Home Office

# Anti-social and other problem behaviours among young children: findings from the Avon Longitudinal Study of Parents and Children

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Home Office Online Report 02/08

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# Executive summary

There is a considerable body of existing research which examines the characteristics that are associated with young people's involvement in anti-social and other problem behaviours. These characteristics are often referred to as 'risk factors'. There is a corresponding and growing body of research which provides evidence of characteristics which can counteract these risk factors; these are commonly referred to as 'protective' or 'resilience' factors.

The two chapters in this volume present the findings of two studies carried out on a sample from the Avon Longitudinal Study of Parents and Children (ALSPAC), a prospective birth cohort study, at two key ages – 8½ and 10½ years.

## Findings

### Patterns of anti-social and other problem behaviours among young children and associated characteristics

- The majority of children in the sample (70%) did not report involvement in any anti-social or other problem behaviours at the two assessment time points: at age 8½ when children were asked if they had *ever* been involved in anti-social and other problem behaviours; and at age 10½ when they were asked if they had been involved in anti-social or other problem behaviours in the previous six months.
- More males than females reported involvement in anti-social or other problem behaviours. Males also reported involvement in a greater number of these behaviours than females.
- Involvement in a number of types of behaviour up to age 8½ significantly increased the likelihood of involvement in further anti-social and other types of problem behaviour at age 10½. These behaviours were: smoking a cigarette; setting fire to property; carrying a weapon in case of a fight; and drinking alcohol without parental permission. This suggests a strong association rather than a causal relationship.
- The children who reported involvement in anti-social and other problem behaviours at both time points (8½ and 10½ ) have significantly greater conduct problems up to the age of 6 ¾, a higher level of family adversity, lower levels of prosocial behaviour, lower levels of performance IQ and poorer friendship quality.

### Characteristics associated with resilience in children at high risk of involvement in anti-social and other problem behaviours

- From the sample of children said to be at high risk of involvement in anti-social and other problem behaviours (on the basis of this study's definition), 88 per cent were defined as being resilient, that is, despite being in the high risk group they nevertheless reported involvement in no or only one type of anti-social and other problem behaviours up to the age of 8½.
- In comparison with the remaining high-risk children, the resilient children had significantly fewer peer problems; higher IQs and self-esteem; greater levels of school enjoyment and lower levels of family adversity. In addition, the mothers of the resilient children had better parenting skills (i.e. interaction with the child), but surprisingly, reported less positive parenting experiences (e.g. bonding with the child).
- Gender was found to be significantly associated with resilience – girls were more likely to be resilient than boys.
- Analysis conducted on the boys-only sample showed that the characteristics associated with resilience amongst the boys were: school enjoyment; demonstrating high levels of pro-social behaviour and having mothers with high levels of parenting skills.

The findings from these studies highlight the importance of early intervention to tackle individual and family factors, particularly those associated with cognitive and behavioural development.

# 1. Introduction and background

## Background

Much of the growing research interest in anti-social behaviour has focused on the involvement of young people and the transition from anti-social behaviour in childhood to more serious offending later on in life.

Some studies have found anti-social behaviour to be a developmental trait that begins early in life and often continues into adulthood. For example, Moffitt's work (1993, and Moffitt et al., 1996a) has suggested that anti-social behaviour has particular developmental characteristics from childhood and that there are several different patterns or 'types' of anti-social behaviour.

- 'Adolescent limited' (AL) anti-social behaviour. This is displayed in approximately one quarter of the population and rarely continues into adulthood.
- 'Life-course Persistent' anti-social behaviour. This starts during childhood and continues into adulthood. This 'Life-course Persistent' (Moffitt, 1993) anti-social behaviour is evident in only six per cent of the population (Moffitt *et al.*, 1996), yet these individuals have been found to be responsible for a disproportionate level of anti-social behaviour and offending (Elliott, Huizinga and Morse, 1986).

Other studies have similarly found that childhood involvement in anti-social behaviour is one of the strongest predictors of adult anti-social behaviour and offending (e.g. Benda, Corwyn and Toombs, 2001; Farrington, 1998; Loeber and Dishion, 1983: Patterson *et al.*, 1998).

According to Moffitt's (1993) study, the characteristics associated with those who correspond to the 'Life-course Persistent' model include cognitive delay, poor attention, and difficult, under-controlled temperament as a toddler. These characteristics in turn increase the young child's vulnerability to the criminogenic features of the child's environment. Moffitt suggests that in combination and interaction, these factors produce an adult anti-social personality.

The two studies described in this volume aim to build on the existing research evidence. The studies are based on data from the Avon Longitudinal Study of Parents and Children (ALSPAC).

### Background to ALSPAC

The Avon Longitudinal Study of Parents and Children is a large study following a cohort of children born to mothers resident in Avon while pregnant. A total of 14,541 pregnant mothers with expected dates of delivery between 1 April 1991 and 31 December 1992 enrolled in the study, representing 85-95 per cent of the eligible population. There were 14,062 live births delivered on or after 20 weeks, and 13,971 infants alive after 12 months. The families in the ALSPAC study are broadly characteristic of those in Britain as a whole with a slight under-representation of minority groups; at five per cent this is lower than the 7.9 per cent for the British general population (ONS, 2001).

An important limitation of the studies described in this volume is that they are not representative of the overall ALSPAC cohort, or therefore the population of England and Wales. The children in both study samples have mothers who were better educated, older at the birth of their first child, and the families were more likely to be living in housing that was owned or mortgaged than the remaining children who did not attend the clinic. Moreover, those children who did form part of the samples on which these studies were based were less likely to be from minority ethnic groups. Therefore the generalisability of these data to such groups is not possible.

#### Definitions of anti-social behaviour

There is no single definition for 'anti-social behaviour', but it is accepted that the term refers to a broad range of behaviours which may be found to be offensive or distressing. In light of concerns about the varying definitions of anti-social behaviour, the Research Development and Statistics (RDS) directorate at the Home Office (2004) developed a typology of anti-social behaviours that reflect the variety of definitions that are currently in use. The types of anti-social behaviour identified broadly fall

into four categories including: misuse of public space (drug/substance use, street drinking, begging, prostitution, abandoned cars); disregard for community/personal wellbeing (noise, rowdy behaviour, nuisance behaviour, hoax calls, animal-related problems); acts directed at people (intimidation/harassment); and environmental damage (criminal damage/vandalism, litter/rubbish).

For the purpose of this study, children were asked about a range of behaviours, some of which fall within the RDS typology of anti-social behaviour, as described above, and others which do not. This reflects the fact that children as young as those in these studies are unlikely to have the opportunity to engage in many of the forms of anti-social behaviour as defined in the RDS typology. Also, many types of behaviour which are not defined as anti-social behaviour can be regarded as problem behaviour for children at the age of those in the study sample. Therefore, the behaviours will be defined in this study as anti-social and other problem behaviours. The list of anti-social and other problem behaviours covered in the two studies are described in Table 1.1. The behaviours listed show the behaviours asked about at the two assessment time points discussed throughout, that is at the child's age at 8½ and at age 10½.

***Table 1.1: Types of anti-social and other problem behaviours asked about at ages 8½ and 10½***

| *Anti-social behaviour asked about at age 8½* | *Anti-social behaviour asked about at age 10½* |
|---|---|
| • **Stolen:** bicycles, from a shop, from a house/garden, from a car, entered a building to steal, pick-pocketed.<br>• **Used substances:** drunk alcohol, smoked cigarettes without parental consent.<br>• **Set fire to property**<br>• **Carried a weapon in case of a fight**<br>• **Been intentionally cruel to animals** | • **Stolen:** bicycles, from a shop, from a house/garden, from a car, entered a building to steal, pick-pocketed.<br>• **Used substances:** drunk alcohol, smoked cigarettes without parental consent.<br>• **Set fire to property**<br>• **Been intentionally cruel to animals**<br>• **Smoked cannabis**<br>• **Destroyed something for fun**<br>• **Got into a fight**<br>• **Used a weapon in a fight** (asked only of those who reported having been in a fight) |

As shown in Table 1.1, children at age 10½ were asked about a greater number of anti-social behaviours; this reflects the expectation that they will have more opportunity for involvement in anti-social behaviour as they get older.

## Data collection

The ALSPAC study collects data on various elements of child health, development and behaviour. The data collected which are relevant to the two studies on anti-social and other problem behaviours are described below.

### Data collection on anti-social behaviour

The data collected on involvement in anti-social and other problem behaviours are based on the behaviours listed in Table 1.1 above. At age 8½, involvement in anti-social and other problem behaviours was self-reported by the children using a posting task as part of a structured clinic session. Children were asked to place envelopes marked with a question about involvement in an anti-social behaviour in one of two boxes; one was labelled 'ever' and the other 'never'.

At age 10½, the children's involvement in anti-social and other problem behaviours was self-reported during a face-to-face interview. The children were firstly asked whether they had friends who had been involved in each behaviour type before being asked whether they themselves had been involved in the behaviour in the last six months.[1]

### Data collection on personal and family-related characteristics

The personal and familial characteristics assessed for the purpose of these studies were based on those identified in previous studies as having an impact on anti-social behaviour.

[1] Because of the different time periods asked about, the differences between those reporting anti-social behaviour at age 8½ and those reporting at age 10½ are not directly comparable with each other. Rather they are presented in Chapter 1 of this OLR to demonstrate differences to the Persistent and No- anti-social groups.

These characteristics were assessed throughout the children's lives to age 10½ via a range of data collection methods. A full summary of the methods of data collection on the personal and familial characteristics used is presented in each of the chapters.

