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Avon Longitudinal Study of Parents and Children: Exposure to Injury Risk in the Road Environment and Reported Road Traffic Injuries in 13–14-year-olds

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EXECUTIVE SUMMARY

Background

The aim of this project is to explore the relationship between reported road traffic injuries and exposure to risk in the road environment and a range of individual, family and environmental risk factors in adolescents aged 13–14 years from a large-scale contemporary cohort, the Avon Longitudinal Study of Parents and Children (ALSPAC).

The Department for Transport has a target to reduce road traffic casualties. Young people aged 11–15 years remain a priority because casualties in this age group have fallen by less than those for younger children. ALSPAC is unique in having detailed information on the transition from childhood to adulthood in a contemporary cohort, which provides an excellent opportunity to investigate the exposure to injury risk in the road environment through adolescence. The second decade of life is an important phase in the life course, where transitions from childhood to adolescence are taking place.

ALSPAC is a longitudinal birth cohort study, which started in 1991 in the former county of Avon in south-west England. Data have been collected on the young people and their parents for the past 18 years. A wealth of data has thus been collected on the children's health, development and environment.

Methods

When the children in the ALSPAC cohort were aged 13–14 they completed two postal questionnaires. These examined their involvement in road traffic injuries in the previous 12 months and their journeys to and from school, travelling by car, bus, train and cycle, and preventive practices in the road environment. The project also includes questions from other questionnaires, completed by the ALSPAC cohort and their parents on a range of individual, family and environmental factors. One of these is an index of Sensation Seeking Behaviour, which was collected as part of the face-to-face focus clinic at age 11 years.

This report presents a descriptive analysis of the findings, in particular the prevalence and types of accident that occurred and any association with background characteristics of the children and families (including the physical attributes of the children).

Main findings

In a representative sample of 6,090 children aged 13–14 years in 2005, over one in twenty (5.5%) responded that they had had a non-fatal road accident in the last year.

The largest group were passengers in motorised vehicles (71%), while 18% were cyclists and 11% pedestrians. Overall just under a third of the children (30%) were hurt in the accident, 18% received medical attention and 3% stayed overnight in hospital. However, if split by mode of transport, there were marked differences.

The proportion of passengers hurt in the accident was just 16% compared with nearly two-thirds of the cyclists and pedestrians. Only 1% of the passengers ended up staying overnight in hospital compared with 4% of the cyclists and 13% of the pedestrians.

Previous studies have suggested that certain background characteristics of children and their families have been associated with higher rates of road traffic accidents and injuries, including a higher preponderance of males, children from larger families, those involved in previous accidents, children scoring highly on a Sensation Scoring Index and children from more deprived families. This study found little evidence of these characteristics in the 13–14-year-old respondents.

Previous studies have also found an association with poor hearing, sight and low IQ. We, however, found no such differences. When comparing all road traffic accidents, the one significant variable was a slight excess among children who had been assessed for statementing; this association was strongest for cycle and, especially, pedestrian accidents. Learning disabled young people of this age are particularly vulnerable to injury in the road environment because of the disparity between their physical and cognitive maturation, and their carers need to provide a higher level of supervision, appropriate for a younger child.

The higher prevalence of males found in earlier studies was not a characteristic of this study when assessing accidents overall, but was a significant characteristic among cyclists.

There was no evidence of differences in any of our socio-economic markers for those children who suffered an accident while being a passenger, but there was some evidence that children from the more deprived backgrounds were prevalent among the cyclists and pedestrians. This research project has provided some evidence in support of the ‘equalisation in youth’ hypothesis for road traffic accidents in 13–14-year-olds.

Conclusions

This project contributes to the growing debate about whether there are fewer inequalities in injury and other health outcomes during youth in contrast to greater inequalities in younger childhood and adulthood. More attention needs to be given to an understanding of influences at different periods during the individual’s life course on health and well-being. There are limited data available on injuries to

adolescents, and on the changes which occur in the transition from childhood to adulthood.

There have been few cohort studies in the literature which have used the full potential of their temporal design, by using repeated measures over a period of time.

The results reported here from children from the ALSPAC cohort aged 13–14 years represent the first phase of our investigation of injury risk to young people, and further data will be available at 16–17 years and 18–19 years. Comparisons will then be possible of the same cohort at three different ages throughout adolescence to examine whether equalisation in earlier youth continues into later youth, or whether greater inequalities appear.

By the end of the overall study, it will be possible to determine the social and developmental trajectories of young people who have frequent or serious accidents, and the resilience factors which protect young people in the road environment from sustaining injury.

1 INTRODUCTION

This is the final report of the project, prepared for the Department for Transport, on 'exposure to injury risk in the road environment and reported road traffic injuries in 13–14-year-olds'. The subjects of the report are children from the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort in England. ALSPAC is a large contemporary cohort and data from the 13–14-year-old children were collected in 2005–06. A number of social changes have occurred in society in the last decade which have had an impact on the health and well-being of young people, which are reflected in the responses of the ALSPAC cohort, 'the Children of the Nineties'. The second decade of life is an important phase in the life course, where transitions from childhood to adolescence are taking place. Road traffic casualties in the 12–15 age range have fallen by less than those for younger age groups, thus this age group is a priority for attention.

After describing the aims and objectives of the study, the background section sets the scene by describing the importance of road injuries both internationally and in Great Britain, why cohort studies are useful in child health, the nature of the ALSPAC study and previous studies on injury from the ALSPAC study. The literature review summarises the risk factors related to road injury in childhood and adolescence. Key results are then presented and illustrated by tables and figues. Finally, there is a discussion of the results, with an emphasis on the preventive messages, and recommendations are made for practice, policy and research.

The study has found some interesting results in road traffic casualties in children aged 13–14 years and their relationship with social deprivation, which is at variance with much of the published literature.

2 AIMS AND OBJECTIVES

The aim of the project is to explore the relationship between reported road traffic injuries and exposure to injury risk in the road environment, with a range of individual, family and environmental risk factors in adolescents aged 13–14 years from the Avon Longitudinal Study of Parents and Children (ALSPAC).

The objectives of the project are as follows:

1. To describe reported road traffic accidents of a cohort of young people aged 13–14 years in England.
2. To describe exposure to the road environment of a cohort of young people aged 13–14 years in England.
3. To explore the relationship between reported road traffic injuries and a range of personal, family and wider environmental risk factors.
4. To explore the relationship between exposure to injury risk and a range of personal, family and wider environmental risk factors.

3 BACKGROUND

3.1 Road safety

A number of international reports have highlighted the problem of road traffic injuries in all age groups in general (Peden *et al.*, 2004; Racioppi *et al.*, 2004) and in children and young people in particular (Toroyan and Peden, 2007; Peden *et al.*, 2008; Sethi *et al.*, 2008). International comparisons show that, for the overall road safety record for all age groups, Britain is ranked highly compared with other high-income countries, but for child pedestrian deaths, a different picture emerges (Department for Transport *et al.*, 2009; National Audit Office, 2009; Bly *et al.*, 1999). The child pedestrian death rates in Britain are higher than in a range of other countries such as Norway, Austria, Sweden and the Netherlands (Department for Transport *et al.*, 2009).

In Great Britain, the Government's strategy *Tomorrow's Roads: Safer for Everyone* (DETR, 2000) set targets to reduce road traffic casualties (killed and seriously injured) of 40% for adults and 50% for children aged 0–15 years, from a baseline of 1994–98 to the target endpoint of 2010. A separate target to reduce road casualties in disadvantaged areas was introduced later. By 2008, the number of people killed or seriously injured had been reduced by 40% for adults and by 59% for children, compared with casualty rates from the 1994–98 baseline. In Great Britain, the reduction in road traffic casualties has differed across age groups. Casualties in the 12–15 age groups have fallen by less than for younger children; for all children aged 0–15 years a reduction of 59% was achieved, whereas, for the 12–15 age group, the reduction was 52% (Department for Transport *et al.*, 2009).

In 2008, 124 children aged 0–15 years were killed and 2,807 were killed or seriously injured (KSI) in road accidents in Great Britain. Children aged 12–15 years were particularly at risk: 41% of children killed (51/124) and 46% of children killed or seriously injured (1,298/2,807) were aged 12–15 years. In the 12–15 year age group, 23 were killed as pedestrians, 18 as car passengers, 6 as pedal cyclists and 4 as other road users (motor cyclists). For KSI casualties aged 12–15 years, cyclists were more numerous than car passengers: the KSI casualties included 765 pedestrians, 251 pedal cyclists, 193 car passengers and 89 other road users (Department for Transport *et al.*, 2009). Young people in the 12–15 age group are thus a priority for attention (Department for Transport, 2007a; Department for Transport *et al.*, 2009).

At all ages, males are more likely to be road traffic casualties than females. Child pedestrians are a particular priority, as they account for most fatal and serious casualties. There is also a significant number of child car-occupant casualties, though a smaller proportion of these are fatal or serious. Disadvantaged areas still

have higher casualty rates than more prosperous areas and these include child casualties.

The Government is actively encouraging all people, including children, to increase levels of walking and cycling (Department of Health and Department for Transport, 2010). Walking and cycling have the potential to make a positive contribution to public policy priorities of health, liveability and urban congestion. Walking and cycling are seen as relatively low cost ways to include physical activity into people's daily routine (WHO, 2002). If increased levels of cycling and walking are achieved, attention needs to be paid to the safety of pedestrians and cyclists. A number of cycling demonstration towns and cities have been set up in England in the last five years, with funding from Cycling England and the Department for Transport. Bristol was designated as a cycling city in 2008.

3.2 Cohort studies

A cohort study is an observational study, where a group of individuals with a common characteristic, such as age, are observed over time. Cohort studies are not experiments, but an observation of subjects over time without intervening. Birth cohort studies and other longitudinal studies of children have investigated child outcomes of survival and health, growth and development, educational attainment and behaviour. They have also examined predictors of adult health and disease, social status, educational attainment and well-being. Risk and protective factors have been identified, which have been incorporated into health, social and educational policy (Samms-Vaughan, 2008). Cohort studies aim at estimating average risks, rates or occurrence times of specific conditions. Cohort studies can be used to measure potential causes before the outcome has occurred and can demonstrate that the causes preceded the outcomes, thus avoiding the debate about what is cause and what is effect (Mann, 2003). Golding believes that 'the ultimate aim of a cohort study is to understand the influences on an individual in order to identify preventive strategies that may be successful' (Golding, 2010).

Cohort studies have not been widely used in injury epidemiology since they tend to require large numbers and are expensive, but they are particularly useful in measuring long-term disability and the burden of injury. A prospective cohort can identify trajectories through childhood leading to different outcomes, and can raise hypotheses about potential causal factors on the pathway, but they cannot ascertain causation as the possibility of residual confounding always exists. Mytton *et al.* (2009) have conducted a systematic review of cohort studies which have reported injury outcomes in school-aged children. They found 44 publications from 18 different cohort studies, but few studies utilised the full potential of their design. Thus, there are few studies which used repeated measures to assess temporal changes in injury occurrence, and few which explored risk factors, particularly those related to the environment.

There have been a number of large-scale cohort studies in the UK. Of the two major national birth cohort studies, the National Child Development Study was initiated in 1958 and the Child Health and Education Study in 1970. Data on adolescents' health and development were thus collected in the 1970s and 1980s (Peckham, 1973; Peckham and Pearson, 1976; Bijur *et al.*, 1988; Beattie *et al.*, 1999). The West of Scotland study collected information on adolescents in the 1990s (West and Sweeting, 2004). ALSPAC is the only contemporary large-scale study collecting data in the 2000s from children in the second decade of their life.

3.3 The Avon Longitudinal Study of Parents and Children (ALSPAC)

ALSPAC is a longitudinal birth cohort study, which started in 1991 in the (then) county of Avon in England (Golding *et al.*, 2001). ALSPAC allows the study of the biological, social and environmental influences on a child's health to be studied. The study recruited mothers during their pregnancy and 14,062 children in the cohort were born between the period April 1991 and December 1992.

The boundaries of the former county of Avon have been retained in the ALSPAC study area. The study area has a population of one million. It includes a major city of population 0.5 million (Bristol) and surrounding areas, which include small towns, villages and farming communities. It contains a wide variety of types of area, including inner-city deprivation, peripheral local authority housing, affluent commuting areas and rapidly growing small towns. It thus represents the range of conditions found in many other parts of the country. The study area has the advantage of being a defined geographic area with services centralised around Bristol. It has a relatively low level of outward migration.

The families initially selected to take part resembled those in Britain as a whole, and were similar to those in the 1991 census. However, in common with all studies where a representative sample has been attempted, the ALSPAC cohort had a slight shortfall in less affluent families (those living in rented accommodation, not having a car or being single or unmarried cohabiting) and in ethnic minority mothers (www.alspac.bris.ac.uk). Over time the loss to follow-up in the ALSPAC cohort has not been random: those families with greatest disadvantage may be less able or interested in contributing to a long-term research project.

