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Avon Longitudinal Study of Parents and Children: Longitudinal Analysis of Risk of Injury in the Road Environment in Childhood and Adolescence

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EXECUTIVE SUMMARY

Aims

The aims of this phase of the Avon Longitudinal Study of Parents and Children (ALSPAC) road safety project were:

1. to investigate the background demographic and early life factors associated with accidents and injuries in the road environment during adolescence (13–17 years); and
2. to investigate the characteristics of children who had repeat accidents in the road environment during childhood (<11 years) and adolescence.

Methods

ALSPAC is a longitudinal birth cohort study based in the South West of England, which started in 1991. A wealth of data has been collected for the past 18 years on the parents' and children's health, development and environment. At several points during childhood, parents completed questionnaires about their child's involvement in accidents and whether they were injured. When the children were aged 13/14 years and 16/17 years, they completed a postal questionnaire, containing questions about their involvement in road traffic accidents in the previous 12 months, and their journeys by car, bus, train and cycle, as well as preventive practices in the road environment. Vulnerable road users were defined as those who had accidents as pedestrians, cyclists and moped/motorcycle riders.

Findings

Accidents in the road environment in the previous 12 months were reported by 5.5% of the 6,090 respondents at 13 years, and 6.3% of the 4,815 respondents at 16–17 years**.** Young people involved in accidents in the road environment between 13 and 17 years were more likely to be male, and to come from a family led by a single parent. There were significant correlations with the number of children in the household, but not with overcrowding in the home. Adolescents living in areas of relative disadvantage were not at greater risk of injury in the road environment, but the mothers of those children involved in road accidents were more likely to be dissatisfied with their neighbourhood. Those involved in an accident between 13 and 17 years were no different from their peers in their early cognitive, motor or sensory development, and were not more likely to be disabled or to have special educational needs.

The behavioural profile of those who had accidents in the adolescent years was different from those who did not, with more reported behavioural difficulties at 9

and 11 years and higher scores for hyperactivity reported from 9 years, but not before this age.

The individual's sensation-seeking profile was a risk factor, with the strongest associations with accidents observed for moped/motorcycle riders, followed by cyclists. No relationship was apparent with the sensation-seeking profile for those who had accidents as pedestrians. The strong associations found between drug and alcohol use and accident risk at 16 years were not seen when the data for 13- and 16-year-olds were combined.

Stressful life events were significantly associated with accidents between 13 and 17 years for girls, but not for boys. Accidents at this age were more frequent in those young people who reported lower levels of parental monitoring: this association was particularly strong for those who had accidents as cyclists or motorcylists.

The young people who had accidents at 13 or 16 years were twice as likely to have had a previous road traffic injury before the age of 11. Most of these earlier events occurred during the primary school age period (5–11 years), with few accidents in the road environment prior to the age of five. Those young people involved in accidents in adolescence who had previously in childhood had an accident in the road environment showed a different profile to those with accidents at 16, with no predominance of the male sex, and associations with conduct difficulties in childhood rather than hyperactivity. Single parenthood (the lack of a father at home) and family dissatisfaction with the neighbourhood were strongly associated with repeated road accidents in childhood and adolescence.

Interpretation

The risk factors for accident involvement between 13 and 17 years are a mixture of factors intrinsic to the young person (such as gender and behavioural profile), those related to family background (single parenthood, number of siblings and level of parental monitoring) and some related to the external environment (stressful life events). There was no evidence of a social gradient in the likelihood of being involved in a road accident in adolescence, in contrast to childhood accidents. This is consistent with the 'equalisation in youth' concept, which explains that, because young people from better-off backgrounds have more access to bicycles, mopeds and motorcycles, they are exposed to increased risk on the road, which counters against the lower risk from living in a better-off neighbourhood and having access to safe play areas. Those children involved in repeat accidents in the road environment in childhood and adolescence showed similar numbers of girls and boys with conduct difficulties, which, combined with lower parental monitoring, increased accident risk.

Conclusions

The risk factors for accident involvement between 13 and 17 years are a mixture of factors intrinsic to the young person (such as gender and behavioural profile), those related to family background (single parenthood, number of siblings and level of parental monitoring) and some related to the external social environment (stressful life events), but not to the external physical environment (indices of deprivation).

1 INTRODUCTION

In 2007 the Department for Transport's Road User Safety Division commissioned road safety research using the Avon Longitudinal Study of Parents and Children (ALSPAC). The aim of the research is to examine exposure to injury risk in the road environment and reported road traffic injuries in the 13–14-year-old and 16–17-year-old sweeps of the ALSPAC survey. Two linked projects were commissioned:

- 'Project 1: Exposure to injury risk in the road environment and reported road traffic injuries in 13–14-year-olds' published as Road Safety Web Publication No. 20 (Towner *et al.*, 2011) – www2.dft.gov.uk/pgr/roadsafety/research/rsrr/theme1/avonlongitudinalstudyparentschildren/pdf/rswp20report.pdfhttp://www2.dft.gov.uk/pgr/roadsafety/research/rsrr/theme1/avonlongitudinalstudyparentschildren/pdf/rswp20report.pdf; and
- 'Project 2: Exposure to injury risk in the road environment and reported road traffic injuries in 16-year-olds' published as Road Safety Web Publication No. 22 (Emond *et al.*, 2011).

This report contains a synthesis of the 13–14 year and 16–17 year results, and a longitudinal analysis of the antecedents and childhood factors associated with road accidents in adolescence. For simplicity, the results at 13–14 years will be referred to as '13 year' and those of 16–17 years as '16 year'.

2 BACKGROUND

The Avon Longitudinal Study of Parents and Children (ALSPAC) is a longitudinal birth cohort study which started in 1991 in the county of Avon in England (www.alspac.bris.ac.uk). The study recruited mothers during their pregnancy and 14,062 children in the cohort were born between the period of April 1991 and December 1992. The study area has a population of one million, with half living in the city of Bristol. It contains a wide variety of types of area, including inner-city deprivation, peripheral local authority housing, affluent commuter areas and rapidly growing small towns, so it represents the range of conditions found in many other parts of the country. The families initially selected to take part were representative of those in Britain as a whole, based on a comparison with the 1991 census data (Golding *et al.*, 2001).

The ALSPAC birth cohort has been followed-up over the past 18 years, including the children whose families have relocated. Data have been collected at regular intervals by questionnaires completed by the child's mother, her partner and the child. From the age of seven years, study children have been seen in research clinics where a range of physical and developmental assessments have been undertaken. Participants have also given permission for data to be extracted from their medical notes and educational records. A wealth of prospective data has thus been collected on the children's health, development and environment. The ALSPAC dataset contains a vast amount of supporting detail, including parental social class, education, income and housing, as well as childcare, family background and parenting styles.

Parental report of their child's unintentional injuries has been collected at the following ages: six months, fifteen months, every year from two years to six years, eight years, eleven years and thirteen years (Warrington *et al.*, 2001; O'Connor *et al.*, 2000). Data have also been collected on parental injuries in some surveys.