## The report

In building on the existing research evidence, the two studies described in this volume examine the involvement of young people in anti-social behaviour. The first chapter describes the patterns of anti-social behaviour among young people and the associated personal and family-related characteristics. The second chapter further examines both personal and familial characteristics in exploring some of the factors that are associated with resilience in children; that is the characteristics that act as protective factors for children who are deemed to be at high risk of involvement in anti-social behaviour.

The previous literature that is relevant to each of the two studies is presented at the start of each chapter.

# 2. Patterns of anti-social and other problem behaviours and associated child characteristics

*Erica Bowen and Jon Heron*

## Background to previous research

A substantial body of research supports the role of family and child-based characteristics in the development of anti-social behaviour. A selection of these studies, which present evidence for the characteristics examined in this study, are reviewed briefly here.

### Family-based risk (family adversity)

A large body of research indicates that anti-social behaviour in youth is associated with several family characteristics including: harsh/authoritative parenting; parental psychopathology and criminality; interparental and family violence; large family size; poverty; and poor educational achievement of parents (e.g. Farrington, 2002; Henry, *et al.,* 1996; Jaffee *et al.,* 2004; Patterson, *et al.,* 1998). Research has also shown that although *individual* risk factors have often weak associations with outcomes, the presence of *multiple* family-based risk factors significantly increases the probability of later negative outcomes including delinquency (e.g. Blanz *et al*., 1991; Rutter, *et al*., 1975; Sanson *et al.,* 1991; Shaw *et al.,* 1994; Stouthamer-Loeber *et al.,* 2002).

### Difficult temperament (negative emotionality)

White *et al.* (1990) found that children rated by mothers as being disruptive or difficult at age three were more likely to be delinquent at age 11. Moreover, Moffitt *et al.* (1996) found that children whose anti-social behaviour in childhood continues into adulthood were rated by parents as having a more difficult temperament as compared to those children whose involvement in anti-social behaviour was limited to adolescence. In addition, Stevenson and Goodman's (2001) longitudinal study of 828 children found that temper tantrums at age three, social development and disruptive behaviours continued to predict adult convictions, particularly for violent offences.

### Social withdrawal (shyness)

Caspi *et al.* (1995) noted that children characterised by low levels of shyness at age three were more likely to be impulsive at age 18. In their longitudinal study of at-risk adolescents, Smokowski *et al.,* (2003) found that shyness was one of several protective factors against juvenile court involvement. Farrington *et al.* (1988) also found that social withdrawal was key to non-involvement in delinquent behaviour.

### Intelligence (cognitive ability)

Research has consistently shown that low levels of intelligence are associated with delinquency (Farrington, 1994; Kandel *et al.,* 1988; Masten *et al.,* 1999; Stattin and Klackenberg-Larsson, 1993; White, Moffitt, and Silva, 1989). For example, Stattin and Klackenberg-Larsson (1993) found that low intelligence at age three significantly predicted officially recorded offending up to age 30 after controlling for social class. Furthermore, delinquency has been reported to be associated with verbal intelligence deficits (e.g. Farrington, 1994). Raine *et al.* (2002) found that persistently anti-social individuals (assessed at eight and 17 years) at age three had spatial deficits even in the absence of verbal deficits, and at age 11 they had both verbal and spatial deficits.

### Empathy/prosocial behaviour

Lack of empathy in adolescence has been associated with future delinquency, aggression, number of violent offences and reoffending in criminal populations (e.g. Brandt *et al*., 1997). Frick *et al.* (2003) found that low empathy in the form of callous, unemotional traits predicted self-reported delinquency in some children who did not necessarily show high levels of conduct disorder, and that this relationship

was strongest for girls. However, other studies have failed to identify such associations (e.g. Bush, Mullis and Mullis, 2000). In their meta-analysis of 35 studies, Jolliffe and Farrington (2003) report that, in general, empathy and anti-social behaviour are negatively associated such that delinquent individuals also exhibit low levels of empathy, but this association is influenced by several factors including the measure of empathy used, and age of the sample.

### Hyperactivity (behavioural problems)

A number of studies have reported an association between behavioural factors, such as hyperactivity and inattention, and anti-social behaviour. For example, the Cambridge study (Farrington, 1992), the Christchurch longitudinal study (Fergusson and Horwood, 1993), the Pittsburgh study (Loeber *et al.*, 1993), the Dunedin study (Moffitt, 1990) and the Montreal longitudinal study (Nagin and Tremblay, 2001). In reporting results from the Pittsburgh Youth Study, Kelley *et al.* (1997) state that boys diagnosed with Attention-Deficit-Hyperactivity Disorder (ADHD) were at the highest risk of becoming persistent delinquents. In addition, Nagin and Tremblay (2001) report in the Montreal longitudinal study that high levels of hyperactivity placed boys at higher risk of persistent physical aggression than boys who were not hyperactive.

### Peer rejection (peer problems)

Moffitt (1993) argues that peer rejection plays an important role in the development of early onset and persistent anti-social behaviour as it has been suggested that children who are rejected are more likely to either withdraw from social interactions or behave aggressively within the context of social interactions. These children therefore deny themselves the opportunity to rehearse prosocial behaviours (Dodge and Newman, 1981; Wood *et al.*, 2002). Others (e.g. Khatri and Kupersmidt, 2003; Rose *et al.*, 2004; Vitaro *et al.*, 2000; Wood, Cowan and Baker, 2002) have hypothesised that children who are involved in early onset anti-social behaviour are at increased vulnerability for peer rejection due to high levels of aggressive behaviour and poor self-control.

## Aims of the current study

The aim of this study was to examine the nature and frequency of anti-social behaviour amongst a group of children who were surveyed at age 8½ and then later when they were aged 10½. In addition, the study set out to identify individual and family characteristics, most of which have been discussed above, that are associated with patterns of anti-social behaviour.

## Sample

The sample in the present study consisted of 5,757 children (2,834 boys and 2,923 girls). These were the children who took part in the study at both of these time points and thus on whom anti-social behaviour data are available at both ages 8½ and 10½ years.

## Prevalence of anti-social and other problem behaviours

Based on the self-reported involvement of anti-social and other problem behaviours used in this study (see Table 1.1) at two assessment time points; age 8½ and 10½:

- seventy per cent (4,029) of the sample did not report involvement in any of the types of behaviours at either time point;
- fifteen per cent (888) reported having ever been involved in any of the types of behaviours at age 8½ only;
- nine per cent (489) only reported involvement in any of the types of behaviours in the previous six months at age 10½ ; and
- six per cent (351) reported involvement in any of the types of behaviour at both ages 8½ and 10½.

For the purpose of establishing baseline data, the children were asked at age 8½ whether they had *ever* committed each of the behaviours listed. At age 10½ the children were asked whether they had committed any of the behaviours in the *previous six months*. It follows that the different time periods

asked about may be the reason for the higher levels of children self-reporting anti-social behaviour at the earlier time point.

### Differences in the extent of involvement in anti-social and other problem behaviours

Analysis revealed that those children who reported involvement in such behaviour at both assessment time points reported involvement in more types of anti-social and problem behaviours (for details of the analysis see Appendix C). Figures 2.1 and 2.2 below show the distribution of frequency scores of those who reported involvement in anti-social and other problem behaviours at one time point only compared to those who reported involvement at both time points. It can be seen that at each assessment time point, the children reporting involvement in anti-social and other problem behaviours at both time points were the most likely to report at least two anti-social activities.

***Figure 2.1: Differences in involvement in number of anti-social activities at age 8½***

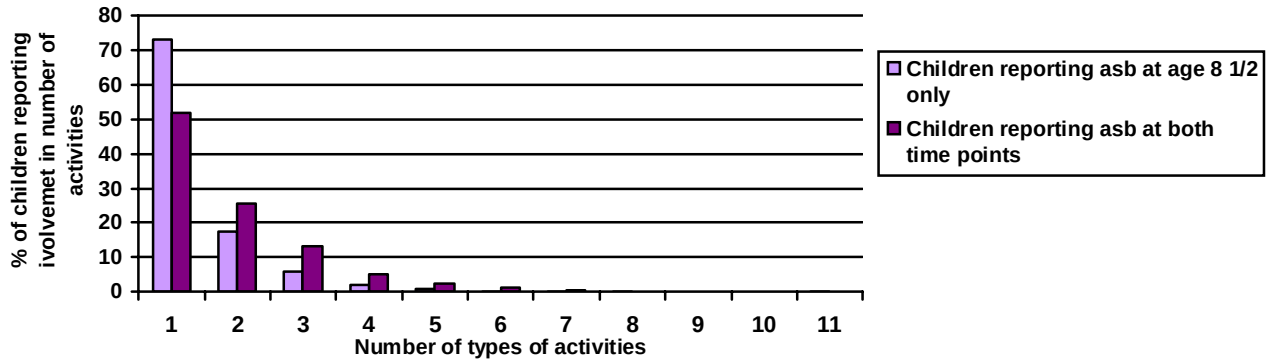
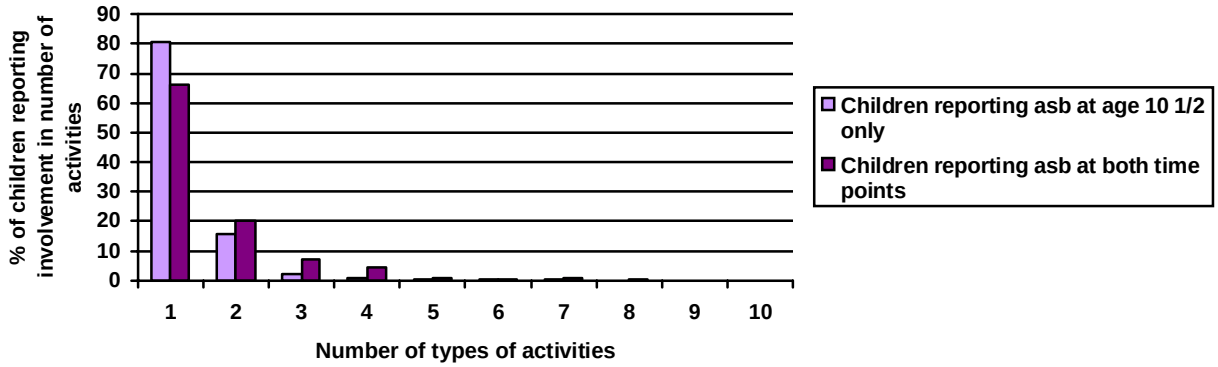


