parents of children who had been admitted to the Department of Paediatric Surgery for traffic accidents and abdominal pain 'contacted' Selected on basis of representing inner city, suburban and urban communities	Unstructured interviews
Miller <i>et al.</i> , 1996	To examine attitudes towards, and use of, bicycle helmets by children aged 5–14 To examine the effect of parental rules on helmet use by children	Survey Parents approached in paediatric practices	Parents given three-page questionnaire to fill in; children were interviewed
Morrongiello and Major, 2002	To examine risk compensation theory as it relates to parents' judgements about school-age children's permissible risk taking in situations wearing/ not wearing safety gear	Survey Selected randomly from Child Development Research Unit register in Guelph Contacted by telephone	Telephone interview
Peterson <i>et al.</i> , 1997	To determine the mode of helmet enforcement that mothers use with their second and third grade children	Survey Mothers randomly selected from local school system Sent letter to invite them to participate in the study	Using 12 vignettes, mothers were probed for responses and reactions to four levels of child resistance to helmet use: child leaving house without helmet; child excuse for not wearing helmet; what final outcome might be; reaction if child continued to refuse

Main results	Generalisability/quality of study	Other comments
<p>Significant: Inner-city children made the most use of bicycles for play Suburban children used bicycles for transport to go to school/visit friends Inner-city and urban children most restricted Parents who judged traffic environment as light tended to report independence goal (66%); those who judged it as severe were inclined to report the carefulness goal (63%) 97% indicated they should have control over child's traffic education Local traffic environment is an important factor in determining how much and for what purpose children use bicycles; parents' traffic education goals; traffic accident reports</p>	<p>Quality of study judged as medium due to a lack of significant information on methodology and sample selection Reliability of content is medium to low due to analysis, which could be questioned Evidence of effect is unclear and generalisability difficult</p>	<p>Cultural differences between Sweden and the UK may make generalisability difficult The researchers conducted a quantitative analysis of qualitative data Findings may therefore need to be treated with some caution</p>
<p>Helmet ownership significantly higher where a parent had college/postgraduate degree ($p < 0.05$), reported always using seat belts ($p < 0.01$), owned a cycle helmet ($p < 0.001$), perceived that helmets were effective for preventing a head injury ($p < 0.05$) 28% reported owning a cycle helmet 64% said they would use a helmet if they had one; parents are an important influence Not purchased: never thought to; never got around to; child would not use it Children not using: forgot; lost; appearance; uncomfortable More children with strict rules used a helmet (88% versus 19%, $p < 0.001$)</p>	<p>Although systematicity and clarity of methodology is high, the quality of the study and reliability of content is medium due to sample selection bias Generalisability of findings is unclear because of study design and flaws in sampling</p>	<p>Estimate of helmet ownership and use may not be representative of practices studied because of small sample size</p>
<p>Wearing a cycle helmet resulted in substantial increases in permissible risk taking Mothers who believed their children had a high level of experience with activities allowed them greater risk taking, even when not wearing safety gear Parents had more confidence about cycle helmet efficacy than previously thought</p>	<p>The quality of the study and clarity of methodology are medium due to limited information on methods and potential sample bias Despite limitations of the study design, evidence of the effect is judged as medium</p>	<p>Sample self-selected Reported behaviour versus 'reality' needs to be taken into account</p>
<p>In most cases no significant main effects of gender or age More likely to command, persuade or discuss the need to wear a helmet than to use 'consequences' ($\chi^2(3) = 92.51, p < 0.01$) Mothers asserted more powerful techniques for children when they were at greatest risk</p>	<p>High- to medium-quality study with high clarity and systematicity of methodology, but medium reliability of content Generalisability of findings is limited due to small study size and cultural differences</p>	<p>Second grade – legal age for riding bicycle unsupervised; eighth grade – peak of cycle injury</p>

8 CAR AND DRIVING SAFETY

Although most research regarding parent-child interaction in the context of road safety tends to focus on pedestrian roadside safety, a small number of studies were identified that were concerned with car safety. The majority of these evaluated seat-belt use but one American research group focused on teen driving.

8.1 Parent-child interaction in the car

Five studies involving a total of 2,849 parents and 7,738 children/young people, which evaluated some form of parent-child interaction while driving, were identified. The large numbers are due to one of the studies being an observational study that included observations of over 10,000 individuals (Williams *et al.*, 2003). The other four studies were surveys and none of the studies were conducted in the UK. Four were conducted in the USA (Page, 1986; Moss and Tobin, 1988; Shin *et al.*, 1999; Williams *et al.*, 2003) and one in Brazil (Bianchi and Summala, 2004). Three studies were concerned with the use of seat belts. One study aimed to determine the seat-belt use of teenage drivers arriving to school in the morning and to football games in the evening compared with the seat-belt use of adults driving teenagers to these events and their teenage passengers (Williams *et al.*, 2003). The other two investigated young people's perceptions of parental use, as well as their own use, of seat belts (Page, 1986), and the socio-economic and ethnic influences on teenage seat-belt use (Shin *et al.*, 1999). Moss and Tobin (1988) investigated the association between parents' perceptions of accident likelihood, their experience of seat-belt use, accident involvement and child car-seat use. The fifth study set out to test whether parents' driving style might predict their children's driving style when exposure factors (to risk) are controlled (Bianchi and Summala, 2004). Further details about the interventions are found in Appendix 3.

8.1.1 Methods

Although four of the studies were surveys, the instruments and methods they used were quite different. Bianchi and Summala (2004) used the validated 'driver behaviour questionnaire' with Brazilian undergraduate and postgraduate students. The students were asked to indicate on a six-point scale how often they had committed three categories of behaviour while driving: violations (deliberately breaking the rules), errors (potentially dangerous failures of judgement or observation), or lapses ('silly' errors which would not cause risk). Once the students had completed the questionnaires, they were asked to take more questionnaires to their parents and for their brothers or sisters. The data consisted of 174 parent-child pairs (123 students and 156 parents, some with more than one case from the same family). Moss and Tobin (1988) also used a questionnaire with a Likert-type scale. The questionnaire addressed:

- parents' perceptions of accident likelihood and accident severity;
- their own seat-belt use and their child's car-seat use;
- whether or not they had been involved in a road traffic accident;
- the effect of a new law requiring the use of car seats and past car-seat practice;
- parental interventions when the child was disruptive in the car; and
- reasons for not using a car seat.

The 81 participating parents with children under the age of four were approached in two rural well-child clinics. Two of the surveys about seat-belt use had questionnaires distributed to 254 high-school students in five (two private, one middle class, two inner-city) mid-Atlantic schools (Shin *et al.*, 1999) and to 256 middle-school pupils in two predominantly middle class Utah schools (Page, 1986). Shin *et al.* (1999) asked questions about the convenience factor of seat belts (seat belts in older cars are less convenient to use), social influences (cultural transmission of socio-economic and ethnic differences), psychological responses (low socio-economic circumstances tend to produce psychological responses which contribute to poorer health-related behaviour), and health and safety factors (low socio-economic status may attribute less value to preventive behaviours). William *et al.* (2003) selected six schools in each of the two states – Massachusetts and Connecticut – and observed driver – passenger behaviour with regard to seat-belt use over a period of six weeks, two days per week.

8.1.2 Findings

Owing to the diversity of the studies, it is difficult to draw clear conclusions from the findings. However, a small range of significant effects were identified in the individual studies. In Bianchi and Summala's (2004) study, parents' driving behaviour was found to influence their children's driving even when major background and exposure factors were controlled. Their driving style explained significantly their children's errors (R_2 change: 11.2%) and ordinary violations (R_2 change: 3.2%). Although there was a correlation between fathers' and their daughters' aggressive violations, the parents' aggressive violations did not explain their children's behaviour. Rather, this was explained by the children's lifestyle, which in this study was closely related to family connectedness. Moss and Tobin (1988) found no relationship between parents' perceptions of accident likelihood and car-seat use. In addition, those parents who believed that their child would be seriously injured, even when restrained, tended to restrain them less frequently. There was a strong relationship between past and current restraint use ($r(87) = 0.75, p < 0.001$), and parents who did not take the child out of the seat and did not ignore him/her when the child was disruptive were significantly more likely to use restraint frequently.