At 13 years of age, a questionnaire was completed by the young people in the cohort about their exposure to injury risk and their self-reported injuries in the road environment. The results of this questionnaire formed the basis of Project 1.

At 16 years of age, a similar questionnaire was completed by the young people in the cohort, with some age-appropriate modifications. The results of this questionnaire formed the basis of Project 2.

3 AIMS AND OBJECTIVES

The aim of this project is to use the longitudinal nature of the database of the Avon Longitudinal Study of Parents and Children (ALSPAC) to explore the relationship between reported road traffic accidents in adolescence and a range of background personal and family risk factors.

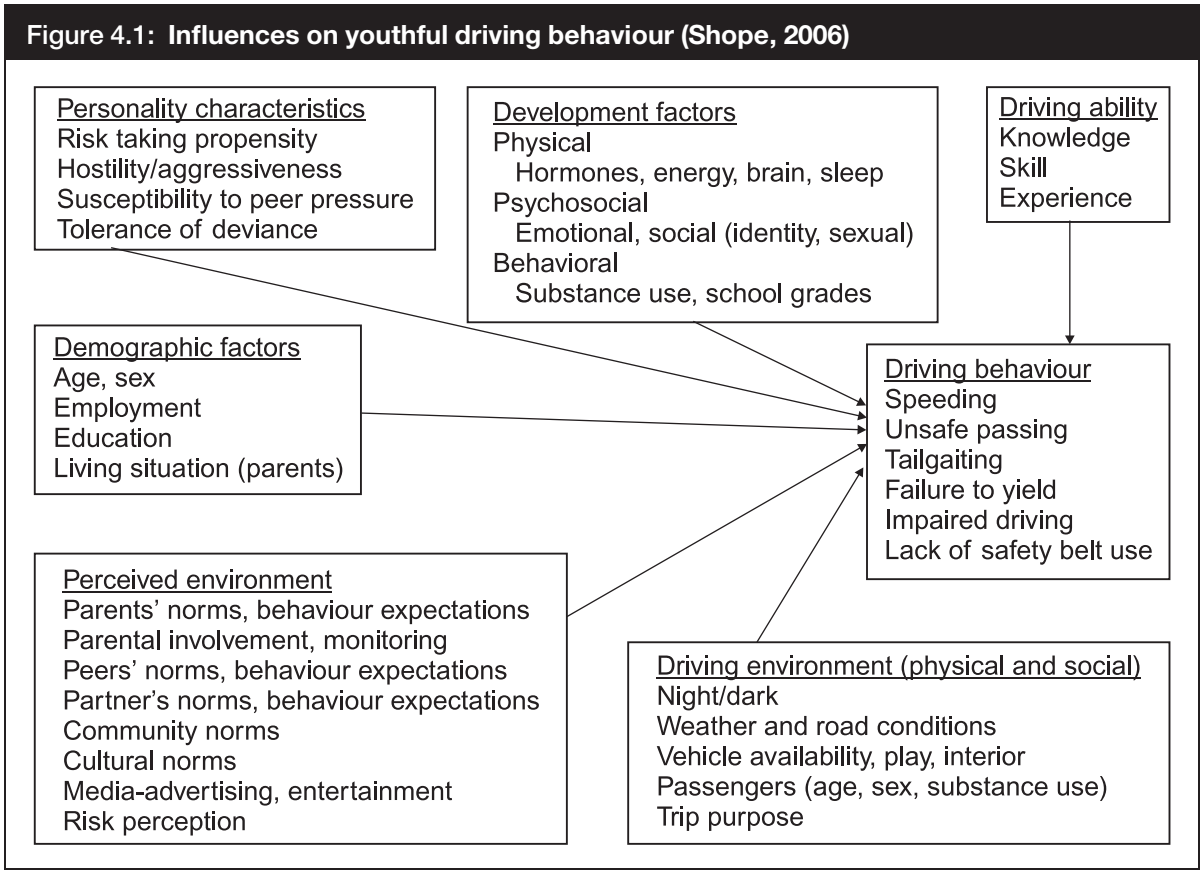
Specific objectives were:

1. to compare the road use and accidents reported at 13 and 16 years;
2. to investigate the background demographic and early life factors associated with accidents and injuries in the road environment during adolescence (13–17 years); and
3. to investigate the characteristics of children who had repeat accidents in the road environment during childhood (<11 years) and adolescence.

4 CONCEPTUAL FRAMEWORK

There are many different factors pertaining to injury risk in the road environment, which interact with each other in complex ways. A literature review of this area has been provided in the previous reports on the 13 year findings (Project 1) and the 16 year findings (Project 2). The theoretical framework which has been used in this analysis is based on that by Shope (2006), which describes young people's driving behaviour. The conceptual framework of influences on young people's driving behaviour includes driving ability, physical, social and behavioural development, personality characteristics such as risk-taking propensity, demographic factors, the perceived environment, and the driving environment. Shope describes each factor in more detail in her review (see Figure 4.1).

Figure 4.1: Influences on youthful driving behaviour (Shope, 2006)



5 METHODS

5.1 Road use and injury data

At 16 years of age, the young people in the Avon Longitudinal Study of Parents and Children (ALSPAC) completed a postal questionnaire which repeated the questions previously used in the 13-year-old questionnaire adapted for age, with some additional questions taken from *The Health Survey for England 2002* (Malbut and Falaschetti, 2003) and from the *British Social Attitudes Survey 2004* (National Centre for Social Research, 2004). In addition to the road use and travel to school questions which were asked at 13 years, new questions on vehicle use and high-risk driving and cycling behaviours were asked for the first time. Most questions were self-coded, with text describing details of injuries – a coding frame for these was developed. The questions explored road use, asking about the most recent journey to school/college/work, and young people's attitudes to safety as pedestrians near their school and home and as cyclists near their home.

Young people were asked about their involvement in road accidents in the last year, how they were travelling, their accompaniment and activity at the time of the accident, and when the accident happened. The respondents were also asked whether they were hurt and whether the injury was treated by a family doctor (GP), at an A&E department or whether they were admitted to hospital.

The questionnaire at 13 years was completed by 6,090 ALSPAC young participants in 2005–06, and the results have been published as Road Safety Web Publication No. 20 (Towner *et al.*, 2011). The questionnaire at 16 years was sent out by post to over 9,000 study members during 2008–09 for self-completion by the ALSPAC participants. Of these, 4,815 were returned, representing a response rate of 52%, and the results of the 16 year analysis are contained in Road Safety Web Publication No. 22 (Emond *et al.*, 2011).