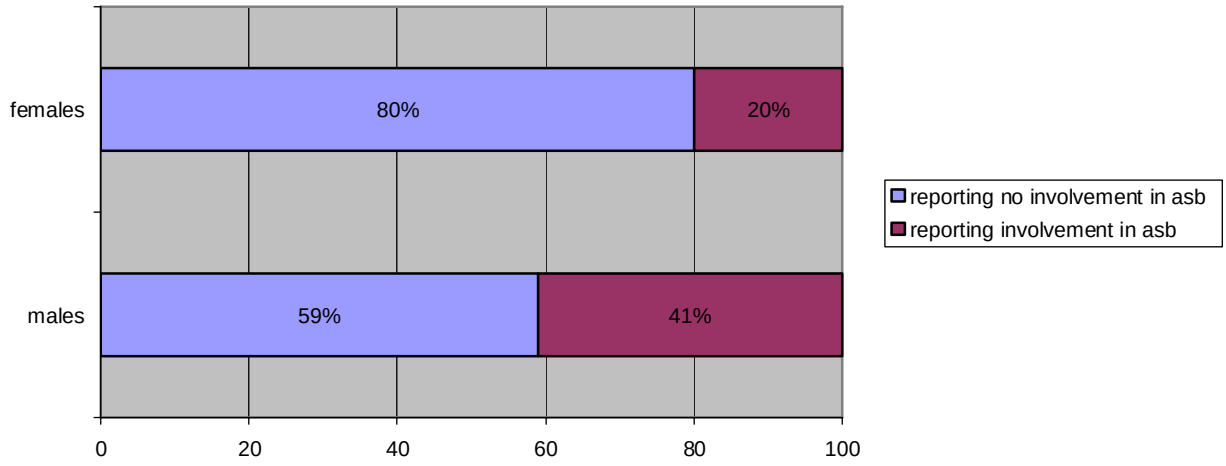

***Figure 2.2: Differences in involvement in number of anti-social activities at age 10½***




## Gender differences in involvement in anti-social and other problem behaviours

Proportionately more males than females overall reported involvement in anti-social and other problem behaviours as shown in Figure 2.3.

***Figure 2.3: Gender differences in involvement in anti-social and other problem behaviours***




Males were also significantly more likely to report involvement in anti-social and other problem behaviours at each assessment time point. The male:female ratio for those reporting involvement in anti-social and other problem behaviours at age 8½ was 1.2:1 (i.e. there was the equivalent of 1.2 males to every 1 female), 3:1 for those reporting involvement in such behaviour at age 10½ only, and 5:1 for those reporting involvement in such behaviour at both time points. Females were over-represented among children who reported involvement in no anti-social and other problem behaviours at any time point; in this case the female:male ratio was 1.75:1. These data are consistent with those reported in previous investigations of early onset and persistent anti-social behaviour that have found gender ratios of between 4:1 (or four males to one female in anti-social behaviour groups) e.g. Fergusson *et al.,* 2000, and 15:1 (or 15 males to one female in each anti-social behaviour group), Kratzer and Hodgins, 1999.

### Gender differences in the extent of involvement in anti-social and other problem behaviours

In addition to being more likely to report involvement in anti-social and other problem behaviours, males were also more likely to report involvement in a greater number of anti-social behaviours, particularly at age 8½. Figures 2.4 and 2.5 show the number of anti-social activities reported by all males and females who reported any involvement in anti-social behaviour at each of the assessment time points.

***Figure 2.4: Gender differences in anti-social and other problem behaviours reported at age 8½***

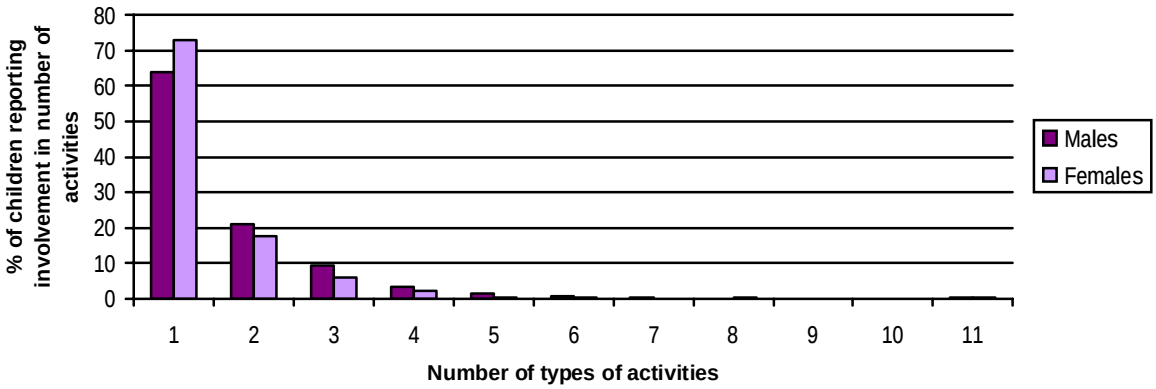
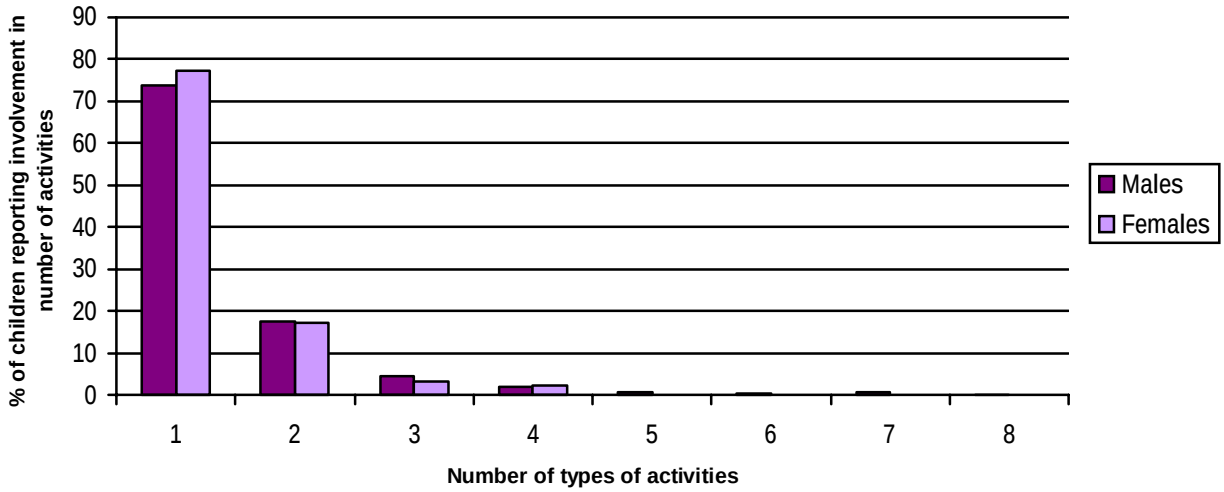


***Figure 2.5: Gender differences in anti-social and other problem behaviours reported at 10½***




## Prevalence of types of anti-social and other problem behaviours

Figure 2.6 shows the prevalence of involvement in the various types of anti-social behaviour of all children (n = 1,239) who reported anti-social behaviour at age 8½.

It shows that stealing something, carrying a weapon, and being cruel to an animal on purpose were the most frequently reported types of anti-social behaviour at age 8½.