The influence of believing in fate was mirrored in Shin *et al.*'s (1998) survey of high-school children's seat-belt use. Those who believed in 'fate' tended to use seat belts less frequently than those who did not. All three studies investigating the use of seat belts demonstrated that parents have a significant influence on children's road safety behaviour. Seat-belt use was significantly higher among students whose parents used seat belts and encouraged seat-belt use (Page, 1986; Shin *et al.*, 1999). In addition, Williams *et al.* (2003) found that teenage passengers with teenage drivers had significantly lower seat-belt use than with adult drivers, regardless of driver gender, although girls tended to use seat belts more frequently. However, teenage passengers were more likely to be belted if the driver was using a seat belt, regardless of whether the driver was a teenager or an adult.

8.1.3 *Quality of findings and evidence*

Overall, the quality of the studies was medium due to the limitations of the study design and a lack of information on validity, the sample and the research process. This also affected the clarity of the methodology. Two of the studies were quite old (Page, 1986; Moss and Tobin, 1988) and were only included because of the type of behaviour they investigated. Most of the studies were fairly small and the findings, therefore, need to be treated with some caution. In addition, self-reported behaviour, as was the case in the four surveys, may have weakened the validity of the findings. The quality of Williams *et al.*'s (2003) observational study was, however, judged to be high, despite limited information on the actual observation process. On the combined evidence of these studies, the effect of parental influence on child safety behaviour in the car is high. For any other effect the evidence was either medium or low. Owing to cultural differences and the methodological limitations, the findings may not be generalisable to British circumstances. However, some lessons can still be learnt from the findings. Further details about the interventions are found in Appendix 3.

8.2 **Teen driving**

The teen-driving research programme in Maryland and Washington DC is reported over a period of 14 years (1990–2004) in 15 peer-reviewed journal articles. The full list of these articles can be found in Appendix 4. The articles can be grouped into four main areas of research: parents' awareness of teen-driver risk (1); parents' perceptions of, and action on, teen drinking and driving (5); parental influence on teen driving (4); driving agreements, checkpoints programme and graduated licensing (5). In addition, one article provides an overview of the research and is included in Section 5. The main findings are described below.

8.2.1 *Parents' awareness of teen-driver risk*

A survey of 424 teenagers and their parents found that the most frequently reported driving rules and teaching were:

- have the car back by a specified time;
- being allowed to take the car only to certain places;
- being required to inform their parents where they are going with the car;
- having a limited number of passengers in the car;
- safe driving in residential areas;
- avoiding other aggressive drivers; and
- anticipate other drivers' actions.

However, teenagers were significantly less likely than their parents to report that they had restrictions on where they could take the car, what routes they were allowed to drive, who could ride with them in the car and how far away from home they were allowed to drive, and were significantly more likely to report that they had been taught how to avoid being an aggressive driver, driving safely at night, driving safely in general, wearing a seat belt and avoiding alcohol-impaired driving (Beck *et al.*, 2001a).

8.2.2 *Parents' perceptions of, and action on, teen drinking and driving*

Parents' perceptions of teen drink-driving risk and action on drink-driving was investigated through:

- two telephone surveys with 428 parents and their adolescents in Maryland and 807 adults in Washington DC;
- focus group interviews with parents of high-school students; and
- a three-month prospective study of 261 licensed adolescents (Beck, 1990; Beck *et al.*, 1991; Haynie *et al.*, 1999; Hartos *et al.*, 2002).

The studies indicate a considerable lack of parental awareness of teen drinking and a frequent denial of their own child's involvement, despite viewing teen drinking and driving to be prevalent. Many parents employed limited strategies for dealing with and managing their children's risky driving behaviour. Although about half said they had family policies concerning drinking, less than a fifth of the parents interviewed had any penalties for violating these policies. The focus group interviews indicated that parents were in favour of skills training to improve their level of communication with their children, but resisted programmes that would require a substantial time commitment. The findings from the three-month prospective study which involved interviews with adolescents at 'baseline' and three months later suggests that high levels of risky driving are related to a (lack of) parenting. The results indicated that risky driving among teenagers was consistent over a three-month period. There was also an indication that parental restrictions and monitoring are related to teenage risky driving. Therefore, adolescents were much more likely to drive safely when

their parents controlled and monitored their driving behaviour. However, sensation-seeking, deviance acceptance and problem-behaving peers were related to risky driving, which could indicate that parental authority may not be conducive to such adolescent orientations.

8.2.3 *Parental influence on teen driving*

The four articles in this group report on a series of interviews with parents and adolescents on parental control and influence on problem driving (Hartos *et al.*, 2000; Beck *et al.*, 2001b; Hartos *et al.*, 2004a, 2004b). Overall, parents reported high levels of intended restrictions and supervision of their adolescent's unsupervised driving. About a third of the parents reported completing driving agreements with their teenage drivers. As in the drink-driving surveys, the results indicate that where parents regularly monitored and had specific rules regarding teen-driver behaviour, the adolescents were less likely to report being distracted by friends, being fined, or driving too fast or aggressively. However, an in-depth study of parental rules showed that, although both parents and teenagers reported parental rules, such rules and the consequences of breaking the rules were not always clearly defined and unambiguous.

8.2.4 *Driving agreements, checkpoints programme and graduated licensing*

The development of programmes that implemented an element of control on teen drivers was explored in one randomised controlled trial ($n = 452$), one non-randomised controlled trial ($n = 579$), one large-scale survey, one pilot survey and one discussion paper (Hartos *et al.*, 2001; Beck *et al.*, 2002; Simons-Morton *et al.*, 2002; Beck *et al.*, 2003; Simons-Morton *et al.*, 2004). The findings mirror the results from the previous studies. In the intervention studies there was a significant increase in the amount of teenage-perceived parental driving restrictions. The results also suggest that there is a relationship between parental restriction and reduced risk driving but not between parental instruction and reduced risk driving. In a non-randomised controlled trial of the check points programme, an information video was given to parents at the same time as the driving agreement. In the intervention group, parents were three times more likely, and intervention teens were five times more likely, to report using a parent–teen agreement.

Similar results were achieved with persuasive education in the form of two newsletters sent to the parents and teenage drivers shortly after receiving the driving agreement. In an initial pilot study of the acceptability of the parent–teen driving agreements, most families liked and used the agreement. Moreover, parents reported placing stricter limits on their teens' driving than they had originally intended. Finally, the findings from the evaluation of the graduated licensing programmes indicate that there was some improvement in parental involvement and restrictions but that there was little evidence that these restrictions resulted from the formal

parental instruction component of the graduated licensing programme. However, teens reported significant increases in the frequency of parental driving instruction and supervised driving.

8.2.5 *Quality of findings and evidence*

Overall, the quality of the majority of the study elements is high. However, some caution is due considering the cultural differences between driving in the United States and in the UK. Two of the main differences are that 16-year-olds are able to drive and in Maryland all 16-year-olds have to be in by midnight. Bearing in mind the limitations of some of the study designs, the evidence of effect ranges between high and medium. The authors also note that the randomised controlled trial does not allow for analysis of how effect was achieved. As the only identified study programme on driving agreements, the findings suggest that such programmes may be effective.

8.3 **Summary of findings**

Table 8.1 provides further detail regarding the main results.

- There is some high-quality evidence that parents' driving styles have an impact on teenagers' car safety behaviour and, in particular, seat-belt use.
- There is some evidence that past car-safety behaviour is a predictor of future safety behaviour.
- There is some evidence that individuals who believe in 'fate' are less likely to restrain their children than those who do not believe in fate.
- There is some evidence that parents who do not lift their child out of the car seat and who do not ignore their child in the car seat are more likely to continue using the car seat.
- There is insufficient evidence that knowledge of accident risk does not increase child car-seat use.
- There is some evidence that parents often lack an awareness of teenage drinking and driving, and frequently deny their own child's involvement in such activities.
- There is some evidence from high-quality American research that parental monitoring and control influence their children's safe driving.
- There is some evidence that parental driving rules and the consequences of breaking the rules are not always clearly defined and are unambiguous.
- On the basis of one high-quality study programme there is some research evidence to suggest that driving agreements with a persuasive educational input are effective in encouraging parents to use the driving agreements, increase the frequency of driving instruction and implement driving restrictions.