5.2 Co-variate data

At the age of 15 the young people in the cohort were invited to a research clinic where a range of physical, psychological and cognitive measurements were taken. A computer-based interview asked about alcohol, drug and substance abuse and other risk-taking behaviours. A sensation-seeking questionnaire was used to assess risk-taking behaviour, using a modified version of Arnett's Inventory of Sensation Seeking (AISS; Arnett, 1994). The interview around sensation seeking was performed on a computer. The young person was presented with a variety of behaviours – each appeared on the screen and was also spoken via headphones. For each behaviour, the respondent was given four options to rate each statement: 'Not like me at all', Not much like me', 'Quite like me' and 'Very like me'. Their parents also completed a questionnaire about their son/daughter at three, nine and eleven

years, including a behavioural profile (Strengths and Difficulties Questionnaire – Goodman and Goodman, 2009). Information on parental monitoring (PM) was provided by the young person at age 13.5 years in a research clinic. The young people completed a PM scale (independently of their parents) derived from that of Stattin and Kerr (2000); the derived summary scores were divided into quintiles, with the first quintile (comparison group) indicating high levels of PM and the fifth quintile indicating low levels of PM.

5.3 Statistical methods

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 young people in the cohort and exposure to injury risk in the road environment for a range of selected variables. Longitudinal 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, moped/motorcycle accidents).

6 RESULTS

6.1 Comparison of accidents and injuries between 13 and 17 years

Accidents in the road environment in the previous 12 months were reported by 5.5% of the 6,090 respondents at 13 years and by 6.3% of the 4,815 respondents at 16 years**.** The details of the accidents and injuries at 13 years are contained in the Project 1 report (Towner *et al.*, 2011), and those at 16 years in the Project 2 report (Emond *et al.*, 2011). The pattern of road use and accidents at the two ages is now compared.

A total of 637 accidents were reported by adolescents in the responses to questionnaires at 13 and 16 years. Two-hundred and thirty-four young people who had an accident returned both 13 and 16 year questionnaires, and 33 (14%) of these reported an accident at both ages.

The injuries resulting from the accidents were more serious at 16 years than 13 years. At 16 years, 42% of the young people were hurt in the accident, and 75% of these sought medical attention, compared with 30% hurt and 21% needing medical attention at 13 years.

6.1.1 Car passengers

Reduced frequency of travel as a passenger was reported at 16 years compared to 13 years. No gender difference or socio-demographic trends in risk of accident or injury were seen with car passengers, which is not surprising considering the young people were not driving.

6.1.2 Pedestrians

There was proportionally less road use as a pedestrian at 16 years (7%) compared with at 13 years (11%). This reflects less walking to school/college and more access to mopeds/motorcycles and cycling at 16 years, and is part of the increasing independence given by parents to children during adolescence. However, the frequency of walking did correlate with the risk of injury, representing increased exposure. No correlation was found for risk of accident or injury as a pedestrian with gender, social class or background demographic factors, or the young person's sensory impairments or personality.

6.1.3 Cyclists

Frequency of cycling decreased at 16 years compared with 13 years. The use of bicycles at 13 years was more recreational, whereas at 16 years usage was more

purposeful (e.g. going to school or college) and for longer distances. Eighteen per cent of accidents at 13 years were as a cyclist compared with 15% at 16 years – the male preponderance in accidents at both ages reflects greater road use and more risk taking. Most cycle owners possessed a helmet, but those involved in accidents were less likely to use a helmet regularly.

6.1.4 Motorcycles/mopeds

These were not used at 13 years, but use increased at 16 years when accidents were associated with males and not having a father at home. Off-road use was common among motorcycle/moped riders (18.4%), and a significant amount of driving on the road without a licence was reported (12% of those who had an accident versus 5 % of those who did not).

6.1.5 Driving cars

No car driving was reported at 13 years, but half of the cohort had driven a car off road at 16 years. A few young people (243/4,365 or 5.6%) reported driving cars on the road at 16 years. Among young people who had an accident, 13% reported having driven a car off-road without a licence, compared with only 5% among young people who did not have an accident. However, more common was riding in cars driven by friends without a licence or unsupervised – 7% in those who did not have an accident and 18% in those who did.

6.2 Longitudinal analyses

6.2.1 Background and childhood factors associated with having an accident in adolescence

For these analyses, children with reported accidents at either 13 or 16 years were combined to increase numbers and improve power.

6.2.1.1 Demographic factors

Table 6.1 shows the childhood characteristics of this bigger group who had an accident at either 13 or 16 years (for full table see Appendix 1, Table A1.1).

Males again predominate among those who have injuries. The association of having an injury at either 13 or 16 years and not having a father at home is strongly demonstrated, even back to the absence of a father during pregnancy. The link with accident risk applies to the child's biological father as well as the mother's partner (father figure). There are significant correlations with having more than three children in the household, but not with overcrowding in the home. There were too few respondents living in truly rural areas to permit a comparison of accidents in urban and rural settings.

Table 6.1: Background characteristics of young people who had an accident at 13 or 16 years compared with the rest of the cohort

Characteristics	Reference group	Accidents at 13 or 16 years		Rest of the cohort			Odds ratios		
		n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
Gender (male)	*Female*	269/601	44.8	1,446/3,576	40.4	0.046	1.19	1.00–1.42	**0.046**
Social background									
Mother's satisfaction with neighbourhood at age five									
Not very good/ not good at all	*V. good/ fairly good*	6/511	1.2	12/3,250	0.4	0.111	3.20	1.19–8.60	**0.021**
Family background									
Partner/husband not living with mother (110 months)	*Lives with mother*	54/500	10.8	254/3,274	7.8	0.021	1.44	1.06–1.96	**0.021**
Biological father does not live with study child	*Lives with child*	26/462	5.6	112/3,017	3.7	0.049	1.55	1.00–2.40	**0.051**
No partner support (32 weeks gestation)	*Partner support*	83/490	16.9	407/3,169	12.8	0.013	1.38	1.07–1.79	**0.014**
⩾3 siblings living in the home	*<3 siblings in home*	17/565	3.0	39/3,465	1.1	<0.001	2.73	1.53–4.85	**0.001**

[1] Using Pearson's coefficient from chi-square test. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.

6.2.1.2 Developmental factors

There are no consistent associations between accidents in the teenage years and cognitive, motor or sensory development measured at 7–8 years. In particular, no link was found with special needs or disability in childhood and later risk of accidents (see Appendix 1, Table A1.1). Although parental report of poor hearing had been independently associated with accidents at 13 years and 16 years, the results of the last time hearing was objectively tested at seven years were not associated with accident risk in adolescence.

6.2.1.3 Behavioural profile

Table 6.2 illustrates the results from the Strengths and Difficulties Questionnaire (SDQ), completed by the mother at different time points in their son's or daughter's childhood. Young people who had accidents in the road environment were reported by their parents to have high hyperactivity scores from nine years onwards, but not prior to this age. Conduct difficulties at nine and eleven years were also associated with an increased risk of accidents.