***Figure 2.6: Types of anti-social or other problem behaviour ever involved in as reported at age 8½***

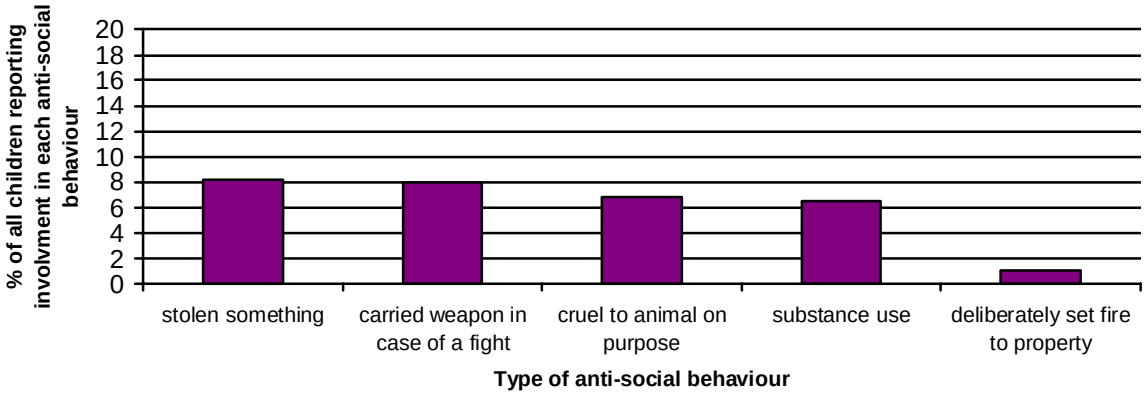
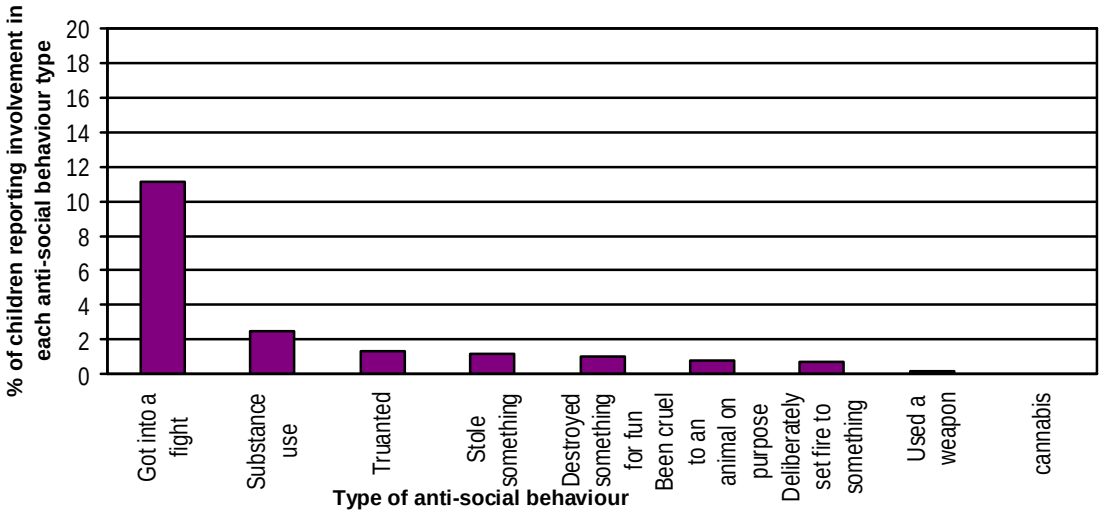



Figure 2.7 shows the prevalence of involvement in the various types of anti-social behaviour of the 840 children who reported some form of anti-social behaviour at age 10½.

The most frequently cited behaviour at age 10½ was getting into a fight, followed by using a substance (alcohol or cigarettes) without parental permission and then truanting. The remaining anti-social behaviours were relatively rarely cited.

***Figure 2.7: Types of anti-social or other problem behaviour involved in during previous six months as reported at age 10½***




## Differences in involvement in types of anti-social and other problem behaviours

There were a number of differences between those children who reported involvement in anti-social and other problem behaviours at one time point only (i.e. only at age 8½ or only at age 10½) and those children who reported involvement in such behaviour at both time points (for details of the statistical analysis used see Appendix C, Tables C2.2 and C2.4).

In comparison to those children who reported involvement in anti-social and other problem behaviours at age 8½ only, those children who reported involvement in such behaviour at both time points were more likely to report most of the types of behaviour at age 8½. In particular, they were significantly more likely to report:

- setting fire to property;
- substance use (smoking or drinking alcohol without parental consent);
- carrying a weapon in case of a fight.

In comparison to those children who only reported involvement in anti-social and other problem behaviours at age 10½, those who reported involvement in such behaviour at both time points were more likely to report involvement in most of the behaviour types at age 10½ and in particular, they were significantly more likely to report:

- being cruel to animals on purpose;
- stealing something;
- substance use (smoking or drinking alcohol without parental consent).

## Behaviours associated with further involvement in anti-social and other problem behaviours

Further analysis was conducted on these data to examine whether some of the behaviours reported at age 8½ were indicative of the likelihood to also report involvement in anti-social behaviour at age 10½. The results are presented in Table 2.1 and show the relative risk ratios[2] reflecting the likelihood of

[2] Relative risk ratios show the probability of an occurrence compared with the whole group. In relation to the analysis referred to here, the relative risk ratio shows the likelihood of children reporting anti-social behaviour at age 10½ based on their reported involvement in a particular behaviour at age 8½ and compared with all children who did not report involvement in that behaviour.

involvement in anti-social and other problem behaviours at age 10½ based on involvement in types of behaviour prior to age 8½.

***Table 2.1: Behaviours reported at age 8½ indicative of further involvement in anti-social and other problem behaviours***

| Activity | Relative risk |
|---|---|
| Smoked a cigarette* | 1.755* |
| Set fire to property* | 1.703* |
| Carried a weapon in case of a fight* | 1.652* |
| Drank alcohol* | 1.575* |
| Entered a building to steal | 1.181 |
| Stole bike/skateboard | 1.136 |
| Taken from a shop without paying | 1.073 |
| Stolen from house/garden/garage | 1.045 |
| Stolen from a car | 1.034 |
| Snatched a purse/wallet | .930 |
| Cruel to an animal or bird | .819 |

* denotes figures which are statistically significant at the 95 per cent level.

These data show a number of statistically significant findings. Those children who reported:

- smoking a cigarette at age 8½ were 1.8 times more likely to report involvement in anti-social and other problem behaviours at age 10½;
- setting fire to property at age 8½ were 1.7 times more likely to report involvement in anti-social and other problem behaviours at age 10½;
- carrying a weapon in case of a fight at age 8½ were 1.7 times more likely to report involvement in anti-social and other problem behaviours at age 10½;
- drinking alcohol without parental permission were 1.6 times more likely to report anti-social and other problem behaviours at age 10½.

Although these behaviours do not suggest a causal relationship, they nevertheless demonstrate that there is a strong association between involvement in the behaviours highlighted and the further involvement of anti-social and other problem behaviours at a later time point.

## Characteristics associated with involvement in anti-social and other problem behaviours

A number of personal and familial characteristics were examined. Table 2.2 presents the characteristics examined along with the age of the child at the time of the assessment and details of the methods for assessment.

***Table 2.2: Timing and method of data collection of characteristic examined***

| Factor | Method | Specific characteristics measure within overall factor | Age of child at observation |
|---|---|---|---|
| **Family adversity** | Parental questionnaire data | | Pregnancy |
| | | | Birth – 2 years |
| | | | 2 – 4 years |
| **Negative emotionality** | Parental questionnaire | Difficult temperament | 4 weeks |
| | Parental questionnaire | Negative mood | 6 months |
| | | Negative mood | 2 years |
| | Parental questionnaire | Emotionality | 3 years |
| | Parental questionnaire | Temper tantrums | 1.5 years |
| | | Temper tantrums | 2.5 years |
| | | Temper tantrums | 3.5 years |
| **Shyness/withdrawal** | Parental questionnaire | Approach | 6 months |
| | | Approach | 2 years |
| | Parental questionnaire | Shyness | 3 years |
| **Behavioural problems** | Parental questionnaire | Hyperactivity | 3.5 years |
| | | Hyperactivity | 4 years |
| | | Hyperactivity | 6 years 9 months |
| | Parental questionnaire | Conduct problems | 3.5 years |
| | | Conduct problems | 4 years |
| | | Conduct problems | 6 years 9 months |
| **Prosocial behaviour** | Parental questionnaire | Prosocial behaviour | 3.5 years |
| | | Prosocial behaviour | 4 years |
| | | Prosocial behaviour | 6 years 9 months |
| | Parental questionnaire | Empathy | 6 years 9 months |
| **Peer problems and friendships** | Parental questionnaire | Friendship problems | 4 years |
| | | Friendship problems | 6 years 9 months |
| | Semi-structured child interview | Friendship satisfaction | 8.5 years |
| **Cognitive ability** | Parental questionnaire | General development | 6 months |
| | | General development | 1.5 years |
| | | General development | 2.5 years |
| | | General development | 3.5 years |
| | Parental questionnaire | Language development | 2 years |
| | | Language development | 3 years |
| | Clinic-based cognitive task | Intelligence | 8.5 years |
| | Clinic-based cognitive task | Attention | 8.5 years |

A multivariate analysis of variance (MANOVA) was used to examine the individual and familial characteristics of the young people. Differences in characteristics were explored between those who reported involvement in anti-social and other problem behaviours and those who did not.

In comparison to the rest of the sample, *those that did not report any involvement* in anti-social and other problem behaviours significantly had the:

- lowest levels of family adversity (including better housing, better family networks, fewer financial difficulties);
- lowest levels of negative emotionality (i.e. they had the easiest temperaments with fewer bad moods and tantrums);
- most advanced motor skills and social development ;

- better cognitive skills;
- lowest level of conduct problems;
- lowest levels of hyperactivity;
- most prosocial;
- best level of peer relationships;
- greatest level of shyness at age 3.

The differences in characteristics between those *who reported involvement in anti-social and other problem behaviours at both time points* and *those children who reported no involvement at all* were also explored and even greater differences emerged.

*Those who reported involvement in anti-social and other problem behaviours at both assessment time points* had significantly:

- higher levels of family adversity;
- lower levels of language development (cognitive ability);
- higher levels of conduct problems and hyperactivity;
- lower levels of prosocial behaviour and empathy;
- more peer problems;
- less satisfactory friendships;
- lower levels of cognitive ability;
- lower IQ;
- lower levels of shyness.

# 3. Characteristics associated with resilience in children at high risk of involvement in anti-social and other problem behaviours

*Erica Bowen and Colin Steer*

This chapter reports on an examination of the association between resilience in children deemed to be at high risk of committing anti-social behaviour and a number of individual and familial social and psychological factors.