8.4 Gaps in knowledge

- No studies on parent–child interaction and driving safety have been conducted in the UK. It is therefore difficult to draw any firm conclusions from existing research in relation to British circumstances.
- There are no European studies on parents’ and teenagers’ expectations regarding driving safety and parental control. Nor is there any research on the effectiveness of driving agreements in a European context.

Table 8.1: Car and driving safety study design and quality of study

Car and driving safety	Aims/objectives of study	Study design/sampling	Methods
Parent–child interaction in car			
Bianchi and Summala, 2004	To test whether parents’ driving style predicts their children’s driving style when exposure factors are controlled	Survey ‘from different courses’ Sampling and recruitment not clear	Completed Portuguese version of Driver Behaviour Questionnaire (DBQ)
Moss and Tobin, 1988	To determine which perceptions and experiences of rural parents were most associated with placing their children in car seats	Survey Parents from two health clinics asked to participate	Questionnaires completed at clinic
Page, 1986	Does parental example play a role in the use of seat belts in pre-adolescent children	Survey Sampling method not stated	Research tool unclear

Main results	Generalisability/quality of study	Other comments
<p>Significant: Errors correlate in each parent-child group Ordinary violations correlate for all groups except mother-son pairs Aggressive violations – significant correlation between fathers and daughters; although this was explained by lifestyle Parents' driving style explains significant children's errors (R2 change: 11.2%) and ordinary violations (R2 change: 3.5%)</p>	<p>Quality of study is medium due to poor clarity and systematicity of methodology and small sample size Generalisability of findings is unclear Evidence of effect is low</p>	<p>Self-reported behaviour may limit reliability</p>
<p>No relationship between parents' perceptions of accident likelihood and car-seat use ($r(81) = 0.0003, p > 0.05$) Weak relationship between car-seat use and belief regarding slight injury Parents who believed that child would be seriously injured, even when restrained, tended to restrain less frequently Weak relation between parents' use of seat belt and use of car seat Frequency of restraint in the past strongly related to frequency of current restraint ($r(87) = 0.75, p < 0.001$) The habit of restraint is an important factor for parent and child</p>	<p>A medium-quality study due to limited information on methodology and analysis Small sample size Despite age of study and study design, evidence of effect high to medium</p>	<p>Age of study limits generalisability of findings</p>
<p>Significant difference between children reporting seeing parents use seat belts/not seeing and their own use Those who had seen parents use seat belts used them on average 20.7/100 trips Those who had not seen parents use seat belts used them on average 2.4/100 trips ($t_{212} = 4.64, p < 0.001$) Significant reasons for not wearing: parents have not asked me to; do not think about it; do not want to be bothered; not cool; not necessary for short trips ($p < 0.001$)</p>	<p>Low-quality small study with weak systematicity and clarity of methodology Not possible to generalise on the basis of findings Because of study design and small sample size, evidence of effect is low</p>	<p>Age of study affects generalisability</p>
<p>(continued)</p>		

Table 8.1: (continued)			
Car and driving safety	Aims/objectives of study	Study design/sampling	Methods
Parent–child interaction in car			
Shin <i>et al.</i> , 1999	To provide evidence on a set of four hypotheses (convenience; psychological; health and safety; social influence) concerning possible causes of socio-economic and ethnic differences in seat-belt use	Survey High-school students in five different schools Not clear how sample frame obtained or how students recruited	Questionnaire distributed
Williams <i>et al.</i> , 2003	To determine seat-belt use of teenage drivers arriving at high school in the morning and evening (football) compared with the belt use of adults driving teenagers to these events and teenage passengers	Observation 12 high schools selected using tight inclusion criteria	Unobtrusive observations conducted by teams of two observers standing side by side at each entrance/exit to school campus

Main results	Generalisability/quality of study	Other comments
<p>Inner-city school children less likely to use seat belts</p> <p>Seat-belt use higher among those whose parents use seat belts</p> <p>Strong inverse association between seat-belt use and inconvenience variable ($p < 0.001$)</p> <p>Higher among students with safety concerns ($p < 0.01$)</p> <p>Lower use among students who believe in 'fate' ($p < 0.10$)</p> <p>Type of school attended is a strong predictor of seat-belt use</p>	<p>A medium-quality study due to a lack of some information on methodology and sample frame</p> <p>Difficult to draw generalisable conclusions from findings due to cultural differences between the UK and the USA</p>	<p>Useful study which considers socio-economic factors and ethnicity. However, study grounded in American social environment and does not consider other social and cultural factors that might influence these findings</p>
<p>Seat-belt use by females higher than for males</p> <p>Teenage male passengers driven by other teenagers had lower seat-belt use than those driven by adults (42% versus 50%, $p = 0.005$), regardless of driver gender</p> <p>Passengers more likely to be belted if driver (teen or adult) was belted, but 25–30% remained unbelted</p> <p>44% of teenagers were not belted when with adults</p>	<p>High-quality study with high systematicity and clarity of methodology and high reliability of content</p> <p>Generalisability of findings may be limited due to cultural differences in driving between the UK and the USA</p> <p>Acknowledging limitations of study design evidence of effect is high</p>	<p>Weakness in study design is that researchers do not take into account other potential reasons for teenagers not using seat belt, e.g. age of car</p>
<p>(continued)</p>		

Table 8.1: (continued)			
Car and driving safety	Aims/objectives of study	Study design/sampling	Methods
Teen driving			
<i>Awareness of teen driving risk</i>			
Beck <i>et al.</i> , 2001a	To determine the nature and prevalence of parental involvement with teen driving and its relationship to teen driving risk	Survey State-wide sample of parents and their provisionally licensed teenagers Contacted through mail by the Motor Vehicle Administration and invited to participate in telephone survey	Interviews lasting approximately eight minutes (parents), seven minutes (teens)
<i>Perceptions of/action on teen driving and drinking</i>			
Beck, 1990	To quantify the extent to which parental awareness of teen drink-driving is reflected in the community	Telephone survey Using computer-generated list of telephone numbers	Calls were made requesting permission to interview head of household Interviews lasted approximately 12 minutes
Beck <i>et al.</i> , 1991	To explore parents' in-depth perceptions of their children's alcohol consumption patterns and influences plus appropriate interventions	Qualitative study Parents of high-school children recruited through announcement in local newspaper and flyer	Four focus groups with 8–12 participants. Parents received \$25. Sessions run by moderator plus observer and were audio-taped
Hartos <i>et al.</i> , 2000	To examine relations among problem-driving practices and parenting practices	Survey Adolescents were asked to participate Parental consent obtained	Telephone interviews lasting approximately 20 minutes
Haynie <i>et al.</i> , 1999	To examine parents' awareness of their adolescents' alcohol-related behaviour and compare parent/teen perceptions of parent strategies to manage teen behaviour	Survey Parents and their teenagers recruited via random digit dialing	Telephone interviews lasting 30 minutes (parents), 20 minutes (teens)

Main results	Generalisability/quality of study	Other comments
<p>Parents stated they employed a variety of rules and restrictions</p> <p>Teenagers significantly less likely than parents to report they had restrictions</p> <p>Parents were significantly less likely to report that their teen had ever engaged in any risky events, apart from driving after dark or played music too loudly</p> <p>Parents least aware when teens rode with drinking driver, was distracted by other passengers, did not wear a seat belt, drove aggressively or had encounter with an aggressive driver</p>	<p>Medium-quality study due to limitations of study, i.e. self-selected sample or self-report, which authors note</p> <p>Evidence of effect is weak due to the exploratory nature of study</p> <p>Cultural differences may limit generalisability of findings</p>	<p>Authors note that due to the limitations of the study design, the findings need to be treated with some caution</p>
<p>Low levels of parental awareness of the extent of teen drinking, particularly among their own children</p> <p>Low levels of parental control of teen drinking/drink-driving</p> <p>Most parents viewed teen drinking/drink-driving to be prevalent, but large proportion never discussed drinking and driving with their teenagers</p> <p>Traffic violations four times more likely with lenient restrictions, two times more likely with low parental control</p> <p>Parents employed a limited repertoire of strategies to manage teen behaviour</p>	<p>Quality of studies range from medium to high</p> <p>Although findings are relevant, they may be difficult to generalise due to cultural differences between the UK and the USA</p>	<p>There is a need for similar studies to be conducted in the UK and the rest of Europe</p>
(continued)		