The ALSPAC birth cohort has been followed up over the past 18 years, including the children whose families have relocated. A wealth of data has thus been collected prospectively on the children's health, development and environment. Data have been collected at regular intervals by postal questionnaires completed by the child's mother, her partner and the child, and by the periodic physical examination and extraction of data from medical notes. The ALSPAC study has run a number of 'focus clinics' when the children and carers have attended a face-to-face session. A

range of tests, including psychological tests, physical measures and biological samples (e.g. blood), have been collected (see Section 4.2 for sources of data used for this project).

Parental reports of their child's unintentional injuries have been collected at the following ages: 6, 15, 18, 24, 38 and 54 months in the pre-school period and at the ages of 5, 6, 8 and 11 years in the primary school period. Data have also been collected on parental injuries in some surveys. ALSPAC contains a vast amount of supporting detail, including parental social class, education, income and housing, as well as childcare, family background and parenting styles. Questions on active transport have been collected at the age of five years, and a variety of measures on weight and physical activity (including physically monitored activity), measures of impulsivity and family characteristics have also been collected.

ALSPAC provides the opportunity to examine the risk factors related to injury in a contemporary British cohort, which reflects very recent trends in society. ALSPAC started in pregnancy and has collected a very rich set of background socio-demographic variables about participating families, information about the child's home, school and wider environment, and has detailed self-reported data on injuries from the age of six months. ALSPAC is also unique in having detailed information on the transition from childhood to adulthood, which provides an excellent opportunity to investigate the exposure to injury risk in the road environment through adolescence.

3.4 Studies of child injuries and other relevant studies from the ALSPAC project

Most of the publications from the ALSPAC cohort related to injuries have involved pre-school children. O'Connor *et al.* (2000) found that, at the age of two years, children in single parent and step families were disproportionately likely to experience unintentional injuries and to be hospitalised or receive attention from a hospital doctor for an injury. Warrington *et al.* (2001) described injuries resulting from accidents in pre-mobile infants. They found that falls in young infants were the most common type of injury, while burns were rare. Haynes *et al.* (2007, 2008) examined child accident events in pre-school children from the ALSPAC cohort. They found that the risk of injuries to pre-school children, and most of the characteristics of children and mothers associated with injury risk, varied significantly between neighbourhoods. Neighbourhoods subjectively defined by planners did not produce stronger effects than computer-generated areas.

Reading *et al.* (2008) found that, for any accident event and for accident events resulting in injury requiring medical attention, risk factors included children who were developmentally more advanced or displayed greater conduct or behavioural problems, mothers who were of a younger age, who were without work, who were

smokers, whose partners were unemployed or who drank alcohol excessively, and households in which there were recent adverse life events or which were under financial stress. Thus, both individual child factors and family factors were significant.

The findings of other ALSPAC studies are of interest to this project. In view of the Department for Transport's interests in increasing walking and cycling in children and young people, studies on physical activity are relevant. Ness *et al.* (2007) objectively measured total physical activity and minutes of moderate and vigorous physical activity using an Actigraph accelerometer and related this to obesity levels in the cohort. Analysis of the results showed a consistent trend – the greater the fat mass, the lower the level of physical activity and the effect was greater in males than in females. The association between physical activity and obesity appeared to be due to moderate and vigorous physical activity, rather than all physical activity. A study when children were aged 11 years found that children who regularly walked to school were more active during the week than those travelling by car, especially if the distance was greater than 0.5 mile (van Sluijs *et al.*, 2009). Increasing participation in active travel might be a useful part of an overall strategy to increase population physical activity.

4 LITERATURE REVIEW ON RISK FACTORS FOR ROAD TRAFFIC INJURIES IN CHILDREN

4.1 Introduction

Mytton *et al.* (2009) have synthesised information about the risk factors for injury in school-aged children in their systematic review of cohort studies which have reported unintentional injuries. Most analyses of risk factors were found to be conducted at the individual child level (23/27 papers), with fewer conducted at the family level (19/27) and very few considering the wider environment. In relation to all unintentional injuries the male sex, psychological, behavioural and risk-taking behaviour, having a large number of siblings and a young mother were all associated with increased injury outcomes across more than one cohort and setting. There were only two studies, however, which specifically looked at road traffic injuries, one analysing the 1958 British cohort (Pless *et al.*, 1989) and the second a cohort from the West of Scotland (West and Sweeting, 2004), and these are described more fully below.

In the review below, we examine studies (cohort, case control studies and other designs) which have reported on risk factors for road traffic injuries in school-aged children using the framework adopted by Mytton *et al.* (2009): individual child factors, family factors and wider environmental factors.

4.2 Individual child factors

Analysis of the 1958 British cohort revealed only two significant child factors related to road traffic injuries: these were fidgeting and abnormal behaviour (Pless *et al.*, 1989). Some studies have shown some association of the child having a physical disability and road traffic injuries. A study of child pedestrian injuries in Scotland found that 14% of children involved in accident events had some form of disability (sight and hearing problems). Christie (1995), in a case control study of child pedestrian injuries, found that physical capability (particularly of hearing) was significant.

The transition during the stage of adolescence from childhood into adulthood may be characterised by risk-taking behaviours, which are normal and a healthy part of growing up for most young people. For some these may result in adverse outcomes in the short term and the adoption of behaviours which are damaging in the longer term. High levels of 'sensation seeking' behaviour can thus be found among young adults and a need to maintain a heightened level of physiological arousal. Young people consequently seek new situations and experiences to maintain this level, irrespective of the risks inherent in the experience. Such sensation-seeking behaviour frequently focuses on risky behaviours, including while driving a vehicle

or crossing a road (Toroyan and Peden, 2007). Sensation seeking has been shown to rise between the ages of 9 and 14 years, peaking in late adolescence or the early twenties, and then declining steadily with age (Toroyan and Peden, 2007). Thuen (1994) studied two aspects of injury-related behaviours among a group of young Norwegian adolescents:

- risk-seeking behaviours – the engagement in potentially dangerous activities; and
- safety-seeking behaviours – actions which reduce the risk of accidents or injuries by the use of safety equipment.

These behaviours appeared to constitute two separate dimensions, but sensation seeking seemed to account for portions of both patterns.

A review by Turner *et al.* (2004) assessed the evidence supporting the association between injury and risk-taking behaviour from six case control studies and one retrospective cohort study. Overall their review found that risk-taking behaviour, however it is measured, is associated with an increased chance of sustaining an injury except in the case of high-skilled, risk-taking sports where the effect may be in the other direction. Thomas *et al.* (2007) conducted a broad-ranging review, covering topics as diverse as drugs, alcohol, transport and sport. It considered the extent to which risk-taking contributes to accidental injury, by locating this within the social circumstances in which young people find themselves. It concluded that, while there is a large literature on a 'culture of risk-taking' among young people, the evidence to support the view that this translates into significant numbers of injuries is limited.

4.3 Family factors

Analysis of the 1958 British cohort revealed three significant family factors related to road traffic injuries, and these related to family disruption or disadvantage, and included:

- crowding;
- family problems and being removed from the family; and
- being placed in the care of the local authority (Pless *et al.* 1989).

Christie (1995), in a case control study of child pedestrian injuries, found that the risk and responsibility score of the parent/carer was important, as was the number of children in the family that the parent cared for.

4.4 Wider environmental factors

A major feature of research on child injury and injuries in the road environment has been the association between socio-economic position and injury occurrence. Laflamme *et al.* (2009) conducted a wide-ranging review of socio-economic position and different injury types; they found that low socio-economic position at both the area and individual level seems to increase the risk of being injured in a number of different injury types, including road traffic injuries. A summary international review of risk factors for child pedestrian injuries came to a similar conclusion, indicating that children living in lower income neighbourhoods were 3.5 to 5.7 times more likely to be injured (Wazana *et al.*, 1997). Other risk factors for pedestrian injury related to deprivation included crowding (up to 3.4 times), living on the streets with predominantly rental units (2.6 times) or apartments and condominiums (5.5 times), and the absence of play areas (5.3 times).

Christie (1995), in a case control study of child pedestrian injuries, found that certain features of the environment that proved significant were the low levels of on-street parking and the age of housing, with pre-1914 housing developments featuring strongly as high-risk environments. There were a great number of different factors that influenced whether child pedestrians were injured, some of which were highly correlated with social group.

A number of studies conducted in Scotland have investigated associations between socio-economic status and road traffic accidents (Abdalla *et al.*, 1997; Chichester *et al.*, 1998; Williams *et al.*, 1996; Williamson *et al.*, 2002). Williams *et al.* (1996) found that a father's occupational classification and low family affluence were both predictive of injuries to 11–15-year-olds occurring on the roads. Abdalla *et al.* (1997), in their study of road traffic injuries and social characteristics in the former Lothian region of Scotland, found large differences for pedestrian casualty rates when they compared the 15% most deprived areas with the 15% most affluent. The rate for 12–16-year-olds in the most deprived areas was more than double that from young people in affluent areas, but the difference was less pronounced when comparing non-pedestrian casualties. Chichester *et al.* (1998) showed a significant association between road traffic accidents and area deprivation categories across all age groups, with the most significant relationships by age found in children and teenagers. A study of head injury mortality among 0–14-year-olds in Scotland showed that pedestrian accidents and other road traffic injuries were the leading causes of injury, with children living in poorer areas having the highest head injury mortality rates (Williamson *et al.*, 2002). Graham *et al.* (2005) noted that deprivation is further associated with an increased likelihood of pedestrian injuries resulting in death or serious injury. The most deprived wards were 4.4 times more likely to have a child pedestrian killed or seriously injured than the least deprived wards.

Graham *et al.* (2005) examined STATS19 road traffic injury data across England and found a strong relationship between an overall index of multiple deprivation (IMD) and pedestrian injuries for both children and adults. However, the relationship appeared to be more substantial in the younger ages. Kendrick (1993) analysed child pedestrian injuries in Nottingham using STATS19 data and found a significantly higher rate in deprived areas. A study of hospital admissions from Trent found that both the number and severity of injuries increased with increasing socio-economic deprivation (Hippisley-Cox *et al.*, 2002). These findings were most pronounced for younger age groups and for pedestrian injuries.

In relation to trends related to socio-economic deprivation and injury, Edwards *et al.* (2006) examined child deaths from injuries to see whether socio-economic gradients had persisted over time. They found that the death rate for children of parents classified as never having worked or in long-term unemployment was 13.1 times greater than for children in higher managerial/professional occupations. For road traffic injuries, the gradients were even steeper: 20.6 for pedestrians and 27.5 for cyclists. Although there had been considerable decreases in overall rates of death from injury, serious inequalities persisted over time. In contrast to these findings, an analysis of STATS19 and census data in Northumberland showed striking socio-economic inequalities for both boys and girls, but inequalities seemed to be decreasing over time (Adams *et al.*, 2005).

The marked inequalities in pedestrian injuries evident in childhood may decrease in adolescence and young adulthood. In an analysis of a cohort of children from the West of Scotland who were followed from ages 11 to 16 years, West and Sweeting (2004) found some evidence for equalisation in pedestrian injuries in both boys and girls as age increased. This contributes to the growing debate about whether there are fewer inequalities in injury during youth (in contrast to greater inequalities in younger childhood and adulthood). West and Sweeting (2004) hypothesise that this change may reflect the increasing prevailing influence of youth culture and the weakening influence of family background as young people get older.

Factors occurring at individual, family and the wider environment levels interact with each other. The interactions between these different factors and road traffic injuries will be investigated in the ALSPAC cohort at the age of 13–14 years.

5 METHODS

5.1 Study population

The study population is composed of children from the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort at the age of 13–14 years. ALSPAC has recruited children from the former county of Avon in south-west England (see Section 3.3).

5.2 Sources of information

A variety of questionnaires have been used in this study. The first is an ALSPAC questionnaire on 'Experiences, Thoughts and Behaviours', which was completed by the children (Questionnaire A – CCQ, see Appendix 1). This was sent out in the summer of 2005 for the children of the cohort to complete around the time of their fourteenth birthday. This included a section on non-fatal road accidents which had taken place in the last year. The second questionnaire is a child-completed questionnaire, which included questions on travel to school and leisure activities (Questionnaire B – CCP 'Travelling, Leisure and School', see Appendix 2). The data collection period for the two questionnaires took place over a period of 18 months from 2005 to 2007. Both were postal surveys.

The survey instruments used have built on a questionnaire that was administered to 11–14-year-old school children in Newcastle in 1990 (Towner *et al.*, 1994) and more recently to a large sample of school children in 15 local authorities in north-west England in the Neighbourhood Road Safety Initiative project, a Department for Transport funded demonstration project (Christie *et al.*, 2007).