## Background to previous research

Over the past two decades, research into delinquency prevention has focused on identifying risk factors and high-risk youths (Williams *et al*., 2004). As a result a considerable body of literature documents numerous characteristics predictive of involvement in anti-social behaviour and delinquency. However, there is mounting evidence that only a substantial minority of those born into 'high risk' adverse family environments (e.g. large family size, parental mental health problems, young mother, parental criminality and substance use, inadequate housing, financial difficulties) develop the emotional and behavioural problems that are generally associated with delinquency. Losel and Bender (2003) have suggested that one's ability to explain, predict and prevent anti-social behaviour will be improved if factors that contribute to 'resilience' are also examined.

A selection of the research which has explored 'risk' and 'resilience' in the context of anti-social and other problem behaviours and young people are reviewed briefly here.

### Defining 'high-risk' children

Numerous definitions of 'high-risk' groups are present within the resilience literature. Some authors favour a single variable definition, for example birth to a mother aged under 20 (Kim-Cohen *et al*., 2004), the presence of a severely criminal father (Kandel *et al*., 1988) or previous levels of difficult behaviour (White *et al*., 1989). However, there is growing consensus that individual risk factors have often weak associations with outcomes, whereas the presence of multiple family-based risk factors significantly increases the probability of later negative outcomes including delinquency. For example, Rutter *et al*. (1975a; 1975b) compiled a Family Adversity Index of chronic stressors. These stressors included: overcrowding in the home or large family size; the mother suffering from depression or other neurotic illness; the father having been convicted of any offence against the law; marital discord; and the father having an unskilled/semi-skilled job (Rutter, 1978). A dramatic increase in the probability of children exhibiting a behaviour disorder was recorded as a function of the number of family stressors present. In further research Rutter (1979) found that the presence of an isolated adverse factor in a child's life did not raise the risk of disorder, but it was only when risks occurred together that children showed an increase in behavioural problems. These findings have been replicated by a number of more contemporary studies (e.g. Appleyard *et al*., 2004; Biederman *et al*., 1995; Sanson *et al*., 1991; Shaw *et al*., 1994). In light of this well documented association, Luthar (1993) suggested that the best approach to the identification of high-risk groups in studies of resilience is through the use of summative indices that summarise a range of childhood experiences.

### Defining 'resilience'

In general it is agreed that the term 'resilience' refers to a dynamic process through which individuals display positive adaptation despite experiences of significant adversity or trauma (Luthar and Cicchetti, 2000; Masten and Curtis, 2000). A number of factors have been highlighted in the research as being associated with resilience.

## Factors associated with resilience

Garmezy (1985) categorised protective factors within a tripartite framework. The three categories of variables are:

- dispositional attributes within the child (e.g. temperament, personality traits, gender, coping styles, locus of control and self-esteem);
- family characteristics (e.g. cohesion and warmth, positive parent-child relationships and harmonious parental relationships); and
- extra-familial contexts (e.g. availability of positive adult figure, positive school experiences, safe, supportive neighbourhoods).

The main findings of the literature which relate to 'resilience' in young people will be briefly reviewed here with the focus on the characteristics assessed in the present study. For more comprehensive reviews readers are referred to Farrington and Coid (2003).

## Dispositional characteristics

### Gender

Few studies have examined sex differences in resilience pertaining to anti-social behaviour. Fergusson and Lynskey (1996) failed to identify any differences in resilience associated with gender across problem behaviour domains in their longitudinal cohort study of 16-year-old adolescents. In addition, Hoge *et al*. (1996) found comparable levels of resilience in male and female incarcerated offenders. In contrast, Smokowski *et al*. (2003) examined longitudinal relationships among childhood risk and protective factors and academic, social and mental health outcomes in a sample of inner-city minority youth. It was found that among other variables, being female predicted significantly lower rates of juvenile court involvement.

### Intelligence

A substantial body of literature implicates low IQ as a risk factor for delinquency. In particular, low verbal intelligence scores are illustrative of both self-reported and officially identified delinquent groups (Farrington, 1997). Conversely, high IQ has been identified as a protective factor against the onset of delinquency in high risk groups (Farrington, 1994; Kandel *et al*., 1988; Masten *et al*., 1999; White, Moffitt, and Silva, 1989). For example, Farrington (1994) found that boys who had high verbal IQ scores at age 10 were less likely to be involved in delinquency between the ages of 10 and 16, and delinquency and officially reported offending between the ages of 17 and 20 years. Kandel *et al*.(1988) hypothesised that criminal groups would have lower IQ scores than non-criminal groups. However this was found to be the case only in the high risk groups, thus suggesting a protective effect of IQ in high-risk groups. In a methodologically enhanced replication of this study in which IQ was assessed prior to criminal behaviour in a mixed sex sample, using the full continuum of delinquent behaviour rather than the extremes of the distribution, White *et al*.(1989) found that for both high-and low-risk groups an average or better than average IQ protected against later delinquency for both males and females.

### Locus of control

Locus of control represents one aspect of Rutter's (1966) social learning theory of personality and represents a generalised expectancy concerning the determinants of rewards and punishments in one's life. At one end of the continuum are people who believe in their ability to control life events (internal locus of control); at the other are people who believe that life's events such as rewards and punishments are the result of factors such as chance, luck or fate. Locus of control is also indicative of coping styles. Several studies have found internal locus of control to be a characteristic of resilient individuals (e.g. Cowan *et al*., 1997, Luthar; 1991; Werner and Smith, 1982).

### Self-esteem

Self-esteem is, according to Coopersmith (1967), the evaluation an individual makes and customarily maintains with regard to the self. In early research it was found that self-esteem was more directly influenced by conditions in the home and the immediate interpersonal environment than it was by external indicators of prestige (e.g. education, wealth, job title; Coopersmith, 1967). Children therefore appear to be influenced in their self-judgements through a process of reflected appraisal in which they take the opinions of them as expressed by others who are important to them and then use these

opinions in their own self-judgements (Basic Behavioural Science Task Force, 1996). It has been found that social cognition's relating to self-images exert a protective effect in various domains. Several studies have reported that resilient individuals possess self-confidence and positive self-esteem (Cicchetti and Rogosch, 1997; Cowen *et al*., 1992; 1997; Werner, 1995). Further studies have reported associations between resilience and relationships with parents, alternative caregivers and peers which implicate the enhanced self-esteem and self-worth resulting from these relationships as a protective process (e.g. Werner and Smith, 1982). However, Baumeister, Smart and Boden (1996) query whether high self-esteem is a sign of positive adaptation, and argue that excessively positive self-appraisals may be associated with the use of aggression and violence. Indeed there is some evidence in support of this (e.g. Fergusson and Lynskey, 1996; Hughes *et al*., 1987).

#### Temperament

Just as negative aspects of temperament or early personality characteristics have been implicated as risk factors for the development of delinquency and anti-social behaviour, so positive temperamental characteristics have been cited as protective factors against such behaviour in high-risk groups (e.g. Born, Chevalier and Humblet, 1997; Kim-Cohen *et al*., 2004; Moffitt *et al*., 1996; Smokowski *et al*., 2003; Werner, 1995).

It has been suggested that the protective function of temperament may reflect not only the inherited dispositions of behaviour regulation, but also influences from the environment. An easy temperament makes interactions with caregivers smooth and is also positively reinforced. Children with more difficult temperaments are more often the target of parental criticism, irritability and hostility (Rutter, 1990), all of which serve to increase the likelihood of them developing problem behaviour.

### Family characteristics

Many researchers suggest that parenting practices are important to consider in predicting child outcomes. A substantial body of empirical evidence supports the role of parenting characteristics in resilience (e.g. Bradley *et al*., 1994; Kim-Cohen *et al*., 2004; Landy and Tam, 1998; Prevatt, 2003). Such characteristics include high levels of maternal acceptance of the child (e.g. Bradley *et al*., 1994), maternal warmth towards the child (e.g. Kim-Cohen *et al*., 2004) maternal-child interaction and positive parenting practices (e.g. Landy and Tam, 1998). Aside from parenting practices *per se,* a good relationship with parents also promotes non-delinquency and suppresses serious delinquency in youngsters (Stouthamer-Loeber *et al*., 1993). Emotionally attentive, supportive and interested parents prove to be a major factor in the acquisition of social competence among children from deprived lower-class milieus (Osborn, 1990). It therefore appears that a substantial body of evidence supports the role of early parenting styles, parent-child interaction and the ongoing development of a good quality parent-child relationship in positive adjustment in high-risk groups.

### Extra-familial characteristics

One of the consistent factors to be associated with protection or people's ability to cope with stressful circumstances is the social support that a person has available to them (Sprott, Jenkins and Doob, 1998). For children, the quality of social relationships external to the family have been found to be important. Protective effects have been identified in a number of extra-familial domains, including attachment to adults other than parents, attachment to school and attachment to peers.

#### Attachments to adults

Attachment to a competent caregiver promotes experiences of emotional security even within other emotional contexts (Cummings and Davies, 1996). This may result in a structured, predictable, regulated environment that contributes to a healthy social and cognitive development. Because delinquents frequently come from an adverse family milieu, it is noteworthy that positive functions of attachment do not seem to be restricted to parents (Werner and Smith, 1982). They can be exercised by grandparents, older siblings, educators, teachers, members of faith groups or other persons outside the family (Werner, 1995). Such positive relationships give young people emotional security and, in addition, the feeling of being important to the other person. Extra-familial support is probably particularly important for youngsters from disadvantaged families because it provides them with a relationship that compensates for their social background. Supportive persons also provide models of active and constructive coping behaviour (Hetherington, 1989).