Table 8.1: (continued)			
Car and driving safety	Aims/objectives of study	Study design/sampling	Methods
Teen driving			
<i>Parental influence on teen driving</i>			
Beck <i>et al.</i> , 2001b	To compare associations between teen and parent reports of parental driving influence to teen-reported high-risk driving	Survey State-wide sample of parents whose children had provisional licence Teenagers recruited if they and their parents gave consent	Telephone interviews with parents and teenagers, lasting eight minutes (parents), seven minutes (teenagers)
Hartos <i>et al.</i> , 2004a	To determine the extent to which parents intend to place driving limits on adolescents approaching unsupervised driving	Survey Parents whose children aged 16 had provisional licence Recruited from local Motor Vehicle Registration site	Parent surveys took 10–15 minutes to complete
Hartos <i>et al.</i> , 2002	To examine the relation between risky driving, parenting and deviance, and the stability of risky driving over time	Three-month prospective study – an exploratory study Convenience sample of adolescents from several high schools in two districts	Teenagers were interviewed by responding to questions with numbered response choices. Interviews took approximately 20 minutes Recontacted after three months and asked about risky driving behaviour Follow-up interviews took approximately 10 minutes
Hartos <i>et al.</i> , 2004b	To assess driving rules reported by newly licensed teens and their parents in terms of content, delivery, rigidity, consequences of minor /serious violations	Survey 24 families recruited from prospective study	Parents and their teenagers completed a telephone interview lasting approx. 20 minutes

Main results	Generalisability/quality of study	Other comments
<p>Teens reporting specific parental rules restricting who could ride with them, and how many, were less likely to report being distracted by friends, getting a fine, driving too fast or aggressively</p> <p>Parents reported high levels of intended limits on adolescents' unsupervised driving</p> <p>Driving limits and completed driving agreements were more likely when parents reported high levels of parental monitoring, discussion of driving rules, risk perception and vehicle access</p> <p>Driving rules were found to cover a full range of concerns, especially night driving and passenger limits; violations were followed by consequences</p> <p>However, many rules not very strict and showed limited parent-teen agreement on content</p> <p>Early risky driving an indicator of risky driving later on</p> <p>Adolescents with high risky driving behaviour were three times more likely to report low parental monitoring, two times more likely to report low parental restrictions, and five times more likely to report high deviance acceptance</p>	<p>Generally high-quality studies</p> <p>Although findings are relevant, they may be difficult to generalise due to cultural differences between the UK and the USA</p>	<p>There is a need for similar studies to be conducted in the UK and the rest of Europe</p>
<p><i>(continued)</i></p>		

Table 8.1: (continued)

Car and driving safety	Aims/objectives of study	Study design/sampling	Methods
Teen driving			
<i>Driving agreements, graduated licensing</i>			
Beck <i>et al.</i> , 2002	To present an analysis of adolescent driving risks, the advantages of graduated licensing programmes and the potential for family-oriented programmes to moderate teen driving risks	Analysis of risk factors, policy (graduated driver licensing programmes), conceptual link between parenting and teen driving, relations between parenting and teen driving, link between parenting and graduated licensing, increasing parental management of teen driving	N/A
Beck <i>et al.</i> , 2003	To determine whether Maryland's new graduated licensing programme was associated with greater levels of parental involvement in, and restrictions on, teens' unsupervised driving	Two separate surveys Parents whose teenagers had obtained a provisional licence invited to participate in a telephone survey	First telephone interviews in 1999, second in 2000 Parents and teenagers interviewed separately: eight minutes for parents, seven minutes for teens
Hartos <i>et al.</i> , 2001	To assess acceptability of the format of content of the Checkpoints P–TDA	Survey Convenience sample of families with adolescents aged < 17.5 years Asked to use programme and complete survey within three months	Telephone interviews with families
Simons-Morton <i>et al.</i> , 2004	To determine whether exposure to brief educational/motivational intervention administered at the Motor Vehicle Administration increases parental limits on teen driving	Non-randomised controlled study Parents and adolescents recruited from local Motor Vehicle Administration site	Parents completed written survey while teenagers completed paperwork for Motor Vehicle Administration One month later, follow-up telephone interviews took place Each week of recruitment was designated as intervention or control – intervention group parents watched Checkpoints video and given copy of video plus parent–teen agreement
Simons-Morton <i>et al.</i> , 2002	To evaluate the effectiveness of the Checkpoints Programme	Randomised controlled trial Parent–teen dyads recruited when teens received learner's permits	Parents and teens completed telephone interviews at recruitment (baseline), 3 months, 6 months and 12 months Intervention group received video Families mailed frequent, brief, persuasive communication: a newsletter Finally, families receive a parent–teen driving agreement in the mail

Main results	Generalisability/quality of study	Other comments
<p>Indication that graduated licensing may lead to significant increases in the frequency of parental driving instruction and supervised driving during permit stage</p> <p>Significant increase in the amount of teen-perceived parental driving restrictions</p> <p>Findings suggest a relationship between parental restriction and reduced risk driving, but not between parental instruction and reduced risk driving</p> <p>Most families like the parent–teen driving agreement (P–TDA)</p> <p>Intervention parents reported more driving rules, restricted driving, limits for high-speed roads, weekend night restrictions, overall driving limits</p> <p>Intervention teens reported more limits on passengers, high-speed roads, night driving and overall driving limits, but not on driving under high-risk conditions</p>	<p>Overall high-quality studies. Although findings are relevant, they may be difficult to generalise due to cultural differences between the UK and the USA</p>	<p>There is a need for similar studies to be conducted in the UK and the rest of Europe</p>

9 DISCUSSION

The aim of this report was to provide a critical review of the literature concerned with parent-child interaction in relation to road safety education. This was achieved by considering the published evidence for the effect of strategies that parents use with their children to enable them to become safer road users and by considering ways of engaging parents in road safety education.

The main methodological problem of the agreed approach was the broad inclusion criteria we adopted. The weakness of this approach was that, at times, it was quite difficult to decide whether a study should be included or excluded. However, this did allow us to search for, and critically review, a wide range of studies that investigated parental interaction with their children regarding safe road use and therefore were relevant to the subject. It was decided, because of the subject area, that it was more important to gain a full picture of the findings from research and evaluation studies than to simply focus on the evaluation of relevant intervention studies. Another problem, which stemmed from the breadth of the studies included in the review, was the judgement of 'quality' and 'evidence'. The majority of systematic reviews appraise the evidence from quantitative intervention studies. However, recently other relevant 'evidence' has started to become acceptable in public health systematic reviews (NHS Centre for Reviews and Dissemination, 1996; Weightman *et al.*, 2005). A standard format was therefore adapted from the Health Development Agency's guidance (Swann *et al.*, 2003) to judge quality and evidence of effect systematically.

The literature search provided a clear overview of what types of review (systematic or 'other') had been conducted on parent-child interaction in the road environment. Although a large number of literature reviews on 'injury prevention' were identified, only a small number included child-parent interaction as a specific behaviour or intervention. In addition, all identified reviews only focused on some element of parent-child interaction, such as traffic clubs. Some of these reviews were also quite old, and were therefore potentially out of date. **This highlighted the need for our review.**

The review provides some important evidence across a range of interventions, behaviours and beliefs regarding road safety and the interaction between parents and their children. With regard to parent-child interaction, the most consistent finding is that parents are an important influence on their children's road safety behaviour as pedestrians, cyclists and car passengers/drivers. In addition, the evidence suggests that holding hands is the most common form of safety behaviour when crossing roads, and children in their parents' company rely on the adult for safety. The association between oral instructions and road safety behaviour is less clear. On one hand there appears to be an association between brief conversations between the parent and the child and more disciplined behaviour, while on the other hand there is

little research evidence to demonstrate that parents' oral instructions increase road safety behaviour.