Table 6.2: Behavioural profile of young people who had an accident at 13 or 16 years compared with the rest of the cohort

	Reference group	Accidents at 13 or 16 years		Rest of the cohort			Odds ratios		
		n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
Behavioural profile									
SDQ at age 3–4									
Abnormal total difficulties score	*Normal*	26/511	5.1	134/3,217	4.2	0.067	1.27	0.83–1.96	0.276
Abnormal hyperactivity score	*Normal*	62/520	11.9	358/3,270	10.9	0.025	1.15	0.86–1.54	0.339
Abnormal conduct problems	*Normal*	55/524	10.5	339/3,287	10.3	0.966	1.03	0.76–1.39	1.390
SDQ at age 9–10									
Abnormal total difficulties score	*Normal*	23/430	5.3	76/2,837	2.7	0.008	2.07	1.28–3.34	**0.003**
Abnormal hyperactivity score	*Normal*	42/480	8.8	161/3,116	5.2	0.007	1.76	1.24–2.51	**0.002**
Abnormal conduct problems	*Normal*	32/474	6.8	150/3,120	4.8	0.034	1.48	0.99–2.19	**0.054**
SDQ at age 11–12									
Abnormal total difficulties score	*Normal*	15/405	3.7	68/2,791	2.4	0.024	1.58	0.89–2.79	0.118
Abnormal hyperactivity score	*Normal*	38/457	8.3	130/3,082	4.2	0.001	2.06	1.41–3.00	**< 0.001**
Abnormal conduct problems	*Normal*	33/455	7.3	131/3,078	4.3	0.001	1.82	1.23–2.71	**0.003**

[1] Using Pearson's coefficient from chi-square test. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.

The sensation-seeking characteristics of this group are clearly seen in Table 6.3. Young people who reported involvement in a road traffic accident in adolescence scored significantly higher on the sensation-seeking scale compared with their accident-free peers in the cohort.

Table 6.3: Sensation seeking and road traffic accidents at 13 or 16 years compared with the rest of the cohort

	Accident at 13 or 16 years				Rest of the cohort				*p*-value*
Sensation-seeking scores	*n*	Mean	SD	Range	*n*	Mean	SD	Range	
Sensation seeking *(total score)*	467	52.68	7.7	28–76	3,424	51.58	7.44	28–77	**0.003**
Sensation seeking *(novelty score)*	467	26.25	4.29	14–40	3,424	25.83	4.28	13–40	**0.050**
Sensation seeking *(intensity score)*	467	26.43	4.73	13–40	3,424	25.75	4.48	12–39	**0.002**

* Two-tailed *t*-test.

Young people who had an accident were also consistently more likely to use cigarettes (OR = 1.89, 95% CI 1.47, 2.40), cannabis (OR = 1.69, 95% CI 1.39, 2.10) and drugs other than cannabis (OR = 1.41, 95% 1.12, 1.80). They were twice as likely to have had a previous road traffic injury before the age of 11 (OR = 2.19, 95% CI 1.50, 3.50). Most of these earlier events occurred during the primary school age period (5–11 years), with few accidents in the road environment prior to age five. The characteristics of this group with repeat accidents in childhood and adolescence are presented in the section below.

Levels of parental monitoring between accident and non-accident groups were compared (Table 6.4). The odds ratio of having had a road traffic accident during adolescence were significantly increased for young people who reported the lowest level of parental monitoring (fifth quintile) compared with those who reported the highest levels of parental monitoring (first quintile).

Table 6.4: Level of parental monitoring and road traffic accidents at 13 or 16 years of age compared with the rest of the cohort

	Accidents		Rest of the cohort			Odds ratios		
Parental monitoring	***n***	**%**	***n***	**%**	***p*-value[1]**	**OR**	**95% CI**	***p*-value[2]**
1st quintile (high-level parental monitoring)	57	17.4	568	20.8		1.00		
2nd quintile	69	21.1	600	22.0		1.15	0.79–1.66	0.469
3rd quintile	61	18.7	585	21.4		1.04	0.71–1.52	0.843
4th quintile	58	17.7	523	19.2		1.11	0.75–1.62	0.610
5th quintile (low-level parental monitoring)	82	25.1	453	16.6	**0.004**	1.80	1.26–2.59	**0.001**

[1] Using Pearson's coefficient from chi-square test. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.

6.3 Vulnerable road users

For this analysis, young people who had an accident as a pedestrian, cyclist or moped/motorcycle rider at 16 were combined into one group, referred to as '**vulnerable road users**' throughout the following section.

6.3.1 Background and childhood factors

Table 6.5 shows that the male gender predominates, but otherwise no background demographic or childhood developmental factors were associated with accidents at 13 and 16 years for vulnerable road users (see Appendix 2, Table A2.1 for data on developmental factors).

Table 6.5: **Background characteristics of vulnerable road users who had an accident at 13 or 16 years compared with the rest of the cohort**

Background characteristics	Reference group	Vulnerable road users at 13 or 16 years		Rest of the cohort			Odds ratios		
		n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
Gender (male)	*Female*	126/203	62.1	2,874/6,573	43.7	< 0.001	2.10	1.58–2.81	**<0.001**
Social background									
Mother rents home (late primary)	*Owns home*	20/169	11.8	693/5,455	12.7	0.738	0.92	0.57–1.48	0.738
One or more house moves since the age of five	*No house moves*	40/160	25.0	1,396/5,316	26.3	0.721	0.94	0.65–1.35	0.721
Mother's satisfaction with neighbourhood at age five									
Not very good/not good at all	*V. good/ fairly good*	3/172	1.7	172/5,476	3.1	0.497	0.55	0.17–1.73	0.305
Family background									
Partner/husband not living with mother (110 months)	*Lives with mother*	13/169	7.7	505/5,442	9.3	0.483	0.81	0.46–1.45	0.483
Biological father does not live with study child	*Lives with child*	3/154	1.9	233/5,115	4.6	0.123	0.42	0.13–1.32	0.135
No partner support (32 weeks gestation)	*Partner support*	27/163	16.6	810/5,368	15.1	0.605	1.12	0.73–1.7	0.605
⩾3 siblings living in the home	*<3 siblings in home*	8/191	4.2	93/5,977	1.6	0.005	2.77	0.32–5.78	**0.007**
>1 person/room (late primary)	*⩽1 person/ room*	0/52	9.6	95/1,539	6.2	0.791	1.56	0.56–4.34	0.391

[1] Using Pearson's coefficient from chi-square test. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.