### School

A substantial body of literature supports the protective role of the school environment and school-based experiences (e.g. Dubois, *et al*., 1994; Jenkins and Keating, 1998; Werner, 1995). One of the main protective factors is school bonding. Thornberry (1998) argues that school bonding and attachment to teachers may have positive effects, similar to those of parental acceptance and supervision. Indeed, Dubois *et al*. (1994) found that youths that were exposed to multiple conditions of economic disadvantage were particularly more likely to benefit from perceived support by school personnel. Indeed perceived social support from school personnel was prospectively positively associated with a variety of academic and socio-emotional outcomes.

### Peer relationships

The role of peer relationships in resilience has received less attention than other potentially protective factors (Fergusson and Lynskey, 1996). Peers may be a protective factor when they have an emotionally supportive and development-promoting function (Bender and Losel, 1997). Stouthamer-Loeber *et al*. (1993), Farrington (1994) and Moffitt *et al*. (1996) found that non-delinquent peers or friends from school protected against the persistence or onset of criminality. Criss *et al*. (2002) found that peer acceptance moderated the association between environmental disadvantage, violent marital conflict and harsh discipline and child externalising behaviour problems. In addition, friendship served as a moderator for the association between harsh discipline and externalising behaviour problems. These findings lend support to previous studies that found similar protective effects of peer relationships for at-risk children although the outcomes assessed were not strictly anti-social behaviour or delinquency related (e.g. Bolger *et al*., 1995).

Although there is now a substantial body of resilience literature, few studies have examined the factors that prevent children engaging in anti-social behaviour prior to adolescence. In addition, there is a dearth of prospective longitudinal studies that have addressed this issue. In light of this, the present study examines the nature of resilience in a group of children identified as being at high risk of early anti-social behaviour.

## Aims of the current study

This study aimed to examine the association between resilience and a number of individual and familial social and psychological factors. Specifically the study aimed to:

- identify a high-risk group of children from the ALSPAC sample;
- describe the individual, familial and extra-familial characteristics of children within the high-risk group;
- identify a subgroup of resilient children who despite being members of the high-risk group do not report involvement in multiple forms of anti-social behaviour by age 8½ years;
- identify from the ALSPAC dataset the individual, familial and extra-familial characteristics that prospectively predict resilience;
- examine potential sex differences in the characteristics associated with resilience.

## Sample

The sample in the present study consists of the 6,553 children for whom data were available on anti-social behaviour and on the other variables of interest to this study. The study drew on data that were collected on the children's involvement in anti-social and other problem behaviours at age 8½[3]. Table 1.1 lists the behaviours asked about.

[3] Unlike the previous chapter, this study did not use data based on the children who reported involvement in anti-social behaviour at age 10 ½. The sample of children who were involved in anti-social behaviour both at age 8 ½ and 10 ½ was too small to run the analyses necessary for the purpose of this study. In addition, the form of questions which asked about involvement in anti-social behaviour at age 10 ½ differed from that asked at age 8 ½ and thus the data from the two time points are not directly comparable.

## Study definitions of high risk and resilience

### High risk

The definition of 'high risk' for the purpose of this study was based on the level of exposure to a number of 'risk factors'. The study used the Family Adversity Index (FAI) as a measure of risk factors. This index has been developed by the ALSPAC study team and describes various aspects of family functioning during pregnancy such as: major care giving problems; substance abuse; and involvement in crime (see Appendix A for more details about the index). The FAI was found to be associated with involvement in anti-social and other problem behaviours in another study based on the ALSPAC cohort (see Chapter one of this volume). In that study, greater levels of family adversity were associated with children who reported involvement in anti-social and other problem behaviours compared to those who were not involved in such behaviours. The FAI was therefore deemed to be a suitable measure on which to base the definition of high risk.

In line with a strategy used previously in similar studies (e.g. Fergusson and Lynskey, 1996) a point on the distribution of the FAI was selected so that children who experienced numbers of family adversities higher than the point selected were described as being at high risk. A consideration in deciding the cut-off point on the FAI scale was the size of the sample which needed to be sufficiently large for meaningful analysis to be conducted.

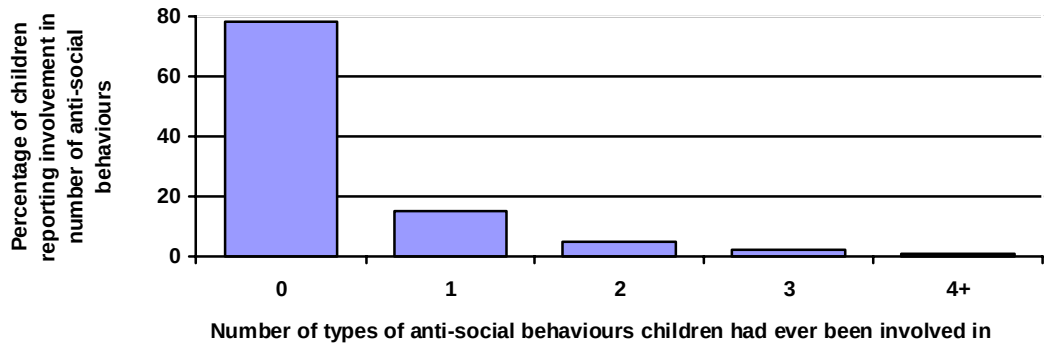
It follows that the 'high risk' group was comprised of *all children who were born into families experiencing at least three family adversities during the mother's pregnancy.*

### Resilience

The definition of 'resilience' for the purpose of this study was based on levels of self-reported anti-social and other problem behaviours.

As with the definition of high risk, the definition of resilience similarly required a cut-off point which would ensure a sufficiently large sample for the analysis. As shown in Figure 3.1 the majority of children in the sample reported involvement in no anti-social behaviours and a further 15 per cent reported involvement in only one type of anti-social behaviour.

***Figure 3.1: Distribution of whole sample by number of types of anti-social and other problem behaviours the children reported ever having been involved in up to age 8½***




The term *resilience* has therefore been used here to describe *children who are deemed to be at high risk but who self-reported involvement in none or only one type of anti-social or problem behaviour* ever by age 8½.

The definition of 'high risk' for the purpose of this study was based on the level of exposure to a number of 'risk factors'.

## Prevalence of high-risk and resilient groups

Table 3.1 shows the distribution of family adversity scores.

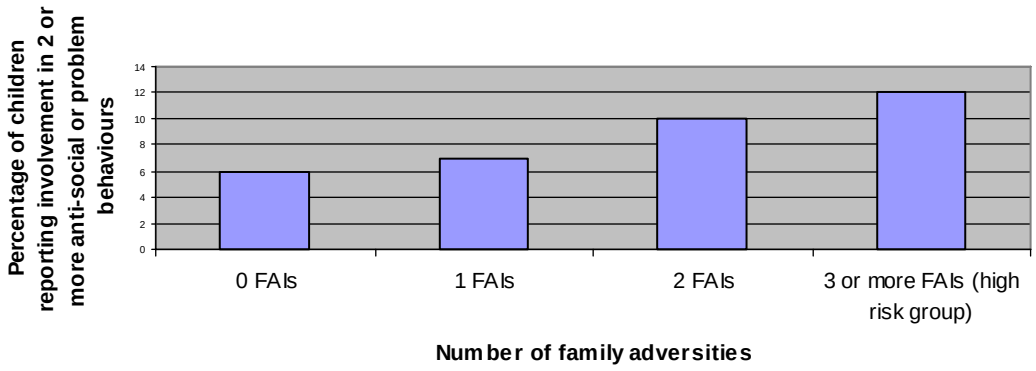
***Table 3.1: Distribution of family adversity scores***

| Number of family adversities | N | % of sample |
|---|---|---|
| 0 | 3,051 | 47 |
| 1 | 1,784 | 27 |
| 2 | 881 | 13 |
| 3+ | 837 | 13 |

As Table 3.1 shows, the high-risk group was comprised of 837 children; this was 13 per cent of the whole study sample (6,553).

Analysis of these data showed that the number of children reporting involvement in two or more anti-social and other problem behaviours increased as the number of family adversities increased. Figure 3.2 shows the percentage of children reporting involvement in two or more anti-social and other types of problem behaviour by the number of family adversities.

***Figure 3.2: Children reporting involvement in two or more anti-social and other problem behaviours by number of family adversities***




As can be seen, 12 per cent (n=93) of the high-risk group reported involvement in two or more problem behaviours by age 8½. The majority of children (n=740, 88%) within the high-risk group therefore reported fewer than two anti-social and other problem behaviours; in line with the definition set for this study, these children were termed the *resilient* group.

Further analysis based on logistic regression analysis also revealed that those in the high-risk group were more likely than the rest of the sample to report involvement in two or more anti-social and other problem behaviours. The odds of reporting at least two types of problem behaviour were 73 per cent higher for those children who were in the high-risk group compared with those who were not. This helps to justify the cut-off points used for the definitions of high risk and resilience used in this study.

## Characteristics associated with resilience

The characteristics assessed for the purpose of this study were based on those identified in previous studies as being related to the likelihood of resilience in high-risk groups. A variety of data collection methods were used; these are set out in Table 3.2.