The review also identified a number of important gaps in the research on parent child interaction in the road environment. Although several evaluation studies have been undertaken regarding traffic clubs and walking buses, there is still a lack of robust research evidence regarding the level of effectiveness of both traffic clubs and walking buses. Millward *et al.* (2003) note in their review of reviews that there is a particular gap regarding the effect of traffic clubs in relation to casualty reduction. Interestingly, despite the large number of studies on child and adolescent road-use behaviour (Elliott and Baughan, 2003), adults' perceptions of risk (ODS Ltd with Market Research UK Ltd, 2004) and pedestrian road safety behaviour, there is a lack of high-quality research that considers the physical and verbal interaction between parents and children, or the impact on casualty rates of this interaction. No studies were found that focused on other types of road-crossing behaviour, such as cycling, other than that of parents and children as pedestrians.

Parent child interaction regarding driving safety was identified as another neglected research area in the UK, as well as in Europe as a whole. This was somewhat surprising when considering the differences in car and road use culture between the United States and Europe. Findings from studies conducted in the United States may not be easily generalised to European circumstances. However, the lack of research on parent child interaction and driving safety in Europe may simply be a reflection of European priorities with regards to children and road safety.

A major gap identified by this review was the lack of research regarding road safety and children with disabilities. Williams *et al.* (2002) in their high-quality review described a limited number of small-scale descriptive studies, which had considered parent child education to improve road safety behaviour. Towner *et al.* (2005) in their review of child injury and inequalities note that few intervention studies have specifically addressed inequalities associated with age, gender, socio-economic group, cultural and/or ethnic group, and where they live. Even fewer studies have set out the research problem in relation to inequalities, taken inequalities into account in the design of the study, or reported whether any differences in impact relating to inequalities occur. Disability as a factor of inequalities was not included in Towner *et al.*'s review, but the findings from our review suggest that inequalities associated with disability, children and road safety have not been addressed in any research studies.

The findings from our review demonstrate that the effect of child parent interaction in relation to road safety education has been far from comprehensively researched. Most research has tended to be descriptive, either in the format of surveys or observational studies, and has, in the main, been quite narrowly focused, both in terms of the interaction and behaviour, and in terms of the measured outcomes. It is notable that, although MacGregor *et al.* (1999) claimed to have observed the road-

crossing behaviour of cyclists, skateboarders and pedestrians, the findings were only reported with regard to pedestrians. The only road safety behaviours that were reported on in the observational studies included in the review were pedestrian road-crossing behaviour and the use of car seat-belts. Likewise, evaluation studies and the only intervention study that was identified were, in the main, concerned with improving child pedestrian safety through parent training, information and education for both parents and children. Measured outcomes were equally limited in the studies identified in this review. The majority were concerned with road safety knowledge and behaviour in a given place and time, or with knowledge/behaviour change from ‘risky behaviour’ to ‘safe behaviour’. Only one study (Wong *et al.*, 2004) attempted to measure changes in child injury rates and hospital admission rates over a two-year period. No significant detectable changes were found.

If the findings from this review are applied to a theoretical perspective using the Health Action Model (Tones and Green, 2004), it is clear that most research to date regarding parent–child interaction in improving road safety behaviour has considered a limited number of influences on road-use behaviour within their study parameters. The three intervention studies included in this review, for example, focused on skills training and education. Only one included a motivational element in the form of an educational booklet to strengthen the intervention (Wood *et al.*, 2003). According to the Health Action Model, other facets that would need to be taken into account when evaluating parent–child road safety interaction include relevant beliefs, motivation and normative factors, as well as the social, economic and physical environment in which the behaviour is placed. Although some of the surveys investigated parents’ beliefs about their own and their children’s road behaviour and related these to self-reported behaviour, it was not clear what other factors might have influenced their behaviour in the road environment. The Health Action Model also suggests that behavioural intention may lead to a discrete single time choice. This might explain Yoshida and Gakuin’s (1996) findings that parents and children are not consistent in their road-crossing behaviour. Most studies make an assumption that individual road safety behaviour is consistent. The assumption is that the behaviour remains fairly stable or it improves, or deteriorates. However, Yoshida and Gakuin’s (1996) study linked to the Health Action Model suggests that such behaviour may be highly variable and dependent on the interplay between determinants, which are different for each new situation depending on motivation, significant others, skills and self-concept at that point in time.

9.1 Conclusions

In conclusion, this review identified a small number of relevant studies of varying quality. In most studies, effect was determined through impact measures or descriptive analysis, rather than through outcome measures, such as morbidity and mortality. The review confirms findings from previous research regarding parents’ influence on children’s behaviour in the traffic environment, and also that parents believe it is mainly their role to teach their children road safety. Importantly,

research suggests that children, when in the company of an adult, rely on the adult for safety. The review found conflicting evidence regarding parents' understanding of their children's level of experience and ability, and regarding the effectiveness of traffic clubs and other similar interventions. Finally, there is limited knowledge of the association between verbal and physical interaction, and a lack of knowledge regarding road-crossing behaviour other than for parents and children as pedestrians. A major gap in this field is the lack of research concerning inequalities relating to the determinants of health.

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APPENDIX 1

Search strategy for literature review

A1.1 The searches

Table A1.1: Keywords and search terms				
Population/target group	Problem area	Prevention/promotion topic	Intervention/method	Type of article
Children Child\$	Road safety Road traffic accidents	Road safety education Child–parent interaction	Interaction Interact\$	Review Overview
Young people Young children Teenage\$	Injury Road injury Road environment	Primary socialisation Behaviour Knowledge	Child–parent interaction Road safety education Educat\$	Evaluation Intervention
Parent\$ Health educator\$	Traffic environment Home	Pedestrian skills Fear	Training Formal	Discussion article Demonstration project
Pedestrians Road user	School	Perception of risk/ perceived risk Disadvantage	Informal Road safety messages	Discussion paper Observation study
Disadvantaged groups Adolesc*		Inequalities Road safety messages	Health education	Trial Survey

The search started with collecting systematic reviews and other reviews on the subject

A1.1.1 Cochrane Database of Systematic Reviews

All Cochrane Library

Search all text

Child* AND accident* AND (road OR traffic)

57

6 systematic review/reviews

“Road safety”

14 records – 0 New

“Road traffic”

29 records – 0 New

(child* OR “young people” OR Teen* OR adolesc*) AND Road* AND Injur*

95 records

0 new

(Child* OR “young people” OR teen* OR adolesc*) AND (Injur* OR accident*)
AND (Educat* OR prevent*)AND (Road* OR traffic)

93 records

0 new

(Child* OR “young people” OR teen* OR adolesc*) AND (parent* OR guardian) AND (Educat* OR
teach*)

180 records

0 new

(Child* OR “young people” OR teen* OR adolesc*) AND (parent* OR guardian) AND “road safety”

2 records

0 new

(Child* OR “young people” OR teen* OR adolesc*) AND (parent* OR guardian)
AND “Pedestrian skills”

1 record

0 new

(Child* OR “young people” OR teen* OR adolesc*) AND (parent* OR guardian)
AND “Health educat*”

0 records

(Child* OR “young people” OR teen* OR adolesc*) AND (parent* OR guardian)
AND “road accident”

1 record

0 new

“Child parent interaction”

0 records

A1.1.2 Campbell Collaboration (www.campbellcollaboration.org/)

Searched a range of keywords, for example “road safety”, pedestrian, “road accident”, “injury prevention” 0 new records found.

A1.1.3 Centre for Reviews and Dissemination at York University (www.york.ac.uk/inst/crd/)

Includes three databases: DARE, NHS EED and the HTA database. These databases are all included in the Cochrane search above, but a further search was conducted using key words such as **child AND “road safety”** in order to double check whether any further reviews would be found.

A1.1.4 Department for Transport publications (www.dft.gov.uk)

The Department for Transport publications on the web site was searched. Searches included:

- children (limited to road safety section) 245; and
- parents (limited to road safety section) 106.