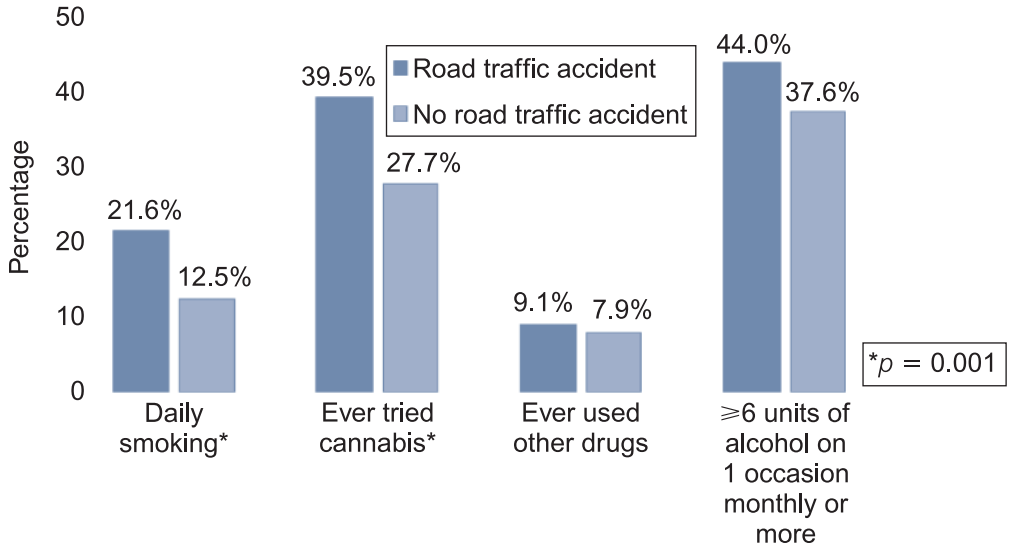
6.3.2 *Behaviour and risk taking*

Results from the SDQ behavioural profiles show that only hyperactivity at age 11 was associated with overall accident risk at 13 or 16 years for vulnerable road users (see Appendix 2, Table A2.2). Sub-analysis by mode of transport did not yield conclusive findings due to small group sizes.

There was evidence of a weak association between accident risk at 13 or 16 years and 'having had an accident in the road environment before the age of 11' (OR = 1.74, 95% CI 0.9, 3.2). The correlations between reported accident involvement and cigarette (OR = 1.93, 95% CI 1.30, 2.90) and cannabis smoking (OR = 1.70, 95% CI 1.2, 2.4) seen in the data from all 13 and 16 year respondents

were also observed with this smaller 'vulnerable' group ($P = 0.001$), but associations with alcohol use (OR = 1.30, 95% CI 0.9, 1.8) and the consumption of drugs other than cannabis (OR = 1.17, 95% CI 0.8, 1.6) were not evident. Again, probably because there was not a great deal of this behaviour at age 13, resulting in small numbers (Figure 6.1)

Figure 6.1: Drug and alcohol risk profile of vulnerable road users who had an accident at 13 or 16 years compared with the rest of the cohort



6.3.3 *Sensation seeking*

The sensation-seeking profile of vulnerable road users who reported accidents at 13 or 16 years (Table 6.6) again shows an increase in total sensation-seeking score when compared with the rest of the cohort, with increases in both novelty and intensity subscales.

Table 6.6: Sensation-seeking profile of vulnerable road users who had a road traffic accident at 13 or 16 years compared with the rest of the cohort

Sensation-seeking profile	Vulnerable road users at 13 and 16 years				No road traffic accident				*p*-value*
	n	Mean	SD	Range	*n*	Mean	SD	Range	
Total sensation-seeking score	152	54.28	7.67	28–73	4,614	51.58	7.46	28–77	**<0.001**
Novelty subscale score	152	26.86	4.33	14–36	4,614	25.80	4.29	10–40	**0.003**
Intensity subscale score	152	27.42	4.56	13–38	4,614	25.78	4.49	12–40	**<0.001**

* Two tailed *t*-test.

The separate sensation-seeking profiles of pedestrians, cyclists and moped/motorcycle users are illustrated in Tables 6.7–6.9. It is clear from these tables that

Table 6.7: Sensation-seeking profile of pedestrians involved in a road traffic accident compared with the rest of the cohort

Sensation-seeking profile	Vulnerable road users at 13 and 16 years (pedestrians)				Rest of the cohort				*p*-value*
	n	Mean	SD	Range	*n*	Mean	SD	Range	
Total sensation-seeking score	45	51.69	6.28	39–64	4,614	51.58	7.46	28–77	0.925
Novelty subscale score	45	25.53	3.88	19–33	4,614	25.80	4.29	10–40	0.673
Intensity subscale score	45	26.16	4.08	17–33	4,614	25.78	4.49	12–40	0.576

* Two-tailed *t*-test.

Table 6.8: Sensation-seeking profile of cyclists involved in a road traffic accident compared with the rest of the cohort

Sensation-seeking profile	Vulnerable road users at 13 and 16 years (cyclists)				Rest of the cohort				*p*-value*
	n	Mean	SD	Range	*n*	Mean	SD	Range	
Total sensation-seeking score	77	54.48	7.68	28–67	4,614	51.58	7.46	28–77	**<0.001**
Novelty subscale score	77	27.17	4.41	14–34	4,614	25.80	4.29	10–40	**0.006**
Intensity subscale score	77	27.31	4.6	13–37	4,614	25.78	4.49	12–40	**0.003**

* Two-tailed *t*-test.

Table 6.9: Sensation-seeking profile of moped/motorcycle riders involved in a road traffic accident compared with the rest of the cohort

Sensation-seeking profile	Vulnerable road users at 13 and 16 (moped riders)				Rest of the cohort				*p*-value*
	n	Mean	SD	Range	*n*	Mean	SD	Range	
Total sensation-seeking score	30	57.63	8.36	44–73	4,614	51.58	7.46	28–77	**<0.001**
Novelty subscale score	30	28.03	4.42	19–36	4,614	25.80	4.29	10–40	**0.005**
Intensity subscale score	30	29.60	4.48	22–38	4,614	25.78	4.49	12–40	**<0.001**

* Two-tailed *t*-test.

the strongest associations between reported accidents and sensation seeking are observed for moped/motorcycle riders, followed by cyclists. No relationship is apparent with sensation seeking for those who had accidents as pedestrians.

6.4 Children with repeat accidents in childhood and adolescence

To investigate the characteristics of the highest risk group in the cohort, analysis was undertaken of the background and childhood factors of the children who had accidents in the road environment, both in childhood (<11 years) and in adolescence (12–17 years).

Data on childhood and adolescent accidents were available for 4,177 young people. Of those, 3.5% (145/4,177) had an accident before the age of 11/12, and 26% (38/145) of the young people who had an accident during childhood also reported an accident during adolescence (that is either at age 13 **or** at age 16).

6.4.1 Childhood factors

Table 6.10 shows that the most important childhood factor associated with repeated road traffic accidents during childhood and adolescence was being brought up in a single parent household: the association with the lack of a father can be seen right back to the third trimester of pregnancy. The associations with low levels of parental monitoring did not reach significance, but confidence intervals were wide.