Questionnaire A (Appendix 1) explores involvement in road accidents in the last

year, how respondents were travelling, accompaniment, and activity at the time of the accident and when the accident happened. It also explores whether the child was hurt and whether the injury was treated by a doctor (general practitioner, at an A&E department or whether the child was admitted to hospital).

Questionnaire B (Appendix 2) examines the most recent journeys to school in the morning and home from school in the evening; travelling by car, bus, train and cycle; leisure time activities and travel to these activities; and young people's attitudes to safety as a pedestrian near their school and home, and as cyclists near their home.

The project also includes questions from a range of other questionnaires, completed by the ALSPAC cohort and their parents on a range of individual, family and

environmental factors. One of these is an index of Sensation Seeking Behaviour (see Appendix 3).

Sensation seeking has been defined as 'the need for varied, novel and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences' (Zuckerman, 1979), and has been applied in relation to potential risk behaviour. As part of the focus clinic at age 11+, a sensation seeking questionnaire was used to assess risk-taking behaviour in the children. This instrument was a modified version of Arnett's Inventory of Sensation Seeking (AISS) (Arnett, 1994) which has been found to reliably measure both age and sex differences in sensation seeking. The original version of the AISS contains 20 questions, and 11 of these were chosen for inclusion at Focus 11+ and a further nine questions, designed by members of the ALSPAC team (Dieter Wolke and Andrea Waylen) were incorporated – these were more age appropriate than the original questions. The interview around sensation seeking was performed on a computer; the child was presented with a variety of behaviours – each appeared on the screen and was also spoken to the child via headphones. For each behaviour, the child was given four options to rate each statement: 'Not like me at all'; Not much like me'; 'Quite like me'; and 'Very like me'. Two scores have been derived: the first (Score A) uses only those questions from the original AISS and the second (Score B) uses all responses.

5.3 Data handling

The data collected from the questionnaires to the 13–14-year-old cohort have been collated, scanned and cleaned. A 'data buddy' from the ALSPAC team has worked as part of the project team to provide anonymous linkage of datasets to ensure the anonymity of the data.

5.4 Statistical methodology

Statistical tests were used to assess whether associations between a range of factors and outcomes could have occurred by chance or were likely to indicate real findings. Where factors were described in categories, a Pearson's chi-square test was used unless any category had less than five results when a Fisher's exact test was used. Factors measured with continuous scales were assessed to determine if they were normally distributed across the cohort and were analysed using t-tests where a normal distribution was found.

This report presents descriptive univariable analyses, presenting cross tabulations for road traffic injuries reported by children in the cohort and exposure to injury risk in the road environment for a range of selected variables. Univariable analyses were conducted, taking the primary outcome variables in turn and exploring their relationship with a range of explanatory variables or risk factors (e.g. all road traffic accidents, pedestrian accidents, cycle accidents). We also explored the use of

multivariable analysis for a range of child, family and wider environmental variables (see Appendix 4 for the list of variables) and for the development of a conceptual framework and a hierarchical model of different variables (Victora *et al.*, 1997). Multivariable analysis is a statistical technique used to understand the relative contributions of a wide variety of explanatory variables to an outcome of interest (Katz, 2006). Because of the lack of sufficient associations in the univariable analyses, we did not run multivariable models for the final analyses of this report. Thus, what is reported below relates to the univariable analyses.

6 FINDINGS RELATED TO ROAD TRAFFIC ACCIDENTS

6.1 Ascertainment

Questionnaire 1 on road traffic casualties was completed by 6,218 individuals. This is made up from 5,933/13,998 (42.3%) who were the survivors at one year from the original cohort and a further 275/532 (51.7%) of those children included since the millennium. The overall ascertainment rate was therefore 42.7% (6,218/14,530). A number of children and their families had moved from the area or dropped out of the cohort.

At the age of 13 years, 10,748 questionnaires were sent out, so the return rate was 6,218/10,748 (59% of the cohort at 13 years). Of the 6,218 who responded, 6,090 (97.9%) answered the question on road accidents (123 did not respond and five triplets/quadruplets were excluded to avoid identification); this will serve as the denominator for the analysis.

6.2 Prevalence and details of the accidents

This is a descriptive analysis of the findings, in particular the prevalence and types of accident that occurred and any association with background characteristics of the children and families (including physical attributes of the children).

In total, 334/6,090 road accidents occurred (5.5%). Of these, 30% (98/329) of the children were hurt in the accident, 18% (56/315) went to see their GP or went to casualty, and 3% (9/294) stayed overnight in hospital. Nearly a third of these accidents (92/314) happened while the respondent was going to or from school, 9% (28/314) while they were playing or hanging around in the street, and the rest on another type of journey. Overall, 44% of the accidents (145/327) occurred either before or after school, 28% at the weekend (93/327) and 27% during school holidays (89/327).

Figure 6.1 shows that 60% of the accidents occurred while the child was a passenger in a car, 11% when the child was a pedestrian and 18% when the child was a cyclist; for a further 11% the response was ‘other’ which was mainly road accidents occurring while the children were on a bus. Thus, the three groups of interest are those in which the child was a passenger (71%), those where the child was a pedestrian (11%) and those where the child was a cyclist (18%). Table 6.1 looks at some of the details of the accident by mode of transport.

Figure 6.1: Mode of transport, *n* = 328 (six did not respond to the mode of transport)

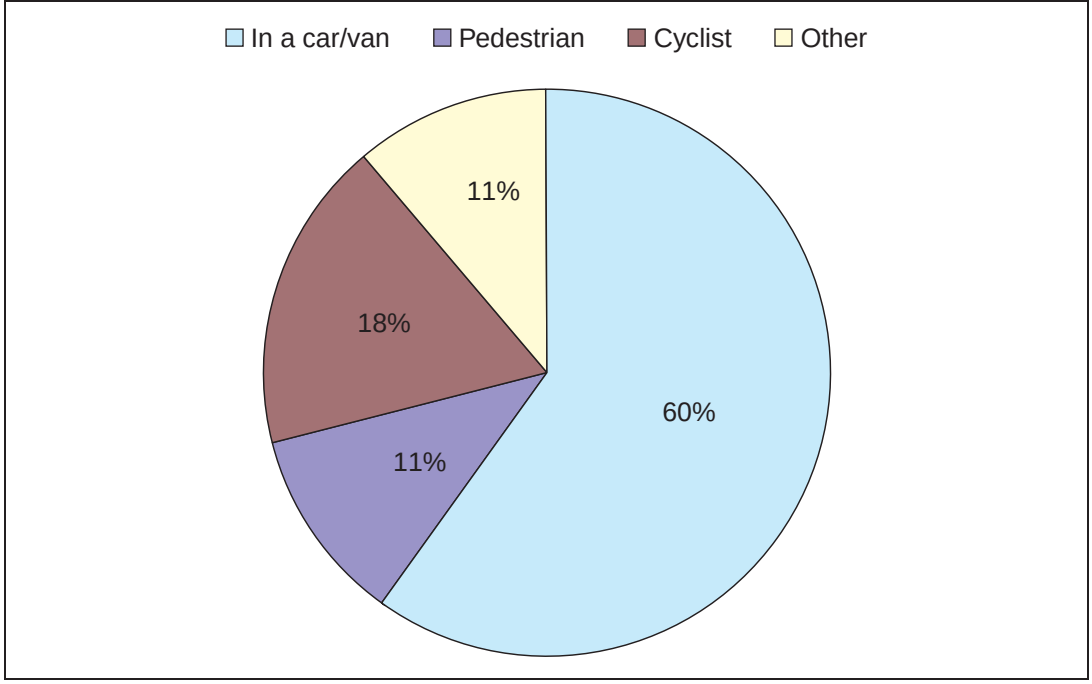


Table 6.1: Details of accident by mode of transport

Details	Category	Passengers in motorised transport		Pedestrians		Cyclists	
		n/n	%	*n/n*	%	*n/n*	%
Respondent hurt	Yes	38/232	16	20/35	57	40/59	68
Saw GP or went to casualty	Yes	24/225	11	9/32	28	23/55	42
Stayed overnight in hospital	Yes	3/208	1	4/31	13	2/53	4
What respondent was doing	Going to/from school Going to/from a place Playing in the street Other journey	61/218 87/218 3/218 67/218	8 40 1 31	14/35 7/35 10/35 4/35	40 20 29 11	15/57 21/57 14/57 7/57	26 37 25 12
When did it happen	Before school After school At the weekend At school holidays	31/231 64/231 74/231 62/231	13 28 32 27	6/34 14/34 6/34 8/34	18 41 18 24	10/59 18/59 13/59 18/59	17 31 22 31

Those travelling as passengers in motorised transport suffered the least injury, just 16% were hurt, 11% needed medical assistance and 1% stayed overnight in hospital. Around two-thirds of the cyclists and pedestrians were hurt, a much larger proportion, and more of them needed medical assistance and around 7% stayed

overnight in hospital. The majority of accidents (91%) occurred while the respondent was going on a journey; for over a quarter of the respondents this journey was to and from school, with a slightly higher proportion among the pedestrians. This was also reflected in the timing of the accident, 41% of the motorised accidents happened before or after school compared with 50% among the cyclists and 60% among the pedestrians.

6.3 Association with background characteristics and child impairments

Table 6.2 compares some background characteristics and child impairments between the respondents who had an accident and those who did not.

Table 6.2: Background characteristics and child impairment for all accidents

Background characteristics

Characteristic	Category	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Gender	Male	155/334	46.4	2,548/5,756	44.3	0.44
Ethnicity	Non-white	14/302	4.6	201/5,265	3.8	0.47
Parity	3 or more	14/312	4.5	232/5,338	4.3	0.91
Maternal age	< 21	10/324	3.1	175/5,491	3.1	
	21–35 years	282/324	87.0	4,835/5,491	88.1	
	> 35	32/324	9.9	481/5,491	8.8	0.79
Social class[2]	I/II	177/295	60.0	3,196/5,114	62.5	
	IIIn/IIIm	105/295	35.6	1,718/5,114	33.6	
	IV/V	13/295	4.4	200/5,114	3.9	0.68
Support	No partner	8/305	0.6	76/5,235	1.5	0.10[3]
Maternal education	CSE or none	38/311	12.2	673/5,332	12.6	0.84

Child impairment

Impairment	Time tested	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Wears glasses	12.5 years	57/248	23.0	854/4,551	18.8	0.10
Poor hearing[4]	13 years	12/264	4.5	257/4,850	5.3	0.59
Statemented[5]	7.5 years	14/270	5.2	140/4,725	3.0	0.04
Low IQ (< 86)[6]	8.5 years	18/252	7.1	403/4,452	9.1	0.30

1. Using Pearson's coefficient from chi-square test, unless otherwise stated. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
2. Using social classification nearest to socio-economic classification (SEC) I of mother and partner (where available).
3. Expected cell less than five, therefore Fisher's exact test used.
4. Based on parental rating using five-point Likert scale (excellent/good versus ok/some sound and can't hear/can't hear much at all).
5. Includes all that were assessed for statement **of special educational needs** even if refused at that time.
6. Cut-off based on approximately lowest 10% overall.

The male preponderance found in previous studies was only slightly in evidence in this cohort and was not significant. Neither were there any statistically significant differences in this univariate analysis with regard to ethnicity, size of family maternal age or social class, using a variety of measures including parental occupation, maternal support of a partner and maternal education.

In terms of child impairment, over three-quarters of the children who responded to the question on accidents had previously been tested at earlier ages for sight (12.5 years), hearing (13 years), whether they need a statement for special educational needs (7.5 years) and IQ level (8.5 years) using the age-adjusted Wechsler Intelligence Scale for Children (WISC) score. More of the children involved in an accident were wearing glasses, although this was not significant, while there was no difference in terms of hearing impairment. There was no difference between these groups in terms of the proportion of children with a low IQ, but slightly more children who had been assessed for a statement at 7.5 years were involved in accidents (5%) compared with the rest of the cohort (3%), a difference that was just significant.

The same comparisons were performed by the mode of transport in which the accident occurred; whether the child was a passenger in a motorised vehicle (Table A5.1), a pedestrian (Table A5.2) or a cyclist (Table A5.3). Tables A6.1–A6.3 are found in Appendix 5.