Seven documents of relevance were found.

A1.1.5 Health Promis (<http://healthpromis.hda-online.org.uk/>)

A1.1.5.1 HDA Evidence Base briefing documents

Searched under “Words or phrase” and used the system’s thesaurus terms for words such as the following: road accidents, road safety, road safety education, roads, traffic, traffic accidents, pedestrian. **Three** new documents found.

A1.1.5.2 Topic databases – Accidental Injury

Searched under “Words or phrase” for words such as: road, pedestrian, “young people”, child\$, road accident, road safety, traffic, parent. **Five** new documents found.

A1.1.6 National electronic Library for Health (www.nelh.nhs.uk/)

Searched for keywords and phrases such as: road safety, pedestrian, road accident, traffic. No further relevant records found.

A1.1.7 HEBS – Health Education Board for Scotland

Searched under “Health topics” “Accidents & safety”. Documents/publications 34 records (0 new). Searched library catalogue (Health Scotland).

Free text search:

Child% AND “road safety”

111 records found

6 new

(“Young people” or teen% or adolesc%) AND “road safety”

26 records found

2 new

Traffic AND child%

37 records found

0 new

Pedestrian AND (child% or “young people” or adolesc% or teen%)

38 records

0 new

Traffic and (teen% or “young people” or adolesc%)

40 records

0 new

(traffic or road%) AND parent%

12 records

1 new

A1.1.8 *Transport Research Laboratory (TRL) (www.trl.co.uk/1024/mainpage.asp)*

The catalogue of all TRL reports was downloaded and searched. **Five** relevant documents were found.

A1.1.9 *The Department of Health (www.dh.gov.uk/Home/fs/en)*

Searches were conducted and no further relevant references were found.

A1.1.10 *World Health Organisation (www.who.int/en/)*

Searches were conducted and no further relevant references were found.

A1.1.11 *ChildData*

ChildData is an extensive information resource covering the education, health and welfare of children and young people. The provider is the National Children’s Bureau and the database is a major source for children’s issues. A search was

conducted using their search terms which included: accidents, adult child relations, child development, childhood, road, traffic, ethnic groups, ethnicity, parent educators, education. No further relevant records were found.

A1.1.12 The Institute for Transport Studies

The Institute for Transport Studies at Leeds University were contacted and the project was explained to them. However, the study is outside their research interests and, therefore, they had no relevant documents or information.

A1.1.13 Kids and traffic (www.kidsandtraffic.mq.edu.au/)

The Early Childhood Road Safety Education Program is part of the Roads and Traffic Authority's program for Children and Young People through a partnership between the **NSW Roads and Traffic Authority (RTA)** and **Macquarie University**. This website had a bibliography from which **eight** new records were found.

A1.1.14 Further searches

Several further searches were made through web sites of organisations concerned with road safety and injury prevention.

A1.1.14.1 Royal Society for the Prevention of Accidents (RoSPA) (www.rospa.com/)

The following search terms were used:

- parent* (restricted to road safety) 55 in total;
- parent* (restricted to safety education) 35 in total;
- child* (restricted to road safety) 100; and
- child* (restricted to safety education) 86.

Three records of relevance were found.

A1.1.14.2 Sustrans (Sustainable transport charity) (www.sustrans.org.uk/)

Searched under publications. These consisted principally of information sheets and guidance and provided no further relevant records.

A1.1.14.3 Safe routes to school (Sustrans)(<http://saferoutestoschools.org.uk/>)

The 'Resource Library' was searched. No further relevant information was found.

A1.1.14.4 Brake – ‘The road safety charity’ (www.brake.org.uk/)

This site provided information leaflets. No further relevant information was found.

A1.1.14.5 Child Accident Prevention Trust (CAPT)

No further relevant publications were found through a search of the CAPT publications.

A1.1.14.6 AA Foundation (www.aatrust.com/aafoundation/reports.cfm)

The list of reports completed by the AA Foundation were checked. **Two** documents were found for potential background reading.

A1.1.14.7 Child Health Promotion Research Unit (Australia) (<http://chpru.ecu.edu.au>)

Looking under ‘Completed Research’ and ‘Current Research’, the following projects were found:

- The Child Pedestrian Injury Prevention Project (1995–97).
- The Early Childhood Pedestrian Injury Prevention Project (2004–06).
- Formative Evaluation of the Road Aware Parents Program (2004).
- Baseline Evaluation of the Road Aware Parents, Road Aware Kids and Child Car Restraints Programs (2004).

There was a link to ‘Reports, publications and resources’ but this page was currently under construction. A search was conducted on Pubmed in order to see whether any of the people listed as being involved in the projects had written any relevant publications. No relevant publications were found.

At the end of the RoSPA document *A review of parent/driver agreements*, the following potentially relevant web sites were listed. These were searched. They provided guidance and information for parents. No further relevant articles were suggested:

- www.parentingteendrivers.com
- www.4myteen.org.us/
- www.ipromiseprogram.com/
- www.drivehomesafe.com/
- www.teendrivers.com

A1.1.15 Searches conducted in EBSCO, Cambridge Scientific Abstracts (CSA) and Pubmed

The searches were not identical on each database due to differences in the set up of each database, the high number of hits recorded for particular searches and an attempt to retrieve an increased number of records through varying the search terms (Table A1.2).

Table A1.2: Searches in EBSCO, CSA and Pubmed

Search term	EBSCOhost Academic Search Elite/CINAHL/Pre-CINAHL/ PsycARTICLES/PsycINFO		CSA Includes: ASSIA (Applied Social Sciences Index and Abstracts), ERIC, Social Services Abstracts, Sociological Abstracts		Pubmed Includes: Medline	
	Total no. of records	Initial sift based on title/abstract/removal of duplicates	Total no. of records	Initial sift based on title/abstract/removal of duplicates	Total no. of records	Initial sift based on title/abstract/removal of duplicates
(Child* OR "young people" OR teen* OR adolesc* OR "road user" OR pedestrian*) AND ("road safety" OR "road traffic accident*" OR "road environment" OR "traffic environment")	267	24	112	1	342	3
Child* AND traffic AND parent*	202	27	185	1	358	8
Child* AND roads AND parent*	315	0	226	1	28	0
Child* AND "road safety"	86	0	41	0	74	0
"child parent interaction"	50	0	23	0	–	See similar search below
"parent child interaction" AND (road* OR traffic OR pedestrian*)	4	0	12	0	4	0
"Road safety messages"	0	0	0	0	8	0
"Road safety education"	23	1	21	0	11	0
"primary socialization" AND ("road safety" OR traffic OR pedestrian*)	0	0	0	0	–	See similar search below
"primary socialization" AND road	0	0	1	0	–	See similar search below
Pedestrian* AND child* AND parent*	61	3	34	0	–	See similar search below

(continued)

Table A1.2: (continued)

Search term	EBSCOhost Academic Search Elite/CINAHL/Pre-CINAHL/ PsycARTICLES/PsycINFO		CSA Includes: ASSIA (Applied Social Sciences Index and Abstracts), ERIC, Social Services Abstracts, Sociological Abstracts		Pubmed Includes: Medline	
	Total no. of records	Initial sift based on title/abstract/removal of duplicates	Total no. of records	Initial sift based on title/abstract/removal of duplicates	Total no. of records	Initial sift based on title/abstract/removal of duplicates
“perception of risk” AND Parent* AND (“road safety” OR traffic OR pedestrian*)	2	0	0	0	–	See search with risk* below
“perceived risk” AND Parent* AND (“road safety” OR traffic OR pedestrian*)	4	0	0	0	–	See search with risk* below
“health educator*” AND Parent* AND (“road safety” OR traffic OR pedestrian*)	0	0	20	0	–	See similar search below
“health educator*” AND Parent* AND Child*	43	0	–	–	–	See similar search below
(“road safety” OR traffic OR pedestrian*)AND parent*AND (disadvantage* OR depriv* OR inequalit* OR poverty)	5	0	28	0	13	0
“road safety” OR traffic OR pedestrian* AND Parent* AND (behav* OR knowledge)	140	5	131	1	145	5
driv* AND parent* AND (“young people” OR teen*)	238	18	238	0	166	6