***Table 3.2: Timing and methods of data collected***

| Category of characteristic | Characteristics examined | Data collection method | Age of child at observation |
|---|---|---|---|
| **Child characteristics** | Prosocial behaviour that benefits other people, e.g. empathy | Parental questionnaire | 4 and 6¾ years |
| | Peer problems – relationships and interaction with peers | Parental questionnaire | 4 and 6¾ years |
| | Friendships – contentment and association with friends | Semi-structured child interview | 8½ years |
| | Intelligence – performance IQ | Clinic-based cognitive task | 8½ years |
| | Intelligence – verbal IQ | Clinic-based cognitive task | 8½ years |
| | Locus of control – the belief in one's ability to control life events | Semi-structured child interview | 8½ years |
| | Self-esteem – e.g. how happy children are with themselves | Semi-structured child interview | 8½ years |
| | Attachment to adults (mother, father, teacher) | Parental questionnaire | 7½ years |
| **Family characteristics** | Family adversity – e.g. parental criminality, financial difficulties, inadequate housing | Parental questionnaire | Mother's pregnancy<br>Birth – 2 years<br>2 – 4years |
| | Parenting skills – parental interaction with the child | Parental questionnaire | 6 months<br>1½ years<br>3 years<br>3½ years |
| | Parenting experiences – e.g. parental bonding and perceived levels of confidence with the child | Parental questionnaire | 8 months<br>1¾ years |
| **Extra-familial characteristics** | School enjoyment – e.g. child looks forward to going to school, bored by school, stimulated by school | Parental questionnaire | 4½ years<br>7½ years<br>8½ years |
| | | Semi structured child interview | 8½ years |

Table 3.2 shows the method used to collect data on each characteristic measure and the time point that the data were collected. The table also shows the overall factor to which each characteristic corresponds. It can be seen from this table that for each of the broad groups of measures referred to (column 1) multiple assessments were available in the ALSPAC dataset (columns 2 and 3). In some cases these were the same measure repeated over time and in other cases more than one measure was used in the study. (For further details on the nature of the characteristics, see Appendix B.)

To explore any differences in the characteristics associated with resilience, the characteristics of the high risk and the remaining resilient children were compared.

Each characteristic was assessed through a number of standardised tests that led to individual scores (see C3 for further details of the tests). Each individual score was then treated as a separate variable.

A three-step regression process was used to determine which of the characteristics were associated with resilience and which characteristics were the most important for predicting resilience. (Full details of the analyses are at Appendix C3.)

### Step one

From a comparison of the scores between the high risk and the remaining children, it was found that the resilient children:

- were more prosocial at age 6¾ years;
- had significantly fewer peer problems at age 4;
- achieved significantly higher performance IQ scores at age 8½;
- had significantly higher levels of self-esteem at age 8½;

- were rated by parents as enjoying school more at 4½ years and 7½ years;
- were more likely to report liking school at age 8½;
- had mothers who, when the child was aged 1½, scored significantly higher on parenting and surprisingly, mothers who, when the child was aged 1¾, reported less positive parenting experiences;
- had experienced significantly lower levels of adversity throughout all three assessment periods (pregnancy, 0–2 years, 2–4 years).

For details of this analysis see Table C3.1.

## Characteristics predictive of resilience

The data were further analysed to explore the characteristics which were predictive of resilience. A regression model was used to predict resilience from each individual variable. In addition, any interaction with gender was explored to determine whether there were sex differences in the predictors of resilience. The results of this analysis are summarised in Table 3.3. Further details of the analysis are presented in Appendix C, Table C3.2.

***Table 3.3: Summary of individual regression models***

| Category of characteristic | Characteristic | Predicted resilience | Interaction with gender |
|---|---|---|---|
| **Extra-familial characteristics** | School enjoyment 4½ yrs | * | |
| | School enjoyment 7½ yrs | * | |
| | School enjoyment 8½ yrs | * | |
| **Child characteristics** | Self-esteem 8½ yrs | * | |
| **Family characteristics** | Positive parenting experiences 1¾ yrs | * | * |
| | FAI 2–4 yrs | * | |
| **Child characteristics** | Verbal IQ 8½ yrs | | * |
| **Family characteristics** | Attachment to father 7½ yrs | | * |
| **Child characteristics** | Prosocial behaviour 4 yrs and 6¾ yrs | - | - |
| | Peer problems 4 yrs and 6¾ yrs | - | - |
| | Friendships 8½ yrs | - | - |
| | Performance IQ 8½ yrs | - | - |
| | Verbal IQ 8½ yrs | - | - |
| | Locus of control 8½ yrs | - | - |
| **Family characteristics** | Attachment to mother 7½ yrs | - | - |
| **Extra-familial characteristics** | Attachment to teacher 7½ yrs | - | - |
| **Family characteristics** | Positive parenting experiences 8 months | - | - |
| | Parenting skills – all assessments | - | - |
| | FAI 0-2 yrs | - | - |

*Note: Those variables in the upper segment of the table have been ranked in order of importance. Those in the lower section were not predictive of resilience*
*statistically significant differences at the five per cent level

As shown in Table 3.3 the following variables were found to be significantly associated with resilience when considered individually.

- School enjoyment (parental questionnaire) at 4½; 7½; and, 8½ years.
- Higher levels of self-esteem at age 8½.
- Positive parenting reported by mothers when the child was 1¾.
- Low levels of family adversity reported at age 2–4 assessment.

In addition to the above, three significant gender interactions were identified.

- Verbal IQ was a significant predictor of resilience for girls but was not a significant predictor for boys.
- Attachment to father was more important as a predictor of resilience for boys than it was for girls, although in neither instance was it a significant predictor (family characteristics).
- Positive parenting experiences were a significant predictor of resilience for girls but were of little importance in this context to boys.

### Step two

Based on the findings of the individual regression models as presented in Table 3.3, further analysis was conducted on the 'attitude to school' variables to determine which was the most important for predicting resilience. As these variables were all significant in the individual regression model, they were entered as a block into another regression model. This analysis revealed that both enjoyment of school at age 4½ and liking school at age 8½ independently predicted resilience. (Details of this analysis are presented in Appendix C.)

### Step three

In the final step of the analysis all of the variables that had predicted resilience in steps one and two were entered together as one block of variables in a final regression model. This analysis enabled the most important variables in predicting resilience to be identified. The results of this analysis are summarised in Table 3.4 below. (Further details are presented in Appendix C, Table C3.3.)

***Table 3.4: Results of multivariable regression analysis***

| Category of characteristic | Characteristic | N | Direct | Interaction |
|---|---|---|---|---|
| **Extra-familial characteristics** | School enjoyment 4½ yrs | **522** | * | - |
| | School enjoyment 8½ yrs | **522** | * | - |
| **Family characteristics** | Close to father 7½ yrs | **522** | - | * |
| **Child characteristics** | Verbal IQ 8½ yrs | 506 | - | - |
| | Self-esteem 8½ yrs | 488 | - | - |
| **Family characteristics** | Positive parenting experiences 1¾ yrs | 488 | - | - |
| | FAI 2 – 4y | 511 | - | - |

*Note: Those variables in the upper section of the table have been ranked in order of importance. Those in the lower section were not predictive of resilience*
** denotes statistically significant differences at the five per cent level*

Table 3.4 shows that the following three variables independently predicted resilience.

- School enjoyment at 4½ years.
- School enjoyment at 8½ years.
- Attachment to father at 7½ years.

Children who reported that they liked school at 8½ years were 44 per cent more likely to be resilient at the age of 8½. However, as both resilience and liking school were assessed at the same time point, it is beyond these data to determine that reports of liking school causally affected the odds of being resilient.

## Gender differences in characteristics associated with resilience

As seen in the preceding analysis the most significant predictor of resilience was gender in that girls were significantly more likely to be resilient than boys. Because of the potential for gender bias in the results, the analyses were reconducted on the sample of boys only.

In line with the findings from the overall sample of boys and girls, school enjoyment remained an important factor. The resilient boys, in contrast to the remaining high-risk boys, were significantly more

likely to report enjoying school at the age of 8½ and were more likely to have been rated as liking school by parents at the age of 4½ assessment and the 7½ assessment.

High levels of parenting skills were also significantly associated with resilience amongst the boys-only sample, although this only related to parenting at ages 1½ and 3½.

Having a high level of prosocial behaviour (demonstrating behaviours that benefit other people) was a further characteristic which was found to be associated with resilience amongst the boys only sample.

In contrast to the findings from the overall sample, self-esteem and family adversity were not variables which were found to be associated with resilience amongst the boys-only sample.

## Gender differences in characteristics predictive of resilience

The characteristics which were found to be predictive of resilience in the boys-only sample are presented in Table 3.5 (the full results of this analysis are available at C3.5, 6 and 7).

***Table 3.5: Characteristics predictive of resilience for boys only***

| Category | Characteristic |
|---|---|
| Extra-familial | **School enjoyment *7½ years* *** |
| | **School enjoyment *8½ years* (parent and child rating)*** |
| Child characteristic | Prosocial behaviour 6y 9m |
| Family characteristic | **Parenting skills 3½ years *** |

** These characteristics remained independently predictive of resilience even after accounting for the possible influence of the other variables*

Table 3.5 shows that in line with the findings on the overall sample, school enjoyment continued to be a significant predictor of resilience. However, unlike the findings from the whole sample, the first assessment time point (age 4½) for school enjoyment did not emerge from the boys-only data as being significantly predictive.

A high level of parenting skills at age 3½ emerged from this analysis as independently significantly predicting resilience amongst the boys in the sample.

An earlier finding based on the analysis conducted on the whole sample (Table 3.3) showed that attachment to father was a significant predictor for boys but not for girls. Although this finding did not emerge significantly from the analysis on the boys-only data, the findings did still show that attachment to father was positively associated with resilience in boys.

# Appendix A. Items in the Family Adversity Index

In order to control for the impact of an adverse family environment throughout the observation period, a Family Adversity Index was used (Steer, Wolke and the ALSPAC study team, 2004). The FAI consisted of 18 items taken from questionnaires that were administered throughout pregnancy (8, 12, 18 and 32 weeks gestation). Summing items that reflected the family-based risk factors devised the score. The following items were used in the FAI; the number of elements making up an item is presented in brackets.