Splitting the data by mode of transport reduces the numbers and thus the power we have to detect statistical significance, but is used here to assess any major differences between the three groups. When comparing all road traffic accidents, the one significant variable was a slight excess among children who had been assessed for statementing for special educational needs; this association was strongest for cycle and especially pedestrian accidents. Thirteen per cent of children who reported pedestrian accidents had been assessed for statementing, compared with 3% of the rest of the cohort (Table A5.2 in Appendix 5), and 8% of children who reported cycle accidents had been assessed for statementing, compared with 3% of the rest of the cohort (Table A5.3 in Appendix 5). The higher prevalence of males found in earlier studies was not a characteristic of this study when assessing accidents overall, but was a significant characteristic among cyclists. Seventy-six per cent of children who reported cycle accidents were male compared with 44% of the rest of the cohort (Table A5.3 in Appendix 5). There was no evidence of differences in any of our socio-economic markers for those children who suffered an accident while being a passenger, but there was some evidence that children from the more deprived backgrounds were prevalent among the cyclists and pedestrians, although the only statistically significant difference was among the latter group for lack of maternal support. Nine per cent of children who reported pedestrian accidents had a mother who lacked support, compared with 2% of the rest of the cohort (Table A5.2 in Appendix 5).

6.4 Sensation seeking and reported road traffic accidents

This next section examines in more detail the association between sensation seeking and whether children reported a road traffic accident. For this analysis, Score B has been chosen (see Section 5.2) – this includes the 11 original questions and nine additional questions. In this index, the higher the sensation seeking score, the higher the sensation seeking behaviour. Of those children who answered the question on accidents (n = 6,090), just over 75% (n = 4,611) were in the focus groups at 11 years old. Figure 6.2 shows that the responses for this group were normally distributed. This means that the majority of the cohort had scores in the middle of the range and smaller numbers of children had very high or very low scores. This is the spread of results that we would expect to see in a normal population.

Figure 6.2: Distribution of sensation-seeking scores for those in focus group aged 11 and over

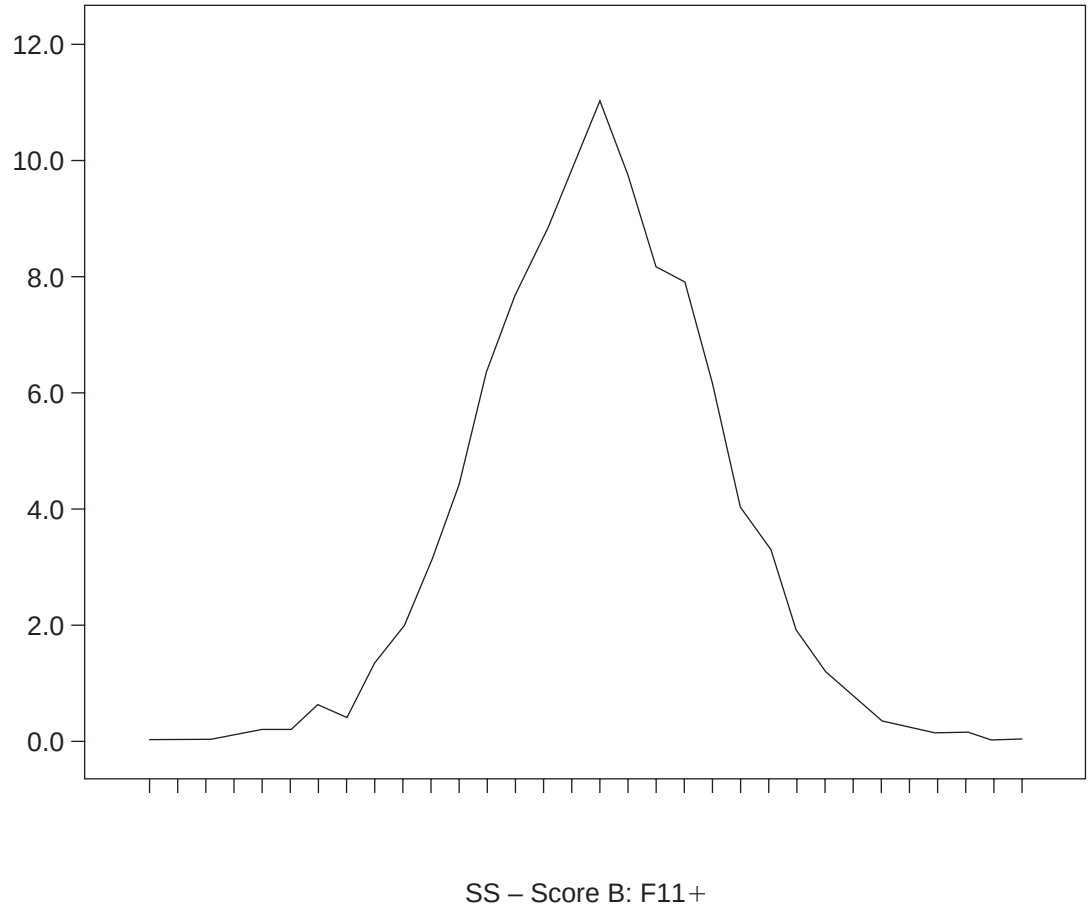


Table 6.3 compares the mean sensation-seeking score between those who had accidents and those who did not, and further splits this by mode of transport. Table 6.3 shows that children who had road traffic accidents (of any type) did not have sensation-seeking scores that were very different to children who did not have accidents.

Table 6.3: Comparing mean score for sensation-seeking behaviour							
	Accidents			Rest of cohort			*p*-value*
	n	Mean	SD	*n*	Mean	SD	
All accidents	251	49.06	3.91	4,360	48.97	3.97	0.75
Passenger only	178	48.60	3.91	4,609	49.00	3.93	0.19
Pedestrian only	23	48.26	3.74	4,764	48.98	3.93	0.38
Cyclist only	37	49.03	3.71	4,750	48.98	3.93	0.94
* Two tailed t-test.							

6.5 Road traffic accidents at age 13–14 years and previous accidents

Data have been collected about whether the children had been involved in an accident (all accidents, not just road traffic accidents) when they were aged 5.5 years, 6.5 years, 8.5 years and 11.5 years. Just over a quarter of the cohort had been involved in a previous accident that involved injuries that needed at least secondary care (1,656/5,815 ~ 28.5%). This denominator excludes 250 children from the primary analysis conducted on road traffic accidents at 13–14 years old, as these 250 children were not part of the original Avon Longitudinal Study of Parents and Children (ALSPAC) cohort (only joining around 2000 –see Section 6.1) and, thus, we have no data on previous accidents. This exclusion reduces the number of accidents at 13–14 years from 334 to 324 children. Table 6.4 shows the association between accidents at 14 years and previous accidents.

Table 6.4: Association between accidents at 13 14 years and previous accidents					
Previous accident	Accident at 14 years		No accident at 14 years		*p*-value*
	n	%	*n*	%	
Yes	99	30.5	1,557	28.4	0.39
No	225		3,934		
* Chi-square test.					

There was no significant difference between road traffic accidents at the age of 13–14 years and experience of previous accidents. If we restrict this test to just those 96 children at 13–14 years who had been hurt in an accident, there was again no difference; 28.1% of those hurt at 13–14 years versus 30.5% of the rest of the cohort had had a previous accident ($p = 0.67$).

6.6 Analysis of those that were hurt in the accident

Of the 334 children who had an accident in the last year, 98 (29.3%) responded that they were hurt in the accident; this represents 1.6% of the cohort. Using this group as a proxy for the more serious accidents (serious to these individuals anyway), Table 6.5 looks at the association with background characteristics and measures of child impairment.

Table 6.5: Background characteristics and child impairment for those who were hurt

Background characteristics

Characteristic	Category	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Gender	Male	46/98	46.9	2,657/5,992	44.3	0.61
Ethnicity	Non-white	3/89	3.4	212/5,478	3.9	0.55[3]
Parity	3 or more	4/94	4.3	242/5,556	4.4	0.61[3]
Maternal age	< 21	6/96	6.2	179/5,719	3.1	
	21–35 years	84/96	87.5	5,033/5,719	88.8	
	> 35	6/96	6.2	507/5,719	8.9	0.16
Social class[2]	I/II	44/86	51.2	3,329/5,323	62.5	
	IIIn/IIIm	36/86	41.9	1,787/5,323	33.6	
	IV/V	6/86	7.0	207/5,323	3.9	0.06
Support	No partner	3/89	3.4	81/5,451	1.5	0.15[3]
Maternal education	CSE or none	13/91	14.3	698/5,552	12.6	0.63

Child impairment

Impairment	Time tested	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Wears glasses	12.5 years	16/74	21.6	895/4,725	18.9	0.56
Poor hearing[4]	13 years	5/78	6.4	264/5,036	5.2	0.39[3]
Statemented[5]	7.5 years	7/79	8.9	147/4,916	3.0	0.01[3]
Low IQ (<86)[6]	8.5 years	6/64	9.4	415/4,640	8.9	0.91[3]

1. Using Pearson's coefficient from chi-square test, unless otherwise stated. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
2. Using social classification nearest to SEC I of mother and partner (where available).
3. Expected cell less than five, therefore Fisher's exact test used.
4. Based on parental rating using five-point Likert scale (excellent/good versus ok/some sound and can't hear/can't hear much at all).
5. Includes all that were assessed for statement **of special educational needs** even if refused at that time.
6 Cut-off based on approximately lowest 10% overall.

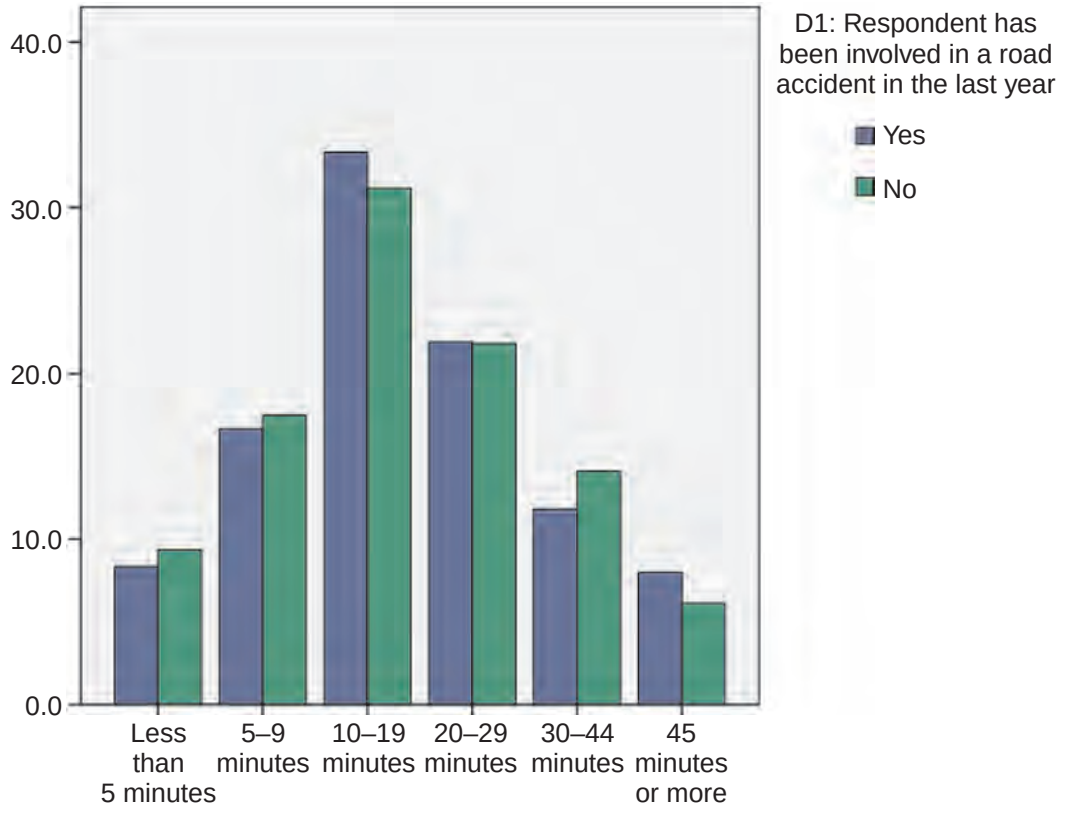
The only statistically significant variable in this analysis was among those children who were assessed for statementing for special educational need; the proportion involved in accident where they were hurt was 8.9% compared with a prevalence of 3% among the rest of the population (some of whom were involved in accidents, but were not hurt).