Table 6.10: Background characteristics of young people who had two or more accidents in their lifetime compared with the rest of the cohort

	Reference group	Accidents		Rest of the cohort			Odds ratios		
		n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
Gender (male)	*Female*	10/38	26.3	1,403/3,469	40.4	3.12	0.53	0.25–1.09	0.082
Social background									
Mother rents home (late primary)	*Owns home*	3/31	9.7	377/3,153	12.0	1.000	0.8	0.24–2.61	0.698
One or more house moves since the age of five	*No house moves*	8/29	27.6	782/3,106	25.2	0.766	1.1	0.50–5.57	0.766
Mother's satisfaction with neighbourhood at age five									
Not very good/not good at all	*V. good/ fairly good*	0/32	0.0	83/3,149	2.6	0.210	2.5	0.58–10.5	0.222
Family background									
Partner/husband not living with mother (110 months)	*Lives with mother*	4/27	14.8	110/2,924	3.8	0.003	4.5	1.51–13.1	**0.007**
Biological father does not live with study child	*Lives with child*	8/32	25.0	398/3,070	13.0	0.045	2.2	1.00–5.02	**0.050**
No partner support (32 weeks gestation)	*Partner support*	3/35	8.6	39/3,359	1.2	<0.001	8	2.34–27.2	**0.001**
⩾3 siblings living in the home	*<3 siblings in home*	1/11	9.1	50/911	5.5	0.461	1.1	0.13–9.59	0.926
>1 person/room (late primary)	*⩽1 person/ room*	2/16	12.5	160/1,679	9.5	1.000	1.36	0.31–6.02	0.689

[1] Using Pearson's coefficient from chi-square test or Fisher's exact test if expected cell less than five.
A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.

Interestingly, the correlation with the male gender is much weaker in this high-risk group, and other demographic and developmental factors do not reach significance.

Table 6.11 shows the behavioural profile of this group, and it is striking that conduct problems seem to be the most important risk factor, rather than hyperactivity. These conduct difficulties are apparent at both nine and eleven years. There may well be a cumulative increased risk here combining behavioural difficulties in the child and reduced supervision from a single parent. No correlation is seen with depressive symptoms in the child. The associations with cigarette smoking (OR = 2.39, 95% CI

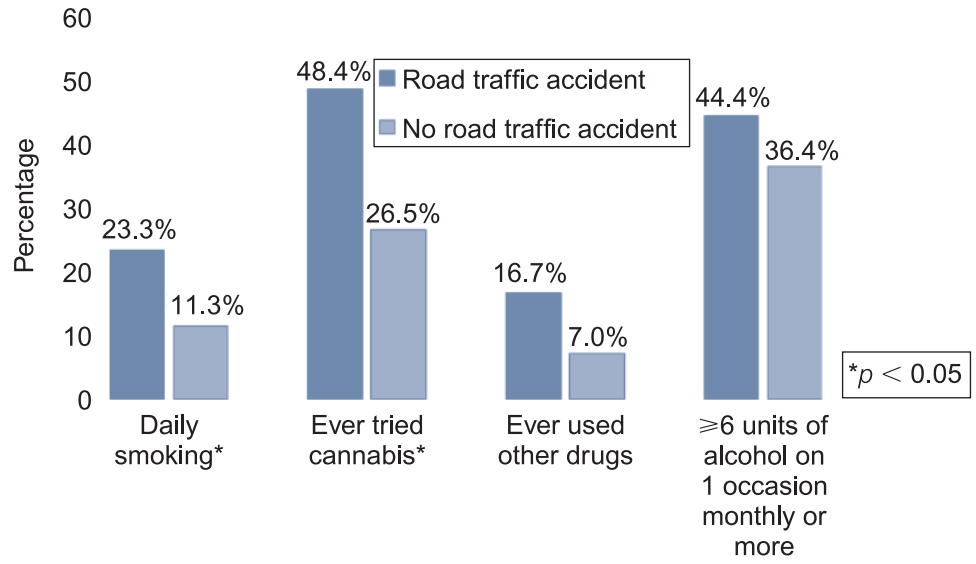
Table 6.11: Behavioural profile of young people who had two or more accidents in their lifetime compared to the rest of the cohort

Behavioural profile	Reference group	Accidents		Rest of the cohort			Odds Ratios		
		n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
SDQ at age 3–4									
Abnormal total difficulties score	*Normal*	0/31	0.0	132/3,119	4.2	0.738	–		
Abnormal hyperactivity score	*Normal*	4/32	12.5	349/3,170	11.0	0.891	1.13	0.39–3.25	0.825
Abnormal conduct problems	*Normal*	2/32	6.3	332/3,187	10.4	0.608	0.61	0.14–2.61	0.508
SDQ at age 9–10									
Abnormal total difficulties score	*Normal*	4/24	16.7	74/2,747	2.7	0.007	7.00	2.33–21.00	**0.001**
Abnormal hyperactivity score	*Normal*	3/31	9.7	156/3,013	5.2	0.219	2.01	0.60–6.73	0.255
Abnormal conduct problems	*Normal*	4/26	15.4	143/3,022	4.7	0.036	3.54	1.20–10.45	**0.022**
SDQ at age 11–12									
Abnormal total difficulties score	*Normal*	1/33	3.0	67/2,706	2.5	0.321	1.27	0.17–9.48	0.813
Abnormal hyperactivity score	*Normal*	3/37	8.1	127/2,985	4.3	0.090	2.09	0.63–6.95	0.226
Abnormal conduct problems	*Normal*	5/37	13.5	126/2,981	4.2	0.019	3.65	1.39–9.59	**0.009**
Risk profile – alcohol and drugs									
Daily smoking	*Not*	7/30	23.3	373/3,300	11.3	0.039	2.39	1.02–5.60	**0.045**
Tried cannabis in the past	*Not*	15/31	48.4	911/3,444	26.5	0.006	2.61	1.28–5.30	**0.008**
Ever used other drugs	*Not*	8/31	25.8	536/3,385	15.8	0.313	1.85	0.82–4.15	0.137
⩾ 6 units of alcohol on one occasion monthly or more	*Less than monthly*	12/27	44.4	1,113/3,055	36.4	0.389	1.40	0.65–2.99	0.391
Depressive symptoms at age 16	*Not*	7/30	23.3	560/3,403	16.5	0.313	1.54	0.66–3.62	0.316

[1] Using Pearson's coefficient from chi-square test or Fisher's exact test if expected cell less than five.
A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.

1.02, 5.60) and cannabis use (OR = 2.61, 95% CI 1.28, 5.30) by the child are again apparent (Figure 6.2).

Figure 6.2: Risk taking behaviours in young people who had two or more road traffic accidents in their lifetime compared with the rest of the cohort



6.4.2 *Sensation seeking*

The sensation-seeking profile of this high-risk group does seem to be different from the larger group with reported road traffic accidents at 13 or 16 years. This is because sensation seeking is not as strongly correlated with childhood (< 11 years) accidents as it is in adolescence (Table 6.12).

6.4.3 *Parental monitoring*

Findings on parental monitoring are not conclusive, as group sizes are small (Table 6.13). However, it appears that a comparatively large proportion of young people who had repeated accidents reported low levels (fifth quintile) of parental monitoring (31.8%) compared with young people who did not have an accident (16.6%).

6.4.4 *Stressful life events*

A none-significant trend was observed for increased risk of a road traffic accident in females who reported stressful life events, which was not apparent in males (Table 6.14).