(continued)

Table A1.2: (continued)						
Search term	EBSCOhost Academic Search Elite/CINAHL/Pre-CINAHL/ PsycARTICLES/PsycINFO		CSA Includes: ASSIA (Applied Social Sciences Index and Abstracts), ERIC, Social Services Abstracts, Sociological Abstracts		Pubmed Includes: Medline	
	Total no. of records	Initial sift based on title/abstract/removal of duplicates	Total no. of records	Initial sift based on title/abstract/removal of duplicates	Total no. of records	Initial sift based on title/abstract/removal of duplicates
“road injury” AND parent* AND child*	-	-	-	-	0	0
“injury prevention” AND parent* Risk* AND parent* AND (“road accident*” OR traffic)	- -	- -	- -	- -	227 193	5 2
Child* AND pedestrian	-	-	-	-	449	5
“child parent interaction” AND (road* OR traffic OR pedestrian*)	-	-	-	-	35	0
“primary socialization” AND parent* AND (“road safety” OR traffic OR pedestrian*)	-	-	-	-	35	0
“health education” AND parent* AND (“road safety” OR traffic OR pedestrian*)	-	-	-	-	46	1
Total	1,440	78	1,072	4	2,134	35
Total records in databases = 4,646						
Total records collected = 117						

A1.2 Totals obtained

Total from these searches databases (see above for details):

- 42 documents/articles; and
- 6 reviews/systematic reviews.

In addition to the above searches, the references from each article/report were consulted in order to 'pick up' articles that may not come up through other searches:

- Additional documents/articles 24 records.
- Documents/articles obtained from electronic databases EBSCO, CSA and Pubmed (see Table A1.2 for details) 119.
- The total number of records collected at the initial sift 189.

APPENDIX 2

Data extraction forms

A2.1 Code: review of road safety interventions – data extraction and synthesis tool

Aim to identify ways in which parents influence their children and young people (0–16):

- To be safer road users.
- How this mechanism for the delivery of road safety education can be most effectively supported and encouraged.
- Parental role: direct control; explicit attempts to educate or influence behaviour; effect of modelling.
- Formal and informal interactions regarding road safety between parents and children.
- Factors influencing risk and parents' perceptions of risk.
- Most effective interactions for different age and road-user groups.
- The relative importance of teaching by parents and the example they set.
- How are the attitudes and behaviours of parents towards their children's road safety formed; what affects their decisions/what influences the way they teach.
- How road safety training skills of parents can be strengthened.

Reference:

1. Type(s) of injury topic included

2. Type(s) of intervention included

3. Does this article/report address:

1. Ways in which parents influence their children and young people (0–16) to be safer road users?
yes no
2. Parental role: direct control; explicit attempts to educate or influence behaviour; effect of modelling?
yes no
3. Formal and informal interactions regarding road safety between parents and children?
yes no
4. Factors influencing risk and parents' perceptions of risk?
yes no
5. How the attitudes and behaviours of parents towards their children's road safety are formed; what affects their decisions/what influences the way they teach?
yes no

4. The article is:

- Not relevant – exclude
- Relevant peripherally – include as background information
- Relevant – include

Type and details of publication:

- Review (use other review extraction form)
- Journal article
- Report
- Book section
- Other

NB: Only answer relevant questions

Intervention characteristics

1. Target group:

- parents and children
- children and their peers

2. Duration of intervention (dates if available)

3. Aims and objectives of intervention (state whether explicit or implicit)

4. Setting/location: not stated

- Not clear
- Community (specify)
- Street/road
- Other (specify)

5. Geographical location of intervention (country, district, etc.)

12. Participants:(numbers)

parents M F

children M F

ethnicity

socio-economic group(s)

urban/rural

other

13. How was the study population sampled?

14. How were participants recruited?

15. Is the study population representative of target population? not stated

unclear

yes

no

explain

Description of study method

16. Outcome variables

17. Time intervals between measurements

18. Instruments/measurement tools used to collect outcome data

- not stated
- unclear
- questionnaire/survey methods
- interviews
- observation
- other (specify)

19. Has consideration been given to the feasibility for actual implementation of the intervention?

- not stated
- to some extent
- yes
- no

20. Are intervention and control groups comparable?

- not relevant
- not stated
- unclear
- yes
- no

explain

21. How was the study population sampled?

21.1 Sample:
homogenous 1-----2-----3-----4-----5 heterogeneous

Data analysis

22. Was validity considered?

- not stated
- unclear
- yes
- no

explain

23. What statistical methods were used?

24. Attrition rate (the estimated percentage of study participants who dropped out before the end of the study)

not stated
unclear
rate

25. List the main effects (tabulating the research results may help)

26. Cost–effectiveness information, if any

Judgements

27. On the basis of the above:

- Quality of study high / medium / low
- Reliability of content high / medium / low
- Generalisability of results high / medium / low

28. Systematicity and clarity of methodology: high / medium / low

29. Evidence of effect

- Unclear
- High
- Medium
- Low/no
- harmful

30. Other comments

A2.2 Code: review of parent–child interaction, road safety – review synthesis tool

Reference: _____

1. Type(s) of injury topic included

2. Type(s) of intervention included

Classed as:

- informal education
- formal education

3. Effect regarding:

- knowledge
- attitudes/beliefs/perceptions
- behaviour

4. Number of studies included in review

5. Quality of review

5a. Is there potential to assess research methods and interventions on the basis of the review?
yes / no

5b. Level of appropriateness of interventions/approaches included in the review in relation to purpose of review
high / medium / low / not clear / not relevant

5c. Adequacy of data included from individual studies to mediate between data and interpretation
high / medium / low

5d. Level and quality of reporting of measurements made in studies
high / medium / low

5e. Samples:
homogenous 1-----2-----3-----4-----5 heterogeneous

5f. Types of study design included in review:

- Not clear
- Randomised control trials
- Non-randomised trials
- Quasi-experimental studies
- Before and after studies
- Surveys

5g. On the basis of the above:

- Quality of review high / medium / low
- Reliability of content high / medium / low
- Generalisability of conclusions high / medium / low

6. Inclusion criteria

7. Exclusion criteria

8. Populations covered

- High risk
- Medium risk
- Low risk
- Other

9. Systematicity and clarity of methodology: high / medium / low / not clear

10. Evidence of effect outcome:

- High
- Medium
- Low/not clear

APPENDIX 3

Parent–child interventions

Table A3.1: Review of parent child interactions and interventions				
	Country of origin	Participants	Activity/intervention	Setting
Pedestrian safety				
<i>Observation</i>				
Dunbar <i>et al.</i> , 2002	Warwick, England	44 children aged 4–10 with parent/guardian	1. Cross road safely –parent and child directed to cross busy two-way road; child asked to post letter 2. Parent instructed child in drawing unseen map	1. Road near the university 2. Laboratory setting
MacGregor <i>et al.</i> , 1999	Ontario, Canada	30 parents interviewed; 208 children aged 5–12 observed	Cross road safely: children crossing at two signalised and four non-signalised intersections with parents	Selected on basis of proximity to facilities used by children, high-residential areas
van der Molen, 1982	The Netherlands	65 groups: 80 parents, 140 children	Cross road safely with parents at two-way undivided busy main road	Main road with bicycle paths; pedestrian islands between road and cycle lane
Yoshida and Gakuin, 1996	Japan	1,076 samples observed; 17 parent–child pairs included in analysis	Crossing road from car to pre-school	Road outside pre-school
Zeedyk and Kelly, 2003	Dundee, Scotland	123 parent and single-child pairs, estimated age < 5 to 10	Cross road safely with parents at city centre. Road crossings over two or four lanes with no middle islands	Four different pelican crossings within two miles of city centre
<i>Surveys</i>				
Antill, 1991	Sydney, Australia	200 parents (21% male; 79% female) of 5–7-year-olds across 22 schools	Perceived road safety education	Not stated
Lam, 2000	Sydney, Newcastle, Wollongong, Australia	Stratified random sample according to children's age 5–14, of 1,525 adults (76.2% female)	Perceived parental modelling of safe behaviour as a pedestrian	Not stated
Owen and Patterson, 1991	Sydney, Australia	30 mothers 32 four-year-olds	N/A	Interviewed in the pre-school
<i>(continued)</i>				