7 FINDINGS RELATED TO EXPOSURE TO THE ROAD ENVIRONMENT AND ROAD TRAFFIC ACCIDENTS

7.1 Trips to and home from school

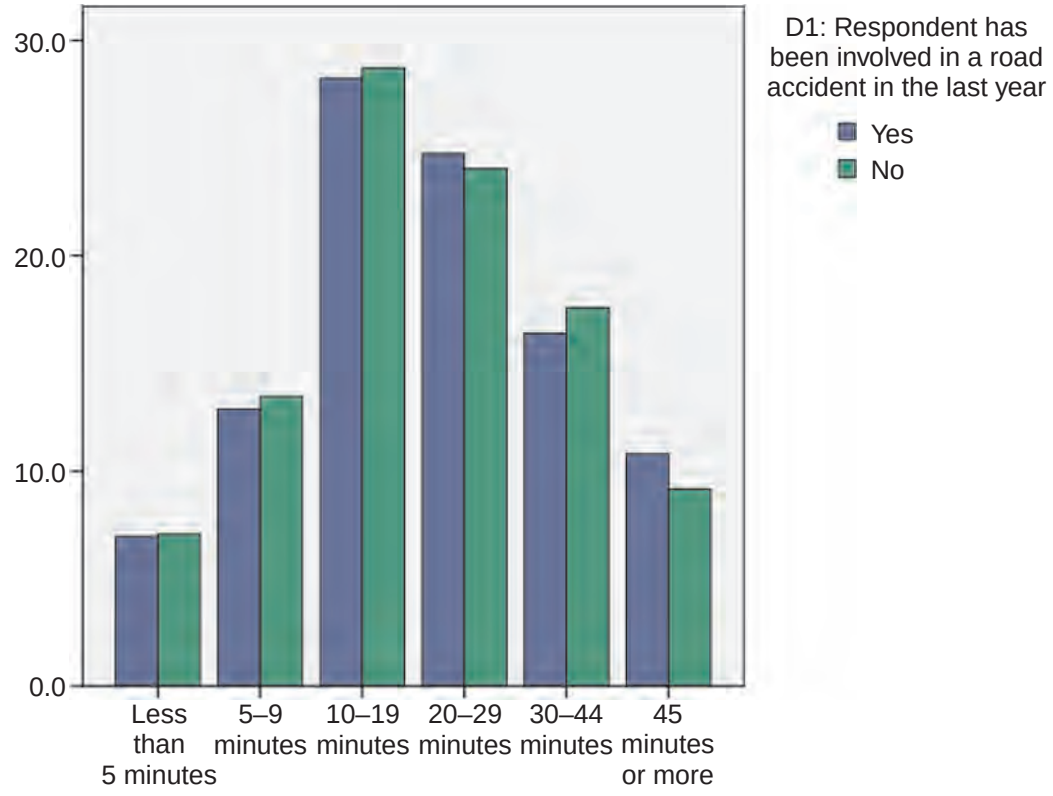
When children in the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort were asked about their trip to school, the peak time taken to get to and from school was around 10–19 minutes; less than 10% of the children in the whole cohort take 45 minutes or longer. Figures 7.1 and 7.2 show how long the children took to get to and from school, split by those who had an accident and those who did not.

Figure 7.1: Time taken to get to school



Comparing respondents who had been involved in a road accident over the last year with the rest of the cohort, there did not seem to be any obvious pattern. The proportion taking more time to get to school (more than 30 minutes) was similar among those involved in an accident – 19.8% (57/288) compared with 20.2% (1,042/5,153) who were not involved in an accident – and was not statistically significant ($p = 0.86$). Coming home from school, the comparison was 27.2%

Figure 7.2: Time taken to get home from school



(78/287) among those who reported an accident versus 26.7% (1,371/5,127) among the rest of the cohort ($p = 0.87$).

Broadly in the cohort as a whole, the number of children walking all the way or part way to school (50.5%; 3,074/6,090) and those using motorised transport (57.4%; 3,493/6,090) was equally split, with only 5.2% (316/6,090) usually using a bicycle. Of those involved in an accident, 46.1% (154/334) usually walked, 61.6% (206/334) usually used motorised transport and 6.5% (21/334) rode a bicycle; among the rest of the cohort the breakdown was 53.5% (2,920/5,756) usually walked, 57.1% (3,287/5,756) usually used motorised transport and 5.1% (295/5,756) rode a bicycle. The figures for travelling home were very similar: 49.7% victims versus 56.4% usually walked all or part of the way to school; 57.8% of victims versus 53.5% used motorised transport; and 6.0% of victims usually used a bicycle compared with 5.1% among the rest of the cohort.

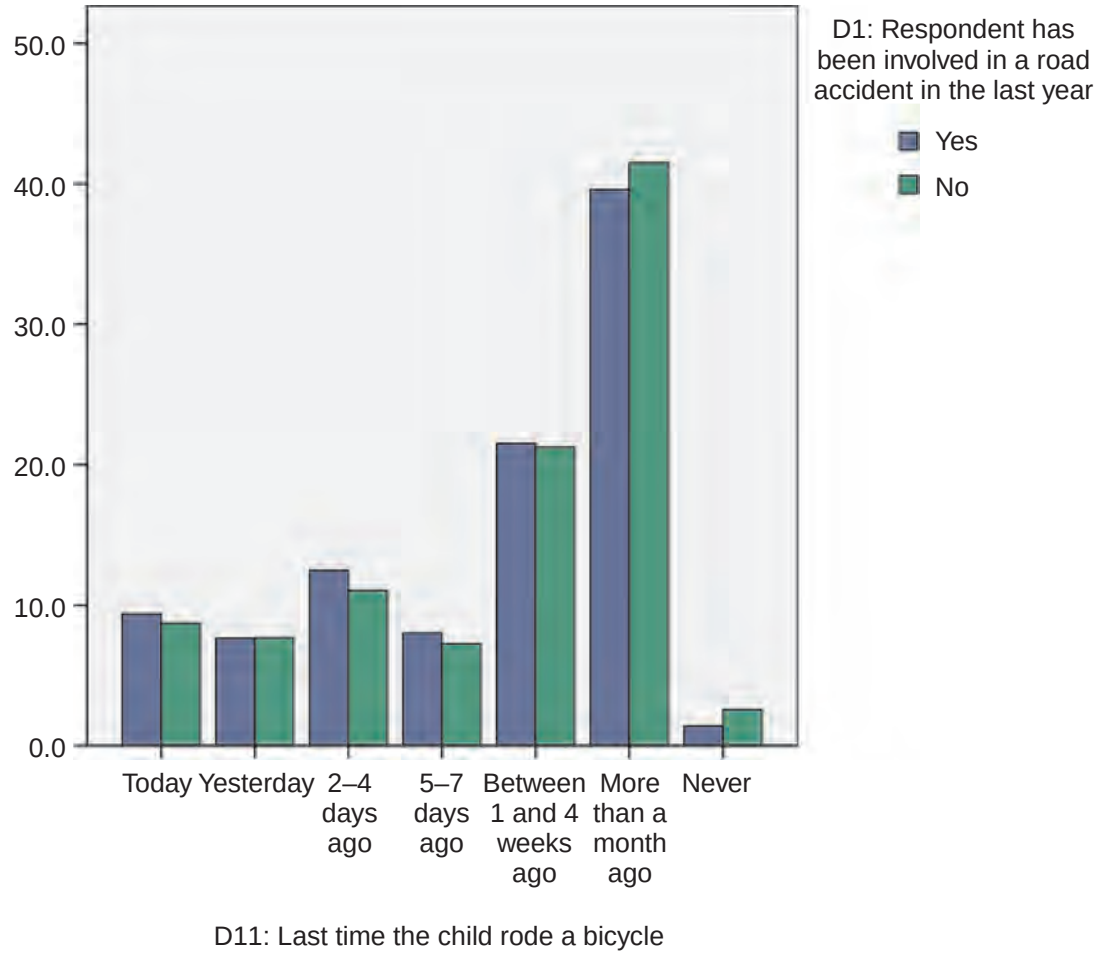
7.2 Bicycles

Most of the children in the cohort owned a bicycle (89.8%; 4,884/5,439). More than half had ridden a bicycle sometime during the last month and more than a third (34.9%; 1,903/5,458) had ridden a bicycle during the last week. However, only a

very small number of children, 5.2% (316/6,090), rode a bicycle to school. Reported bicycle helmet ownership was high, with 61.2% (3,317/5,423) saying that they owned a helmet. Usage of helmet was, however, lower, with 30.3% (1,523/5,034) of children reporting that they had worn a helmet the last time they had ridden a bicycle. 41.3% (2143/5186) of the cohort had been on a cycling proficiency training course.

Figure 7.3 shows when the children had last ridden a bicycle. Slightly more of the children who responded that they had an accident in the last year had ridden a bicycle in the last week: 37.5% (108/288) versus 34.7% (1,795/5,170), but this was not significant ($p = 0.34$).

Figure 7.3: Time since last rode a bike



A similar proportion of those involved in an accident, 62.3% (177/284), owned a bicycle helmet compared with those who were not involved, 61.1% (3,140/5,139). Restricting this to just those children who owned a bicycle yielded similar results: 64.9% compared with 66.7%. A similar proportion of those involved in an accident, 32.5% (86/265), wore a helmet the last time they rode a bike compared with those

who were not, 30.1% (1,437/4,769). Slightly more of those involved in an accident had been on a cycling proficiency training course, 44.4% (121/272), compared with those who had not, 41.1% (2,022/4,914), but this difference was not significant ($p = 0.28$).

7.3 Household car ownership and use

A very high proportion of the respondents, 96.4% (5,256/5,453), said that they lived in households where someone owned a car or a van. Car usage was also high, with 78.7% of the cohort saying that they had travelled in a car or van within the last two days (4,296/5,461). Reported seat-belt use in the last journey made in a car was also very high, with 97.3% (5,297/5,444) reporting that they had worn a seat belt the last time they travelled in a car.

A similar proportion of those involved in an accident, 96.5% (277/287), lived in households where somebody owned a motor vehicle compared with those who did not, 96.4% (4,979/5,166), a non-significant difference ($p = 0.91$). A similar proportion of those involved in an accident, 81.3% (234/288), travelled in a car, van or taxi in the last two days compared with those who did not, 78.5% (4,062/5,173), a non-significant difference ($p = 0.27$). A similar proportion of those involved in an accident, 96.8% (274/283), wore a seat belt the last time they travelled in a car compared with those who did not, 97.3% (5,023/5,161), a non-significant difference ($p = 0.61$).

A similar proportion of those involved in an accident, 74.3% (214/288), were taught about road safety compared with those who were not, 73.6% (3,803/5,169), a non-significant difference ($p = 0.78$).

7.4 Road traffic accidents and accompaniment

Of the 233 children who had accidents while travelling in or on motorised transport, only six (2.6%) were on their own (travelling by bus or coach), 190 (81.5%) travelled with an adult and the rest with brothers, sisters or friends. Of the 59 children who had an accident while walking to school, 31 (52.5%) walked alone and only one child was with an adult, the rest walked with friends or siblings. Of the 36 children who had an accident while cycling to school, just seven (19.4%) were cycling on their own, and just one was cycling with an adult, the vast majority were cycling to school with their friends or siblings.

8 DISCUSSION

8.1 Strengths and limitations of the study

The strength of the study is in its use of the large Avon Longitudinal Study of Parents and Children (ALSPAC) cohort, the largest contemporary cohort study in the UK today, which has collected a wealth of data for a period of 18 years. When this cohort was initiated, it was representative of a whole community and it covered a range of environments from inner city to semi-rural in one geographical area. ALSPAC has also collected a diverse range of psychological and physical measures from both the children and their families. The other big strength of the method used is that the questionnaires have been completed by the young people themselves and, hence, the results do not rely on data collected from emergency departments or general practitioners, but reflect the experience of a community-based sample.

The constraints of the ALSPAC study relate to the omission in the study of certain key elements of the population, including families in the most deprived circumstances. This is a characteristic of many cohort studies (Mann, 2003). As in many other surveys of adolescents, there have been differential response rates of males and females in completing the surveys. These constraints need to be borne in mind when discussing the results of this study.

8.2 Commentary on findings

The data collected in 2005–06 reflect the experience of 13–14-year-olds, an age group in the transition from childhood to adolescence. Within this age group there are very wide variations in physical and psychological maturity, and in the amount of freedom given by parents in the road environment.

Previous studies have suggested that certain background characteristics of children and their families have been associated with higher rates of road traffic accidents and injuries, including a higher preponderance of males and children from larger families, those involved in previous accidents and children from more deprived families. As described in the review of the literature (Section 4.4), a number of studies have described strong associations of road traffic injuries and social deprivation. In this study there was some evidence of children from more deprived background among the pedestrians, although the differences were not marked. Can this be viewed as part of the process of 'equalisation in youth' suggested by West (1997)? One of the central features of children growing up involves the progressive detachment of individuals from their parents and their parental homes (West, 1997). This process accelerates at entry to primary school and even more so at entry to secondary school. The amount of time spent in the parental home thus reduces with age, and children are exposed to different hazards as they range more widely. At the same time, parental control and influence diminish and the influence of peers, the

school environment and a prevalent youth culture increases. The 'equalisation in youth' hypothesis suggests that social differences in health are more marked at an early age when the influence of the parents and home is greatest, but declines with age, particularly in the period 11 to 16 years and then the difference widens once more.