Table 6.12: Sensation-seeking profile of young people who had two or more accidents in their lifetime compared with the rest of the cohort

Sensation-seeking profile	Accidents				Rest of the cohort				*p*-value*
	n	Mean	SD	Range	*n*	Mean	SD	Range	
Total sensation-seeking score	31	50.9	9.19	33–67	3,322	51.58	7.44	28–75	0.611
Novelty subscale score	31	25.5	5.16	17–39	3,322	25.84	4.28	13–40	0.641
Intensity subscale score	31	25.4	5.08	15–33	3,322	25.74	4.48	12–39	0.688

* Two-tailed *t*-test.

Table 6.13: Level of parental monitoring in young people who had two or more road traffic accidents in their lifetime compared with the rest of the cohort

Parental monitoring	Accidents		Rest of cohort			Odds ratios		
	n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
1st quintile (high-level parental monitoring)	4	18.2	550	20.8		1.00		
2nd quintile	5	22.7	580	21.9		1.19	0.32–4.44	0.801
3rd quintile	5	22.7	574	21.7		1.20	0.32–4.48	0.789
4th quintile	1	4.5	502	19.0		0.27	0.03–2.46	0.247
5th quintile (low-level parental monitoring)	7	31.8	439	16.6	0.232	2.19	0.64–7.54	0.213

[1] Using Pearson's coefficient from chi-square test or Fisher's exact test if expected cell less than five.
A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.

Table 6.14: Stressful life events in young people who had two or more road traffic accidents in their lifetime compared with the rest of the cohort

Life events	Yes to road traffic accident		No to road traffic accident			Odds ratios		
	n	%	*n*	%	*p*-value[1]	OR	95% CI	p-value[2]
All young people	12	40.0	863	25.29	0.065	1.97	0.95–4.11	0.070
Females	10	43.5	543	26.74	0.072	2.11	0.92–4.84	0.078
Males	2	28.6	320	23.15	0.666	1.33	0.26–6.87	0.736

[1] Using Pearson's coefficient from chi-square test or Fisher's exact test if expected cell less than five.
A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.

7 DISCUSSION

These findings from a large contemporary English cohort study provide evidence for the factors antecedent to accidents in the road environment in adolescence. No validation of accident data with other sources was possible, so limited information was available from the young people on the circumstances of the accident.

The strengths of this study are that it used a large sample from a contemporaneous cohort, with a good social spread and that road use was self-reported by 13- and 16-year-old young people, not by their parents. Also, all injuries resulting from accidents were reported by the young people, which avoided the biases intrinsic to collecting data from A&E departments and hospital records. The Avon Longitudinal Study of Parents and Children (ALSPAC) provided a wealth of previously collected background characteristics of the cohort, going back to pregnancy, which enabled the research team to look at a wide range of factors potentially linked to road accidents in adolescence.

The main limitation of this research is the missing data, with only 52% of eligible young people returning the questionnaire at 16 years. The non-response was not at random, so bias could have been introduced because the non-responders to the questionnaires, when compared with the responders, were more likely to be male and from more deprived social backgrounds, with mothers with lower educational levels. Therefore, bias could have been introduced. However, given that males are generally more likely than females to be involved in accidents in adolescence, the missing data will have led to an underestimation rather than an exaggeration of the number of accidents and the strength of the associations found.

The most common circumstance for being involved in an accident at both 13 and 16 years was being a passenger in a vehicle driven by someone else – the associations of which would reflect the characteristics of the driver rather than the young person. So it was not surprising that no gender difference and no social differences ($>$ 90% of ALSPAC families have access to a car) were found between those who reported road accident involvement and those who did not, and there was no relation to sensation-seeking characteristics of the young person. The group of vulnerable road users excluded car passengers, so the associations with reported accidents in this group were more likely to reflect the characteristics of the young people and their families.

The risk factors for accident involvement between 13 and 17 years of vulnerable road users are a mixture of factors intrinsic to the young person (such as gender and behavioural profile), those related to family background (single parenthood, number of siblings and level of parental monitoring) and some related to the external environment (stressful life events). There was no evidence of a social gradient in the likelihood of being involved in a road accident in adolescence, in contrast to

childhood accidents (Graham *et al.*, 2005). This is consistent with the 'equalisation in youth' concept (West and Sweeting, 2004), which explains that, because young people from better-off backgrounds have more access to bicycles, mopeds and motorcycles, they are exposed to increased risk on the road which counters against the lower risk from living in a better-off neighbourhood and having access to safe play areas.

The lack of association between accident risk and the child's sensory development might be considered surprising, as other studies have found links between accidents in the road environment and visual or hearing impairments, and the data showed a weak association with parent-reported hearing impairment at 16 years (but not at 13 years – see Project 2 (Emond *et al.*, 2011)). The lack of association with visual impairment may be because the ALSPAC cohort have had their eyes checked several times, and referred for glasses if visual acuity defects were identified. It may also be that ALSPAC children with more severe visual and hearing impairments were more supervised by their parents and had less exposure to risk in the road environment.

No association was seen with learning difficulties, which may reflect less unsupervised road use because of enhanced parental supervision.

In general, vulnerable road users (those who had accidents as pedestrians, cyclists and motorcyclists) showed the associations with early childhood and individual factors (e.g. sensation seeking) most strongly, as the diluting influence of those who reported accidents as car passengers was removed. However, the numbers were much smaller in this group, which did widen confidence intervals for some odds ratios and make some associations non-significant (e.g. stressful life events). Interestingly, the correlations with parental monitoring were particularly robust for accident risk for vulnerable road users, with increased injury risk associated with lower levels of parental monitoring.

The characteristics of those children involved in repeat accidents in the road environment in childhood and adolescence were different to those who had accidents at 16 years, with similar numbers of girls and boys, and their behavioural profile, highlighting conduct difficulties rather than hyperactivity, which seemed to dominate accident risk in the 16-year-olds. These conduct problems, and lower parental monitoring levels, were both factors associated with accident risk.

8 CONCLUSIONS

The risk factors for accident involvement between 13 and 17 years are a mixture of factors intrinsic to the young person (such as gender and behavioural profile), those related to family background (single parenthood, number of siblings and level of parental monitoring) and some related to the external social environment (stressful life events), but not to the external physical environment (indices of deprivation).