Table A3.1: (continued)

	Country of origin	Participants	Activity/intervention	Setting
Roberts, 1995	Auckland region, New Zealand	Parents of 54 cases of children who had been killed or seriously injured in RTA, and 157 controls	The role of parents accompanying their children to school	Interviewed in hospital (parents of injured children) or in the home
<i>Intervention studies</i>				
Thomson <i>et al.</i> , 1998	Glasgow, Scotland	60 children aged five	Parent volunteers provide practical skills training	Parents trained through local school Children: four sessions on table top model at school; two sessions at the roadside
Wood <i>et al.</i> , 2003	Kent, West Sussex, England	1. 1,027 parent–child pairs 2. 521 parent–child pairs	Training/activity booklet sent to parents as support to teach their children traffic skills	Skills training in traffic environment; assessment in own home
Zeedyk and Wallace, 2003	Scotland	120 families (parents and children)	‘Edutainment’ video, watched at home	Own home
<i>Traffic clubs</i>				
West <i>et al.</i> , 1993	Two regions in England	First survey: 1,032 children and parents Second survey: 1,601 children and parents	Children aged three were sent an activity book, then every six months until the age of five	Interviews in their own homes lasting approximately 25 minutes
<i>Walking buses</i>				
Collins and Kearns, 2005	Auckland, New Zealand	23 school representatives 22 walking bus coordinators = 29 of 34 schools	Children walk to school in organised groups, supervised by volunteer parents	Route home to school Telephone interviews
Kearns, 2001	Auckland, New Zealand	21 volunteer parents 52 children (age range not clear)	Children walk to school in organised groups, supervised by volunteer parents	Participant observation on the way to school Interviews in the school and by telephone contact
Wong <i>et al.</i> , 2004	Auckland, New Zealand	12 key stakeholders	Children walk to school in organised groups, supervised by volunteer parents	Route home to school Unclear where interviews took place
<i>(continued)</i>				

Table A3.1: (continued)

	Country of origin	Participants	Activity/intervention	Setting
Cycling safety				
Berg and Westerling, 2001	Bålsta, Enköping, Sweden	All school children, aged 12–15; total: 1,673 1,485 returned questionnaire	Parent and school influence on the use of cycle helmets by children aged 12–15	Local community
Johansson and Drott, 2001	Uppsala, Sweden	58 parents of children admitted to Department of Paediatric Surgery for RTAs and Abdominal Pain	Different ways of coping with traffic hazards in inner-city, suburban and rural areas	Local traffic environment
Miller <i>et al.</i> , 1996	Chicago, USA	129 parents and 169 children aged 5–14 approached in waiting room of five paediatric practices (city, suburban)	Influences on cycle-helmet use among children	Not stated
Morrongiello and Major, 2002	Guelph, the Netherlands	54 mothers	Risky behaviour: swimming, climbing on playground climber, sledging, cycling, in-line skating, playing tag outside, trampolining, running	Any location where activity was possible
Peterson <i>et al.</i> , 1997	Missouri, USA	160 mothers 36 boys, 47 girls in second grade 39 boys, 38 girls in eighth grade	Cycle helmet enforcement when riding bike	N/A – mothers asked to consider a range of different scenarios when child might be expected to use cycle helmet
Car and driving safety				
<i>Parent–child interaction in car</i>				
Bianchi and Summala, 2004	Brazil	174 parent–child pairs: 41 son–father; 54 daughter–father; 19 son–mother; 60 daughter–mother pairs	Parent drivers' influence as role models on teenage driving	Traffic environment
Moss and Tobin, 1988	Iowa, USA	81 parents 87 children, aged four or under	Predictors of young children's car-seat use	Rural areas
Page, 1986	Utah, USA	256 children in middle school	Influence of parental example in pre-adolescents' seat-belt use	Car travel in middle-class areas
<i>(continued)</i>				

Table A3.1: (continued)

	Country of origin	Participants	Activity/intervention	Setting
Shin <i>et al.</i> , 1999	Mid-Atlantic city, USA	254 high school children, aged 15–20 from two private, one middle-class and two inner-city schools	Impact of socio-economic and ethnic differences in young people’s seat-belt use	Traffic environment in ‘major mid-Atlantic city’ and nearby metropolitan area
Williams <i>et al.</i> , 2003	Connecticut, Massachusetts, USA	3,638 vehicles; 2,899 teenage drivers, 2,612 adult drivers, 4,206 front-seat teen passengers at 12 high schools	Seat-belt use among parent and teenage drivers and teenage passengers	Morning and evening observations outside 12 high schools
Teen driving				
<i>Awareness of teen-driving risk</i>				
Beck <i>et al.</i> , 2001a	Maryland, USA	454 parents and provisionally licensed teenage drivers	Driving rules for teenage drivers	Local traffic environment
<i>Perceptions of/action on teen driving and drinking</i>				
Beck, 1990	Washington, DC, USA	807 parents	Parents’ perceptions and control of teen drink-driving	Suburban community
Beck <i>et al.</i> , 1991	Washington, DC, USA	Four focus groups with parents of high-school students, approximately 8–12/group	Parental perceptions and control of teen alcohol consumption and driving	Suburban, middle-class community
Hartos <i>et al.</i> , 2000	Washington, DC, USA	300 adolescents, licensed two years or less, aged 16–18	Parenting practices, e.g. monitoring, control as protection against risky driving, drink-driving	Metropolitan area
Haynie <i>et al.</i> , 1999	Maryland, USA	428 parents and their adolescents aged 14–18	Parents’ awareness of their adolescents’ alcohol-related behaviour and compare it with parents’ and teenagers’ perceptions of parental control	Across Maryland
<i>(continued)</i>				

Table A3.1: (continued)

	Country of origin	Participants	Activity/intervention	Setting
<i>Parental influence on teen driving</i>				
Beck <i>et al.</i> , 2001b	Maryland, USA	424 parents and their provisionally licensed teenagers	The nature and prevalence of parental involvement with teen driving and its relationship to risk	State-wide
Hartos <i>et al.</i> , 2004a	Maryland, USA	658 parent–adolescent dyads	Parents’ intended limits on adolescents’ driving and completion of driving agreements	‘Local’ area linked to Motor Vehicle Administration site
Hartos <i>et al.</i> , 2002	Washington, DC, USA	261 adolescents from several high schools	Predicted risky driving	Two Maryland school districts
Hartos <i>et al.</i> , 2004b	Maryland, USA	24 parent–teen dyads	Parents’ driving rules and consequences with teenagers	‘Local’ area linked to Motor Vehicle Administration site
<i>Driving agreements, graduated licensing</i>				
Beck <i>et al.</i> , 2002	N/A	N/A	Potential of graduated licensing programmes; the influence of parenting to reduce teen driver risk	N/A
Beck <i>et al.</i> , 2003	Maryland, USA	Separate samples of teenagers with provisional licences before ($n = 424$) and after ($n = 600$) programme implemented	Adoption of new Graduated Driver Licensing	State-wide
Hartos <i>et al.</i> , 2001	Connecticut, USA	Families with adolescent aged < 17.5 years: 34 parents and 33 teens	Family members asked to use Checkpoints Parent–Teen Driving Agreement	Teens tested at five private driving schools
Simons-Morton <i>et al.</i> , 2004	Maryland, USA	579 parent–teen dyads (16-year-olds eligible for provisional licence)	Intervention: parents watched Checkpoints video, given a copy of video and Parent–Teen Driving Agreement. One week later received supporting newsletter Control: unclear	Local Motor Vehicle Administration unit
Simons-Morton <i>et al.</i> , 2002	Connecticut, USA	452 parent–teen (recently received learner licence) dyads	Intervention: receive Checkpoint programme (parents receive educational materials; persuasive communication) Comparison: receive general set of materials on driving and cars	Department of Motor Vehicles where teenagers receive learner’s permit

APPENDIX 4

Teen driving references

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