West and Sweeting (2004) examined data from the West of Scotland cohort in children aged 11–16 years and found evidence for equalisation for some types of accidents and injuries, including pedestrian road traffic injuries in both males and females, as well as burns and scalds, and sports injuries in females. This evidence is also supported by work in Sweden, where schoolgirls demonstrated equalisation for some injury types, such as traffic-related and self-inflicted injuries (Engstrom *et al.*, 2003). There is also some evidence available from the analysis of Health Survey for England data which relates to this issue. No association was found between major accident rates in young adults (aged 16 to 24) and three socio-economic indicators: social position (based on current or former occupation of the household reference person), household income or area deprivation (Malbut and Falaschetti, 2003). That is, young people seemed to experience the same rate of accidents regardless of where they lived, their household income or their social position.

Previous studies have also found an association with poor hearing, sight and low IQ. We, however, found no such differences, the only significant excess was among children who had been assessed for statementing and this was just among cyclists and pedestrians.

When focusing on the smaller number of children who were hurt in an accident over the last year (1.6% of the population), again there were no differences in background characteristics, although the prevalence among those children assessed for statementing was significantly higher. In Bristol, in 2005, around 4% of children were being referred for a multidisciplinary assessment for a statement of special needs. These children had a mixture of learning difficulties, sensory impairments, behavioural problems and developmental conditions, such as attention-deficit hyperactivity disorder (ADHD) and autistic spectrum disorders. Many of these children with special educational needs would have impairments in motor co-ordination, attention and impulse control, which could render them more likely to be injured in the road environment, even if supervised. It would also not be surprising if children with hearing loss or visual impairment were found more likely to be involved in road accidents as pedestrians or cyclists, but the numbers were not sufficient to show a significant association.

The 13–14 age group are very heterogeneous in their psychological and neuro-developmental maturity, with a disparity between their higher cognitive skills and their self-control abilities. The 'executive function' abilities are still not mature, so that planning, spatial awareness, attention skills and control of impulsivity maybe out of step with their 'thinking' abilities; combined with peer pressure and

encouragement, this results in risk taking and exposure to injury. This disparity is more marked in boys, but there are also underlying genetic factors which influence neuro-biological maturation in both sexes

A number of previous studies have also suggested that children who have accidents score higher for measures of sensation-seeking behaviour. Using Arnett's inventory to measure this behaviour at 11 years old showed no difference among the groups. This, however, is in line with the findings of Thomas *et al.* (2007), who, in a wide ranging review, found a lack of evidence which consistently links individual risk-taking with accidental injury. Golding (2010) discusses the importance of null findings from research in informing health policy and cites examples of null results, including the lack of associations between DTP (diphtheria, tetanus and poliomyelitis) vaccines and childhood asthma; MMR (measles, mumps and rubella) and autism; autism and bowel disorders; breast feeding and the reduced risk of eczema. Interpretation of such null finding can lead to the abandoning of erroneous health education messages and policies.

We compared the findings for the ALSPAC survey with other studies in the literature. In relation to the mode of transportation on the school journey, in the ALSPAC study we found that 50% of children reported that they walked all the way or part of the way to school (the survey was completed in the period 2005/06). These results of the 2006 National Travel Survey showed that, for secondary school children, the proportion of journeys to school made on foot was 41%. The 2006 figure had changed little in the National Travel Survey from the rate of 42% reported in 1995/97 (Department for Transport, 2007b). The proportion of children travelling to school by car in the ALSPAC study is higher than the National Travel Surveys for 2006, when the rate was 20%, and for 1995/97, when a rate of 20% was also reported. About 3% of secondary school pupils cycled to school in the National Travel Survey in 2006 (Department for Transport, 2007b). In the ALSPAC study, 6% of children travelled to school by bicycle.

This study found that 61% of children said that they owned bicycle helmets and about half of these (30%) had worn a helmet on their last cycle trip. This compares favourably with figures reported by the Department for Transport: cycle helmets were observed being worn by 14% of children on major roads in built-up areas in 2004 (Department for Transport, 2004), compared with 18% in 1994 (Department for Transport, 2007c). Cryer *et al.* (1998) found striking differences at different ages, with 10–12-year-old children reporting much higher cycle-helmet wearing rates than 14–16-year-olds: 32% of males and 29% of females aged 10–12 years, compared with 14% of males and 10% of females aged 14–16, reported that they always wore helmets. Comparisons with the cohort at the age of 16–17 years will be possible in the second phase of the study.

9 CONCLUSIONS AND RECOMMENDATIONS

In this study of a representative sample of 6,090 children aged 13–14 years in 2005, over one in twenty (5.5%) responded that they had had a non-fatal road traffic accident in the last year. The largest group were passengers in motorised vehicles (71%), 18% were cyclists and 11% pedestrians. Overall, just under a third of the children (30%) were hurt in the accident, 18% received medical attention and 3% stayed overnight in hospital. However, if split by mode of transport, there were marked differences. The proportion of passengers hurt in the accident was just 16% compared with nearly two-thirds of the cyclists and pedestrians. Only 1% of the passengers ended up staying overnight in hospital compared with 4% of the cyclists and 13% of the pedestrians. Nearly a third of these accidents happened while the respondent was going to or from school; 9% while they were playing or hanging around in the street.

This research project has provided some evidence in support of the 'equalisation in youth' hypothesis for road traffic accidents in 13–14-year-olds. More attention needs to be given to an understanding of influences at different periods during an individual's life course on health and well-being. The second decade of life is an important phase in the life course, where transitions from childhood to adolescence are taking place.

Results show that this age group are vulnerable to injury when on their own in the road environment: balance needs to be struck between giving young teenagers appropriate autonomy and protecting them from injury in a hazardous environment. Training in road use as a pedestrian and as a cyclist (cycling proficiency) needs to be combined with the appropriate reinforcement of cycle helmets, the use of cycle paths and the provision of safe places for young teenagers to meet (e.g. youth clubs), rather than hanging out on the street.

Learning disabled young people of this age are particularly vulnerable to injury in the road environment because of the disparity between their physical and cognitive maturation, and their carers need to provide a higher level of supervision, appropriate for a younger child.

There have been few cohort studies in the literature which have used the full potential of their temporal design, by using repeated measures over a period of time. There are also limited data available on injuries to adolescents, and on the changes which occur in the transition from childhood to adulthood. The Avon Longitudinal Study of Parents and Children (ALSPAC) dataset is unique, and can provide an important contribution to the injury literature and our understanding of the risks during this important transition, when deaths and disability from injury in the road environment (in later youth and in young adults) are higher than at any other age.

The results reported here from 13–14 years represent the first phase of our investigation of injury risk to young people, and further data will be available at 16–17 years and 18–19 years. Questionnaire data on road traffic injuries and exposure to risk have already been collected when the cohort was 16–17 years: these data are now available and will be analysed in Project 2, with particular reference to other risk-taking behaviours at this age. Further data collection on reported road traffic injuries and exposure to the road environment will be collected when the young people in the cohort are aged 18–19 years (analysis will be subject to funding). It should thus be possible to compare data collected when the cohort is aged 13–14 years with that of the cohort at 16–17 years and at 18–19 years, and to examine whether equalisation in earlier youth continues into later youth, as the cohort grows older or whether greater inequalities appear. The second two sweeps will also capture the period when the young people are learning to drive, and we will be able to investigate factors influencing young driver attitudes and behaviour, and the risk of injury from road accidents. It will be possible to determine the social and developmental trajectories of young people who have frequent or serious accidents, and the resilience factors which protect young people in the road environment from sustaining injury.

At the end of this research, the ALSPAC project on injuries to young people in the road environment will have made an important contribution to the literature and informed policy and practice.

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11 REFERENCES

Abdalla, I., Raeside, R., Barker, D. and McGuigan, D. (1997) An investigation into the relationships between area social characteristics and road accident casualties. *Accident Analysis and Prevention*, 29, 583–593.

Adams, J., White, M. and Heywood, P. (2005) Time trends in socioeconomic inequalities in road traffic injuries to children, Northumberland and Tyne and Wear 1988–2003. *Injury Prevention*, 11, 125–126.

Arnett, J. (1994) Sensation seeking: a new conceptualization and a new scale. *Personality and Individual Differences*, 16(2), 289–296.

Beattie, T., Richards, D., Belton, N., Moffat, M. and Elton, R. (1999) Injuries in the adolescent population in Scotland: patterns and types of injuries sustained. *Health Bulletin (Edinburgh)*, 57, 165–174.

Bijur, P. E., Golding, J., Haslam, M. and Kurzon, M. (1988) Behavioral predictors of injury in school-age children. *American Journal of Disease in Childhood*, 42, 1307–1312.

Bly, P., Dix, M. and Stephenson, C. (1999) *Comparative Study of European Child Pedestrian Exposure and Accidents.* London: MVA Ltd.

Chichester, B., Gregan, J., Anderson, D. and Kerr, J. (1998) Associations between road traffic accidents and socio-economic deprivation on Scotland's west coast. *Scottish Medical Journal*, 43, 135–138.

Christie, N. (1995) *The High-risk Child Pedestrian: Socio-economic and Environmental Factors in their Accidents.* TRL Research Report PR117. Crowthorne: Transport Research Laboratory.

Christie, N., Ward, H., Kimberlee, R., Towner, E. and Thoreau, R. (2007) The United Kingdom Neighbourhood Road Safety Initiative: baseline results on risk factors for children in deprived communities. *African Safety Promotion*, 5(2), 42–50.

Cryer, P., Cole, J., Davidson, L., Rahman, M., Ching, V. and Goodall, J. (1998) Rates of, and the factors affecting, cycle helmet use among secondary schoolchildren in East Sussex and Kent. *Injury Prevention*, 4(2), 106–110.

Department of the Environment, Transport and the Regions (DETR) (2000) *Tomorrow's Roads: Safer for Everyone*. *The Government's Road Safety Strategy and Casualty Reduction Targets for 2010*. London: DETR.

Department of Health and Department for Transport (2010) *Active Travel Strategy.* London: Department for Transport. www.dft.gov.uk/pgr/sustainable/cycling/activetravelstrategy/pdf/activetravelstrategy.pdf (accessed on 4 October 2010).

Department for Transport (2004) *Walking and Cycling: An Action Plan*. London: Department for Transport.

Department for Transport (2007a) *Tomorrow's Roads – Safer for Everyone: The Second Three Year Review. The Government's Road Safety Strategy and Casualty Reduction Targets for 2010.* London: Department for Transport. www.ukroads.org/ukroadsafety/articlespapers/articles_dft_sfe_s3yr.pdf (accessed on 4 October 2010).

Department for Transport (2007b) *National Travel Survey 2006*. London: Transport Statistics. http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/adobepdf/162469/221412/221531/223955/322743/NTS2006V3.pdf (accessed on 4 October 2010).

Department for Transport (2007c) *Child Road Safety Strategy.* London: Department for Transport.

Department for Transport, Scottish Government and Welsh Assembly Government (2009) *Reported Road Casualties Great Britain 2008: Annual Report.* London: The Stationery Office. www.dft.gov.uk/adobepdf/162469/221412/221549/227755/rrcgb2008.pdf (accessed on 4 October 2010).

Edwards, P., Green, J., Roberts, I. and Lutchmun, S. (2006) Deaths from injury in children and employment status in family: analysis of trends in class specific death rate. *British Medical Journal*, 333, 119–122.

Engstrom, K., Laflamme, L. and Diderichsen, F. (2003) Equalisation of socioeconomic differences in injury risks at school age? A study of three age cohorts of Swedish children and adolescents. *Social Science and Medicine*, 57, 1891–1899.

Golding, J. (2010) Are findings from large longitudinal studies of child health and development useful or just of interest? *Paediatrics and Child Health*, 20(4), 163–166.

Golding, J., Pembrey, M., Jones, R. and the ALSPAC Study Team (2001) ALSPAC – the Avon Longitudinal Study of Parents and Children. Study methodology. *Paediatric and Perinatal Epidemiology*, 15, 74–87.

Graham, D., Glaister, S. and Anderson, R. (2005) The effects of area deprivation on the incidence of child and adult pedestrian casualties in England. *Accident Analysis and Prevention*, 37, 125–135.

Haynes, R., Daras, K., Reading, R. and Jones, A. (2007) Modifiable neighbourhood units, zone design and residents' perception. *Health and Place*, 13(4), 812–825.

Haynes, R., Jones, A. P., Reading, R., Daras, K. and Emond, A. (2008) Neighbourhood variations in child accidents and related child and maternal characteristics: does area definition make a difference? *Health and Place*, 14(4), 693–701.

Hippisley-Cox, J., Groom, L., Kendrick, D., Coupland, C., Webber, E. and Savelyich, B. (2002) Cross sectional survey of socioeconomic variations in severity and mechanism of childhood injuries in Trent 1992–7. *British Medical Journal*, 324, 1132–1134.

Katz, M. H. (2006) *Multivariable Analysis: A Practical Guide for Clinicians.* Cambridge: Cambridge University Press.