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APPENDIX 1: Background and developmental characteristics of young people who reported a road traffic accident in adolescence

Table A1.1: Background and developmental characteristics of young people who had an accident at 13 or 16 compared with the rest of the cohort

Characteristics	Reference group	Accidents at 13 or 16 years		Rest of the cohort			Odds ratios		
		n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
Gender (male)	*Female*	269/601	44.8	1,446/3,576	40.4	0.046	1.19	1.00–1.42	**0.046**
Social background									
Mother rents home (late primary)	*Owns home*	68/501	13.6	362/3,271	11.1	0.100	1.26	0.96–1.67	0.101
One or more house moves since the age of five	*No house moves*	121/488	24.8	804/3,205	25.1	0.890	0.98	0.79–1.23	0.890
Mother's satisfaction with neighbourhood at age five									
Not very good/not good at all	*V. good/ fairly good*	6/511	1.2	12/3,250	0.4	0.111	3.20	1.19–8.60	**0.021**
Family background									
Partner/husband not living with mother (110 months)	*Lives with mother*	54/500	10.8	254/3,274	7.8	0.021	1.44	1.06–1.96	**0.021**
Biological father does not live with study child	*Lives with child*	26/462	5.6	112/3,017	3.7	0.049	1.55	1.00–2.40	**0.051**
No partner support (32 weeks gestation)	*Partner support*	83/490	16.9	407/3,169	12.8	0.013	1.38	1.07–1.79	**0.014**
⩾ 3 siblings living in the home	*< 3 siblings in home*	17/565	3.0	39/3,465	1.1	< 0.001	2.73	1.53–4.85	**0.001**
> 1 person/room (late primary)	*⩽ 1 person/ room*	23/260	8.8	164/1,731	9.5	0.746	0.93	0.59–1.46	0.746
Cognitive development									
IQ – WISC[3] at 8 years (⩽ 86)		23/456	5.0	169/2,949	5.7	0.554	0.87	0.56–1.37	0.554
Statemented at 7/8 years	*Not*	8/494	1.6	54/3,212	1.7	0.336	0.97	0.46–2.05	0.938
Statemented at 11/12 years	*Not*	9/51	17.6	67/265	25.3	0.081	0.71	0.32–1.57	0.399
Special educational needs at 11 years	*Not*	41/469	8.7	228/3,186	7.2	0.219	1.24	0.88–1.76	0.220

(*continued*)

Table A1.1: (*continued*)

Characteristics	Reference group	Accidents at 13 or 16 years		Rest of the cohort			Odds ratios		
		n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
Motor development									
Gross motor skills score (bottom 10th percentile)	*Top 90th percentile*	59/447	13.2	459/3,355	13.7	0.780	0.94	0.72–1.23	0.651
Fine motor skills score (bottom 10th percentile)	*Top 90th percentile*	37/447	8.3	288/3,352	8.6	0.823	1.08	0.79–1.49	0.609
Sensory development									
Wears glasses at 7 years	*No glasses*	47/475	9.9	256/2,974	8.6	0.358	1.17	0.84–1.62	0.358
Hearing assessment at 7 years									
Bilateral normal hearing		352/377	93.4	2,668/2,855	93.5	0.150	1.00		
Bilateral hearing impairment		12/377	3.2	54/2,855	1.9		1.39	0.74–2.62	0.307
Unilateral hearing impairment		13/377	3.4	133/2,855	4.7		0.66	0.38–1.15	0.145

[1] Using Pearson's coefficient from chi-square test. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.
[3] Wechsler Intelligence Scale for Children III.

APPENDIX 2: Characteristics of vulnerable road users (pedestrians, cyclists and motorcyclists) who reported a road traffic accident in adolescence

Table A2.1: Developmental factors of vulnerable road users who had an accident at 13 or 16 years compared with the rest of the cohort

Developmental characteristics	Reference group	Vulnerable road users at 13 or 16 years		Rest of the cohort			Odds ratios		
		n	%	*n*	%	*p*-value[1]	OR	95% CI	*p*-value[2]
Cognitive development									
IQ – WISC[3] at 8 years (⩽ 86)		9/140	6.4	381/5,013	7.6	0.605	0.84	0.42–1.65	0.606
Statemented at 7/8 years	*Not*	3/160	1.9	104/5,328	2.0	0.105	0.98	0.31–3.12	0.971
Statemented at 11/12 years	*Not*	3/16	18.8	134/512	26.2	0.561	0.58	0.16–2.11	0.413
Special educational needs at 11 years	*Not*	15/155	9.7	563/5,408	10.4	0.625	1.14	0.67–1.97	0.625
Motor development									
Gross motor skills score (bottom 10th percentile)	*Top 90th percentile*	26/183	14.2	746/5,737	13.0	0.634	1.11	0.73–1.69	0.634
Fine motor skills score (bottom 10th percentile)	*Top 90th percentile*	17/183	9.3	509/5,733	8.9	0.847	1.06	0.63–1.75	0.847
Sensory development									
Wears glasses at 7 years	*No glasses*	17/158	10.8	484/5,188	9.3	0.543	1.17	0.70–1.95	0.544
Hearing assessment at 7 years									
Bilateral normal hearing		147/152	96.7	4,603/4,972	92.6	0.176	1.00		
Bilateral hearing impairment		2/152	1.3	116/4,972	2.3		0.54	0.13–2.21	0.391
Unilateral hearing impairment		3/152	2.0	253/4,972	5.1	0.176	0.37	0.12–1.17	0.091

[1] Using Pearson's coefficient from chi-square test. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.
[3] Wechsler Intelligence Scale for Children III.

Table A2.2: **Behavioural profile of vulnerable road users who had an accident at 13 or 16 years compared with the rest of the cohort**									
Behavioural profile	**Reference group**	**Vulnerable road users at 13 or 16 years**		**Rest of the cohort**			**Odds ratios**		
		n	**%**	***n***	**%**	***p*-value[1]**	**OR**	**95% CI**	***p*-value[2]**
SDQ at age 3–4									
Abnormal total difficulties score	*Normal*	7/161	4.3	250/5,418	4.6	0.767	0.96	0.44–2.06	0.909
Abnormal hyperactivity score	*Normal*	20/166	12.0	659/5,510	12.0	0.944	1.02	0.63–1.64	0.941
Abnormal conduct problems	*Normal*	21/169	12.4	621/5,547	11.2	0.644	1.09	0.68–1.75	0.715
SDQ at age 9–10									
Abnormal total difficulties score	*Normal*	5/134	3.7	148/4,781	3.1	0.916	1.21	0.49–3.01	0.676
Abnormal hyperactivity score	*Normal*	11/154	7.1	329/5,298	6.2	0.89	1.16	0.62–2.16	0.643
Abnormal conduct problems	*Normal*	9/151	6.0	284/5,302	5.4	0.924	1.13	0.57–2.24	0.734
SDQ at age 11–12									
Abnormal total difficulties score	*Normal*	1/129	0.8	136/4,649	2.9	0.112	0.27	0.04–1.92	0.190
Abnormal hyperactivity score	*Normal*	15/154	9.7	281/5,185	5.4	0.069	1.88	1.09–3.25	**0.024**
Abnormal conduct problems	*Normal*	12/156	7.7	274/5,189	5.3	0.109	1.56	0.85–2.85	0.151

[1] Using Pearson's coefficient from chi-square test. A *p*-value of < 0.05 means that the finding is unlikely to have occurred by chance.
[2] Using unadjusted odds ratios to assess the odds of having had an accident versus the rest of the cohort.