Kendrick, D. (1993) Prevention of pedestrian accidents. *Archives of Disease in Childhood*, 68, 669–672.

Laflamme, L., Burrows, S. and Hasselberg, M. (2009) *Socioeconomic Differences in Injury Risks. A Review of Findings and a Discussion of Potential Countermeasures.* Copenhagen: World Health Organization Regional Office for Europe.

Malbut, K. and Falaschetti, E. (2003) Non-fatal accidents. In K. Sproston and P. Primatesta (eds), *The Health Survey for England 2002. Vol 1: The Health of Children and Young People*. London: The Stationery Office.

Mann, C. J. (2003) Observational research methods. Research design II: cohort, cross sectional and case-control studies. *Emergency Medicine Journal*, 20, 54–60.

Mytton, J., Towner, E., Brussoni, M. and Gray, S. (2009) Unintentional injuries in school-aged children and adolescents: lessons from a systematic review of cohort studies. *Injury Prevention*, 15, 111–124.

National Audit Office (2009) *Department for Transport: Improving Road Safety for Pedestrians and Cyclists in Great Britain.* London: The Stationery Office.

Ness, A. R., Leary, S. D., Mattocks, C., Blair, S. N., Reilly, J. J., Wells, J., Ingle, S., Tilling, K., Smith, G. D. and Riddoch, C. (2007) Objectively measured physical activity and fat mass in a large cohort of children. *PLoS Med*, 4(3), e97.

O'Connor, T., Davies, L., Dunn, J., Golding, J. and the ALSPAC Study Team (2000) Distribution of accidents, injuries and illnesses by family type. *Paediatrics*, 106, e68.

Peckham, C. S. (1973) Preliminary findings in a national sample of 11 year old children. *Proceedings of the Royal Society of Medicine*, 66, 701–703.

Peckham, C. S. and Pearson, R. (1976) Preliminary findings at the age of 16 years on children in the National Child Development Study (1958 Cohort). *Public Health (London)*, 90, 271–280.

Peden, M., Scurfield, R., Sleet, D., Mohan, D., Hyder, A., Jarawan, E. and Matheres, C. (eds) (2004) *World Report on Road Traffic Injury Prevention.* Geneva: World Health Organization.

Peden, M., Oyegbite, K., Ozanne-Smith, J., Hyder, A., Branche, C., Fazlur Rahman, A. K. M., Rivara F. and Bartolomeos, K. (eds) (2008) *World Report on Child Injury Prevention.* Geneva: World Health Organization.

Pless, I. B., Peckham, C. and Power, C. (1989) Predicting traffic injuries in childhood: a cohort analysis. *Journal of Pediatrics*, 115(6), 932–938.

Racioppi, F., Eriksson, L., Tingvall, C. and Villaveces, A. (2004) *Preventing Road Traffic Injury: A Public Health Perspective for Europe.* Copenhagen: World Health Organization Regional Office for Europe.

Reading, R., Jones, A., Haynes, R., Daras, K. and Emond, A. (2008) Individual factors explain neighbourhood variations in accidents to children under age 5 years. *Social Science and Medicine*, 67(6), 915–927.

Samms-Vaughan, M. (2008) Comprehensive longitudinal studies of child health, development and behaviour in Jamaica: findings and policy impact. *West Indian Medical Journal*, 57(6), 639–644.

Sethi, D., Towner, E., Vincenten, J., Segui Gomez, M. and Racioppi, F. (eds) (2008) *European Report on Child Injury Prevention.* Copenhagen: World Health Organization Regional Office for Europe.

Thomas, J., Kavanagh, J., Tucker, H., Burchett, H., Tripney, J. and Oakley, A. (2007) *Accidental injury, risk-taking behaviour and the social circumstances in which young people (aged 12–24) live: a systematic review.* London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

Thuen, F. (1994) Injury-related behaviours and sensation seeking: an empirical study of a group of 14-year-old Norwegian school children. *Health Education Research*, 9(4), 465–472.

Toroyan, T. and Peden, M. (2007) *Youth and Road Safety.* Geneva: World Health Organization.

Towner, E., Jarvis, S., Walsh, S. and Aynsley-Green, A. (1994) Measuring exposure to injury risk in schoolchildren aged 11–14. *British Medical Journal*, 308, 449–452.

Turner, C., McClure, R. and Pirozzo, S. (2004) Injury and risk-taking behavior – a systematic review. *Accident Analysis and Prevention*, 36, 93–101.

van Sluijs, E. M., Fearne, V. A., Mattocks, C., Riddoch, C., Griffin, S. J. and Ness, A. (2009) The contribution of active travel to children's physical activity levels: cross-sectional results from the ALSPAC study. Preventive Medicine, 48(6), 519–524.

Victora, C., Huttly, S., Fuchs, S. and Olinto, M. T. (1997) The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. *International Journal of Epidemiology*, 26, 224–227.

Warrington, S., Wright, C. and the ALSPAC Study Team (2001) Accidents and resulting injuries in premobile infants: data from the ALSPAC study. *Archives of Diseases of Childhood*, 85, 160–165.

Wazana, A., Kreuger, P., Raina, P. and Chambers, L. (1997) A review of risk factors for child pedestrian injuries: are they modifiable? *Injury Prevention*, 3(4), 295–304.

West, P. (1997) Health inequalities in the early years: is there equalisation in youth? *Social Science and Medicine*, 44, 833–858.

West, P. and Sweeting, H. (2004) Evidence on equalisation in health in youth from the West of Scotland. *Social Science and Medicine*, 59, 13–27.

Williams, J., Currie, C., Wright, P., Elton, R. and Beattie, T. (1996) Socioeconomic status and adolescent injuries. *Social Science and Medicine*, 44, 1881–1891.

Williamson, L., Morrison, A. and Stone, D. (2002) Trends in head injury mortality among 0–14-year-olds in Scotland (1986-95). *Journal of Epidemiology and Community Health*, 56, 285–288.

World Health Organization, Regional Office for Europe (2002) *Physical Activity through Transport as Part of Daily Activities.* Copenhagen: World Health Organization, Regional Office for Europe.

Zuckerman, M. (1979) *Sensation Seeking: Beyond the Optimal Level of Arousal.* Hillsdale, NJ: Lawrence Erlbaum.

APPENDIX 1: Questionnaire A

Questionnaire A is a child-completed questionnaire which included questions on road traffic injuries experienced in the previous year (Questionnaire CCQ: Boys/ Girls Experiences, Thoughts and Behaviours), administered between 27 September 2005 and 30 January 2007, when the cohort was aged 167 months. Questions D1 to D10, pages 19–20: www.bristol.ac.uk/alspac/documents/ques-c20-girls-experiences-thoughts-and-behaviour.pdf.

Section D: Accidents

D1. In the last year, have you ever been involved in a road accident?

Yes 1 ☐ No 2 ☐ ⟶ **If no, please go to section E on page 21**

D2. Thinking about the last accident you had, how were you travelling?
(Mark **one** box only)

In a car or van	1 ☐
Walking in or across a road	2 ☐
Cycling	3 ☐
Something else e.g. bus	4 ☐

(please cross box then describe below)

D3. Who was with you at the time of the accident? **(You can mark more than one box)**

a) On my own	1 ☐
b) Parent or other adult	2 ☐
c) Brother(s) or sister(s)	3 ☐
d) With friends	4 ☐

D4. What were you doing at the time of the accident? (Mark **one** box only)

Going to or from school	1 ☐
Playing or hanging out in the street	2 ☐
Going to or from a particular place e.g. club, disco, sports field, church etc.	3 ☐
Other journey e.g. on holiday	4 ☐

(Please cross box then describe below)

D5. When did the accident happen? (Mark **one** box only)

- Before school 1☐
- After school 2☐
- At the weekend 3☐
- During school holidays 4☐

		Yes	No
D6.	Were you hurt?	1☐	2☐
D7.	Did you see a family doctor?	1☐	2☐
D8.	Did you go to the casualty ("A & E") department at hospital?	1☐	2☐
D9.	If you went to the casualty department, did you stay overnight in hospital?	1☐	2☐

D10. Space for you to tell what happened and what your injuries were:

APPENDIX 2: Questionnaire B

Questionnaire B is a child-completed questionnaire (Questionnaire CCP Travelling, Leisure and School) administered between 6 July 2005 and 13 December 2006, when the cohort was aged 166 months. Questions C1 to E5, pages 7–15: www.bristol.ac.uk/alspac/documents/ques-c19-travelling-leisure-and-school.pdf.

Section C: Going to school

C1. How long does your journey to and from school usually take?
(Tick **one box** in **each** column)

	(i) To school	(ii) From school
Less than 5 minutes	☐ 1	☐ 1
5–9 minutes	☐ 2	☐ 2
10–19 minutes	☐ 3	☐ 3
20–29 minutes	☐ 4	☐ 4
30–44 minutes	☐ 5	☐ 5
45 minutes or more	☐ 6	☐ 6

C2. How do you get to and from school?
(You **can** tick **more** than one answer in **each** column)

	(i) To school	(ii) From school
a) Walk all the way	☐ 1	☐ 1
b) Walk part of the way	☐ 2	☐ 2
c) By public bus	☐ 3	☐ 3
d) By school bus	☐ 4	☐ 4
e) By car/taxi	☐ 5	☐ 5
f) By bicycle	☐ 6	☐ 6
g) By train/metro	☐ 7	☐ 7
h) Skateboard or scooter	☐ 8	☐ 8

C3. Who do you usually go to school and come home with?
(You **can** tick **more** than one box in **each** column)

	(i) To school	**(ii) From school**
a) On your own all the way	☐ 1	☐ 1
b) On your own for part of the way	☐ 1	☐ 1
c) With a parent or step-parent	☐ 1	☐ 1
d) With other adults (e.g. grandparents, other relatives, neighbours or friends)	☐ 1	☐ 1
e) With younger children (brothers, sisters or friends)	☐ 1	☐ 1
f) With other young people of about your age	☐ 1	☐ 1
g) With older brothers, sisters or friends	☐ 1	☐ 1

C4. How many roads do you usually have to cross **ON FOOT** on the way to school? (If none write 00)

☐☐ roads **If none, go to C6 on page 9**

C5. When crossing these roads, how often do you use pedestrian crossings?
(Tick **one** box only)

Always, if available ☐ 1

Most times if available ☐ 2

Sometimes I use them, sometimes I don't ☐ 3

Never or hardly ever – I just cross where it's convenient ☐ 4

C6. Has anyone (apart from parents and relatives) ever taught you about Road Safety Education or the Green Cross Code, to learn how to crossroads?

Yes [1] No [2] Can't remember [3]

C7. How safe do you feel crossing the roads outside your school?

Very safe [1]
Quite safe [2]
A bit unsafe [3]
Not safe at all [4]

C8. How safe do you feel crossing the roads near where you live?

Very safe [1]
Quite safe [2]
A bit unsafe [3]
Not safe at all [4]

Section D: Travelling by car, bus, train and bike

D1. When was the last time you travelled in a car or van or taxi?
(Tick **one** box only)

Today	1
Yesterday	2
2–4 days ago	3
5–7 days ago	4
Between 1 and 4 weeks ago	5
More than a month ago	6
Never	7

D2. The last time you travelled in a car, did you sit in the front seat or the back seat? (Please tick **one** box only)

Front seat	1
Back seat	2
Can't remember	3

D3. The last time you travelled in a car, did you wear a seat belt?

Yes 1 No 2 Can't remember 3

Go to D5 on page 11

D4. If you did wear a seat belt, was this because:
(You **can** tick **more** than one answer)

a) You always wear a seat belt ☐ 1

b) You chose to this time ☐ 1

c) The driver asked you to ☐ 1

d) Everyone else had theirs on and you didn't want to be different ☐ 1

D5. Does anybody in your house own a car or van?

Yes ☐ 1 No ☐ 2

D6. When was the last time you travelled on a bus or train?
(Tick **one** box only in **each** column)

	(i) Bus	(ii) Train
Today	☐ 1	☐ 1
Yesterday	☐ 2	☐ 2
2–4 days ago	☐ 3	☐ 3
5–7 days ago	☐ 4	☐ 4
Between 1 and 4 weeks ago	☐ 5	☐ 5
More than a month ago	☐ 6	☐ 6
Never	☐ 7	☐ 7

D7. The last time you travelled on a bus or train, were you:
(You **can** tick **more** than one box in **each** column)

	(i) Bus	**(ii) Train**
a) On your own all the way	☐ 1	☐ 1
b) On your own part of the way	☐ 1	☐ 1
c) With a parent or step-parent	☐ 1	☐ 1
d) With other adults (e.g. grandparents, other relatives, neighbours, friends)	☐ 1	☐ 1
e) With younger children (brothers, sisters or friends)	☐ 1	☐ 1
f) With other young people of about your age	☐ 1	☐ 1
g) With older brothers, sisters or friends	☐ 1	☐ 1
h) Can't remember	☐ 1	☐ 1
i) I've never travelled this way	☐ 1	☐ 1

D8. Do you<u>own</u> a bike? Yes ☐ 1 No ☐ 2

D9. Do you <u>own</u> a bike helmet? Yes ☐ 1 No ☐ 2

D10. The last time you rode a bike did you wear:	**Yes**	**No**	**Can't remember**
a) a helmet	☐ 1	☐ 2	☐ 3
b) fluorescent or reflective clothing	☐ 1	☐ 2	☐ 3

D11. When was the last time you rode a bike? (Tick **one** box only)

Today	1
Yesterday	2
2–4 days ago	3
5–7 days ago	4
Between 1 and 4 weeks ago	5
More than a month ago	6
Never	7 → **Now go to Section E on page 14**

D12. How far did you ride your bike at that time? (Tick **one** box only)

Less than a mile	1
1–3 miles	2
Over 3 and up to 5 miles	3
More than 5 miles	4

D13. How safe do you feel riding your bike near where you live?
(Please tick **one** box only)

Very safe	1
Quite safe	2
A bit unsafe	3
Not safe at all	4

D14. Have you ever been on a Cycling Proficiency Training Course?

Yes 1 No 2 Don't know 3

Section E: Your leisure time

Think about the last time you spent some time with your friends **OUTSIDE**, away from school and away from home:

E1. How long did it take you to get there? (Tick **one** box only)

Less than 2 minutes	☐ 1
2–5 minutes	☐ 2
6–10 minutes	☐ 3
11–20 minutes	☐ 4
More than 20 minutes	☐ 5
I don't spend time outside with friends	☐ 6 → **Now go to E5 on page 15**

E2. How did you travel there? (You **can** tick **more** than **one** answer)

a) Walked all the way	☐ 1
b) Walked part of the way	☐ 1
c) By bus	☐ 1
d) By car/taxi	☐ 1
e) By bicycle	☐ 1
f) By metro/train	☐ 1

The **last time** you went out to see your friends:

E3. How many roads did you have to cross **ON FOOT** to get where you played or spent time with them?

☐☐ roads **If none, go to E5 on page 15**

(If none write 00)

E4. How often did you use pedestrian crossings on the way to see your friends?

- Every time if there was one
- Sometimes I used them, sometimes I didn't ☐ 2
- Not at all – I just crossed where it was convenient ☐ 3
- There weren't any pedestrian crossings ☐ 4

E5. Which of these activities did you do last weekend?
(You **can** tick **more** than one box in **each** column)

You:	**(i) With an adult (including being taken or dropped off/collected)**	**(ii) Without an adult**
a) Went to a playground	☐ 1	☐ 1
b) Went to a park or playing field	☐ 1	☐ 1
c) Went swimming	☐ 1	☐ 1
d) Played outside your home	☐ 1	☐ 1
e) Hung around in the street	☐ 1	☐ 1
f) Went for a walk	☐ 1	☐ 1
g) Cycled around	☐ 1	☐ 1
h) Went to the shops	☐ 1	☐ 1
i) Went to the library	☐ 1	☐ 1
j) Went to a club or class	☐ 1	☐ 1
k) Went to a leisure centre	☐ 1	☐ 1
l) Went to the cinema	☐ 1	☐ 1
m) Went to a football (or other sports) match	☐ 1	☐ 1
n) Played in a football (or other sports) match	☐ 1	☐ 1

APPENDIX 3: Sensation Seeking Index

As part of the focus clinic at age 11+, a sensation-seeking questionnaire was used to assess risk-taking behaviour in the children. This instrument was a modified version of Arnett's Inventory of Sensation Seeking (AISS) (Arnett, 1994) which has been found to reliably measure both age and sex differences in sensation seeking. The original version of the AISS contains 20 questions, 11 of these were chosen for inclusion at Focus 11+ and a further nine questions designed by members of the Avon Longitudinal Study of Parents and Children (ALSPAC) team (Dieter Wolke and Andrea Waylen) were incorporated – these were more age appropriate than the original questions.

The interview around sensation seeking was performed on a computer at the focus clinic: the child was presented with a variety of behaviours – each appeared on the screen and was also spoken to the child via headphones. For each behaviour, the child was given four options to rate each statement: 'Not like me at all'; 'Not much like me'; 'Quite like me' and 'Very like me'. Two scores have been derived, the first (Score A) uses only those questions from the original AISS and the second (Score B) uses all responses. The behaviours were as follows:

- SS1 – When water cold, prefer not to swim.
- SS2 – When listen to music, like it to be loud.
- SS3 – Stay away from movies said to be frightening.
- SS4 – Like to ride on roller coasters/other fast rides.
- SS5 – Would never gamble money, even if could afford it.
- SS6 – Like a movie with explosions and car chases.
- SS7 – Interesting to see a car accident happen.
- SS8 – Like feeling of standing next to the edge/looking down.
- SS9 – Would be exciting to be in battle during a war.
- SS10 – Fun/exciting to perform/speak before a group.
- SS11 – If possible to visit another planet/moon, be first to sign up.
- SS12 – Enjoy playing exciting computer games.
- SS13 – Like using the diving boards when swimming.
- SS14 – Don't worry about coming home late.
- SS15 – Don't do homework until last minute.
- SS16 – Happy to go to new places/do new things on my own.

- SS17 – My parents or carers would be worried if they knew about some of the things I do.
- SS18 – Always join in with what friends are doing.
- SS19 – Ride a bike as fast as possible.
- SS20 – Enjoy playing sports and activities which could be dangerous.

APPENDIX 4: Range of child, family attributes and wider environmental variables examined in ALSPAC

A Child attributes

A1 Personal attributes

A1.1 Sex

A1.2 Ethnicity

A2 Physical attributes

A2.1 Vision

A2.2 Hearing

A2.3 Hyperactivity

A2.4 School achievements (SAT at 8)

A2.5 Intellectual function (IQ at age 8)

A2.6 Statemented

A2.7 Previous injuries

A3 Psychological attributes

A3.1 Total behavioural problems

A3.2 Anxiety/depression

A3.3 Social responsibility

A3.4 Anti-social behaviour

A3.5 Impulsivity

A3.6 Anti-social behaviour

A3.7 Sensation seeking

A3.8 Emotional symptoms

A3.9 Self-reported well being

B Family attributes

B1 Parental attributes

B1.1 Maternal social status

B1.2 Paternal social status

B1.3 Maternal education

B1.4 Paternal education

B1.5 Maternal employment status

B1.6 Paternal employment status

B1.7 Mother's age at child birth

B1.8 Mother's martial status

B1.9 Mother lives with husband/partner

B1.10 Mother reported general health

B1.11 Mother's life events score

B1.12 Mother's satisfaction with home

B1.13 Mother's social support

B1.14 Mother reported financial difficulties

B1.15 Mother behavioural index

B1.16 Mother's partner had trouble

B1.17 Mother's partner had trouble with law

B1.18 Mother had road accident

B2 Household attributes

B2.1 Home ownership status

C WIDER Environmental Variables

APPENDIX 5: Additional tables for report

Table A5.1: Background characteristics and child impairment for accidents as a passenger

Background characteristics

Characteristic	Category	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Gender	Male	94/233	40.3	2,609/5,857	44.5	0.21
Ethnicity	Non-white	11/212	5.2	204/5,355	3.8	0.31
Parity	3 or more	10/218	4.6	236/5,432	4.3	0.86
Maternal age	< 21	5/226	2.2	180/5,589	3.2	
	21–35 years	197/226	87.2	4,920/5,589	88.0	
	> 35	24/226	10.6	489/5,589	8.7	0.46
Social class[2]	I/II	121/207	58.5	3,252/5,202	62.5	
	IIIn/IIIm	78/377	37.7	1,745/5,202	33.5	
	IV/V	8/207	3.9	205/5,202	3.9	0.46
Support	No partner	4/213	1.9	80/53,278	1.5	0.41[3]
Maternal education	CSE or none	24/217	11.1	687/5,426	12.7	0.49

Child impairment

Impairment	Time tested	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Wears glasses	12.5 years	42/177	23.7	869/4,622	18.8	0.10
Poor hearing[4]	13 years	8/189	4.2	261/4,925	5.3	0.52
Statemented[5]	7.5 years	7/192	3.6	147/4,803	3.1	0.65
Low IQ (<86)[6]	8.5 years	10/184	5.4	411/4,520	9.1	0.09

1. Using Pearson's coefficient from chi-square test, unless otherwise stated. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
2. Using social classification nearest to socio-economic classification (SEC) I of mother and partner (where available).
3. Expected cell less than five, therefore Fisher's exact test used.
4. Based on parental rating using five-point Likert scale (excellent/good versus ok/some sound and can't hear/can't hear much at all).
5. Includes all that were assessed for statement **of special educational needs** even if refused at that time.
6. Cut-off based on approximately lowest 10% overall.

Table A5.2: Background characteristics and child impairment for pedestrian accidents

Background characteristics

Characteristic	Category	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Gender	Male	12/36	33.3	2,691/6,054	44.4	0.18
Ethnicity	Non-white	0/33	0	215/5,534	3.9	0.27[3]
Parity	3 or more	2/35	5.7	244/5,615	4.3	0.66[3]
Maternal age	< 21	2/36	5.6	183/5,779	3.2	
	21–35 years	33/36	91.7	5,084/5,779	88.0	
	> 35	1/36	2.8	512/5,779	8.9	0.33
Social class[2]	I/II	20/34	58.8	3,353/5,375	62.4	
	IIIn/IIIm	11/34	32.4	1,812/5,375	33.7	
	IV/V	3/34	8.8	210/5,375	3.9	0.34
Support	No partner	3/34	8.8	81/5,506	1.5	0.01[3]
Maternal education	CSE or none	4/36	11.1	707/5,607	12.6	0.52[3]

Child impairment

Impairment	Time tested	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Wears glasses	12.5 years	3/25	12.0	908/4,774	19.0	0.27[3]
Poor hearing[4]	13 years	2/25	8.0	267/5,089	5.2	0.38[3]
Statemented[5]	7.5 years	3/23	13.0	151/4,972	3.0	0.03[3]
Low IQ (< 86)[6]	8.5 years	3/25	12.0	418/4,679	8.9	0.39[3]

1. Using Pearson's coefficient from chi-square test, unless otherwise stated. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
2. Using social classification nearest to SEC I of mother and partner (where available).
3. Expected cell less than five, therefore Fisher's exact test used.
4. Based on parental rating using five-point Likert scale (excellent/good versus ok/some sound and can't hear/can't hear much at all).
5. Includes all that were assessed for statement **of special educational needs** even if refused at that time.
6. Cut-off based on approximately lowest 10% overall.

Table A5.3: Background characteristics and child impairment for cyclist accidents

Background characteristics

Characteristic	Category	Accidents		Rest of cohort		*p*-value[1]
		n/n	%	*n/n*	%	
Gender	Male	45/59	76.3	2,658/6,031	44.1	< 0.0001
Ethnicity	Non-white	3/52	5.0	212/5,303	3.8	0.33[3]
Parity	3 or more	2/54	3.7	244/5,352	4.4	0.58[3]
Maternal age	< 21	3/56	5.4	182/5,759	3.2	
	21–35 years	46/56	82.1	5,071/5,759	88.1	
	> 35	7/56	12.5	506/5,759	8.8	0.38
Social class[2]	I/II	31/48	64.6	3,342/5,361	62.3	
	IIIn/IIIm	15/48	31.2	1,808/5,361	33.7	
	IV/V	2/48	4.2	211/5,361	3.9	0.94
Support	No partner	1/52	1.9	83/5,488	1.5	0.55[3]
Maternal education	CSE or none	9/53	17.0	702/5,590	12.6	0.33

Child impairment

Impairment	Time tested	Accidents		Rest of cohort		p-value[1]
		n/n	%	*n/n*	%	
Wears glasses	12.5 years	10/42	23.8	901/4,757	18.8	0.42
Poor hearing[4]	13 years	2/45	4.4	267/5,069	5.3	0.58[3]
Statemented[5]	7.5 years	4/50	8.0	150/4,945	3.0	0.07[3]
Low IQ (< 86)[6]	8.5 years	5/38	13.2	416/4,666	8.9	0.25[3]

1. Using Pearson's coefficient from chi-square test, unless otherwise stated. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
2. Using social classification nearest to SEC I of mother and partner (where available).
3. Expected cell less than five, therefore Fisher's exact test used.
4. Based on parental rating using five-point Likert scale (excellent/good versus ok/some sound and can't hear/can't hear much at all).
5. Includes all that were assessed for statement **of special educational needs** even if refused at that time.
6. Cut-off based on approximately lowest 10% overall.