- Age of mother (1): < 20 years at first pregnancy/childbirth.
- Housing (3): a) inadequacy: crowding index / periods of homelessness b) Basic living: no availability of hot water, or no indoor toilet, bath or shower, or no kitchen c) major defects/infestation.
- No educational qualifications (mother or father) (1).
- Financial difficulties (1).
- Partner relationship (4) a) status b) affection and aggression c) physical/emotional cruelty d) no social support.
- Family (2): a) family size (> 4 children) b) Major care-giving problems (child in care/not with natural mother, or on social services at risk register).
- Social network (2): a) no emotional support b) no practical/financial support.
- Maternal affective disorder (1): Depression, anxiety and suicidality.
- Substance abuse (1): drugs or alcohol (use of hard drugs, alcoholism, high alcohol consumption).
- Crime (2): a) In trouble with police, or b) convictions.

# Appendix B. Full description of measures

## Anti-social behaviour

At age 8½, 11 questions regarding anti-social activities were taken from the self-reported anti-social behaviour for young children questionnaire (Loeber *et al*., 1989). The behaviours enquired about included: stealing (bicycles, from a shop, from a house/garden, from a car, entered a building to steal, pick-pocketing); substance use (drunk alcohol, smoked cigarettes without parental permission), set fire, carried a weapon and cruelty to animals. The assessment was conducted as a structured interview and the answers provided in the format of a posting task. Each of the questions was written on a different envelope. The children were asked to place the envelope into one of two boxes marked as 'ever' or 'never' depending on their answer.

At age 10½, 12 questions regarding the child's participation in anti-social activities during the last six months were asked, and each question was preceded by a question in which the child was asked whether his/her friends had done the anti-social activity of interest in the last six months. The child was also asked how frequently he or she had participated in the activity, and for some questions (e.g. getting into fights) further questions were asked (e.g. was a weapon used, was the fight public disorder, and whether the child was injured). The activities enquired about included: truancy; destroying something for fun; setting fire; stealing; getting into fights; cruelty to animals and birds; smoking cigarettes without parental permission; drinking alcohol without parental permission; and smoking cannabis. The data used in this study concerned the incidence rather than the frequency of each anti-social behaviour.

## Attachment to adults

At 91 months parents were asked to complete the Development and Well Being Assessment (DAWBA) (Goodman, Ford, Richards, *et al*., 2000). The DAWBA is a package of interviews, questionnaires and rating techniques designed to generate ICD-10 and DSM-IV psychiatric diagnoses on 5- to 17-year-olds (Goodman *et al*., 2000; www.dawba.com). The diagnoses cover the major emotional, behavioural and hyperactivity disorders. Amongst the items are those relevant for diagnosing separation anxiety that consist of items enquiring about strong attachments to certain individuals in particular and the overall number of strong attachments held by the child. For this study, the items concerning strong attachment to mother, father and teacher were used, as well as the number of attachments held by the child. In each instance the parent simply indicated whether the child had strong attachments to each adult (yes/no) and gave a numerical value for the number of attachments held.

## Cognitive ability

Several measures of cognitive ability were employed. Firstly, the Language score from the MacArthur Infant Communication Questionnaire (Fenson *et al.,* 1991) was used. Mothers completed this scale at two years and three years. The Language score consisted of summing the scores from subscales measuring vocabulary, tenses, plurals and grammar ability. For each item, the parent is asked whether the child says a listed word and whether he or she understands it. If the child neither says nor understands the listed word a score of zero is given. If the child understands the word a score of one is given and if the child says the word a score of two is given. For the remaining subscales a score of zero is given if the child is yet to master the language skill described, one is given if he or she sometimes achieves the skill described and two is given if he or she often achieves the skill described. High scores therefore reflect more advanced language skills.

Secondly, an adaptation of the Denver Developmental Screening Test (DDST; Frankenburg and Dodds, 1967) was administered at six months, 1½ years, 2½ years and 3½ years. The DDST is a standard validated test of early childhood development. It is a developmental screening test for ages from birth to six years, which is designed to cover the developmental areas of gross and fine motor, social, cognitive, expressive language, receptive language and self-help skills. A three-point likert-type scale is employed for all subscales with 3 = often, 1 = once or twice and 0 = not started yet. At six and

18 months the total score obtained from summing the social, fine and gross motor, and communication skills subscales was used. At age 2½ and 3½ years the communication scale was not administered and so the total score from summing the social, fine and gross motor skill subscales was used.

Finally, the children completed the Test of Everyday Attention (TEACh; Manly, 1997) during clinic sessions at eight years. This test assessed children's selective, sustained and attentional control/switching abilities. The selective attention task (sky search) examined children's ability to filter information and reject irrelevant/distracting information. The child had to circle pairs of identical spaceships from an array of non-identical and identical spaceships as quickly as possible, whilst trying to avoid missing any set of spaceships out or making any errors. This task was repeated with the non-identical pairs of spaceships removed in order to determine the child's motor performance that is used to adjust the attention focus scores.

In the divided attention task (Sky Search DT) children repeated the selective attention task, but in addition they had to count the number of spaceship noises played together in series of differing lengths throughout the task. The scores for this test were determined initially by dividing the task completion time by the number of correctly circled identical pairs, and this score was then weighted to account for the child's performance on the counting task. This was achieved by dividing the number of noises counted correctly by the total number of noises presented and then dividing the initial performance score by this noise identification score.

The opposite worlds subtask of the TEACh is a timed measure of attentional control and switching. Children are required to give a verbal response that contradicts the visual information he or she is given. In the 'same world' condition the child is presented with a trail made up of the numbers one and two, with 24 numbers in total. The child must read out the numbers as they are as quickly as possible. In the 'opposite world' condition, the child performs this task and has to call out 'two' when he or she reaches one and 'one' when he or she reaches two. The examiner points and moves to the next number only after a correct response. Therefore incorrect responses incur a time penalty.

## Conduct problems

Hyperactivity and impulsivity were assessed through two mother-report questionnaires, the Hyperactivity index of the Revised Rutter Behaviour Scale (RRBS; Elander and Rutter, 1996) administered at 3½ years and the Hyperactivity scale of the Strengths and Difficulties Questionnaire administered at age 4 and 6¾. The four hyperactivity items of the RRBS included items such as 'Is restless, runs about or jumps up and down'. The RRBS employs a three-point likert-type scale where 0 = not like him/her and 3 = certainly like him/her. High scores indicate higher levels of hyperactivity.

The SDQ hyperactivity scale consists of five items such as 'she is constantly fidgeting or squirming'. A three-point likert-type scale indicate the extent to which the item matches the behaviour of the child from 1 = not like him/her to 3 = certainly like him/her. High scores represent greater levels of hyperactivity.

Conduct problems were assessed at three time points, using two different measures: the RRBS at 3½ years and the SDQ at age 4 and 6¾. The RRBS conduct problems scale consists of eight items, including 'blames others for things'. Respondents use a three-point likert-type scale to indicate that their child 'certainly, sometimes, or never' likes the item. High scores reflect more problematic conduct. The conduct problem scale of the SDQ is a five-item scale that includes items such as 'bullies other children'. Once again a three-point likert-type scale is used, and high scores reflect more problematic conduct.

## Intelligence

*A*t 8½ years children completed the WISC-III UK in order to assess cognitive function (Wechsler, Golombok and Rust, 1992). A short form of the measure was employed where alternate items were used for all subtests. The ten WISC subtests comprise five verbal subtests: information (child's knowledge); similarities; arithmetic; vocabulary and comprehension, and five performance subtests: picture completion; coding; picture arrangement; block design and object assembly. Raw scores were

calculated according to the items used in the alternate item form of the WISC. This was achieved by summing the individual items within each subtest and multiplying by two for picture completion, information, arithmetic, vocabulary, comprehension and picture arrangement; multiplying by five/ three for similarities; and multiplying by three/ two for object assembly and block design. This resulted in scores that were comparable to those that would have been obtained had the full test been administered. Age-scaled scores were obtained by consulting the look-up tables in the WISC-III UK manual, and total scores were calculated for the performance and verbal scales. At this point scores were prorated. If a child obtained a score on only four out of the five subtests one each of the performance or verbal scales, the total scores for each scale could still be calculated by substituting the mean of the four available scaled scores in for the fifth score and summing in the usual way. This was done in accordance with WISC instructions. For the purpose of this study the age-scaled verbal, performance and total WISC scores were used.

## Friendships and peer problems

Data regarding the nature of friendships and popularity were obtained from two sources: the peer problems scale of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1999) administered in questionnaire form and completed by the mother at 4 and 6¾ years. The SDQ peer problems scale included five items. These were 'child was solitary and played alone', 'had at least one good friend in the past six months', 'generally liked by other kids', 'been bullied in the last six months' and 'got on better with adults'. Items were rated on a three-point likert-type scale with 1 = not true and 3 = certainly true. Scores ranged from 5 to 15 with high scores indicating problematic peer relationships.

Five questions were also incorporated into the interview session regarding contentment with friends. These five items were taken from the Cambridge Hormones and Moods project Friendship questionnaire (Goodyer, 1990). The items included: 'Are you happy with the number of friends you've got?' 'How often do you see your friends outside of school?' 'Do your friends understand you?' 'Do you talk to your friends about problems?' and 'Overall how happy are you with your friends?' The items were coded so that a score of zero denotes the most positive friends score, and a score of 15 denotes the least positive. Children who responded 'don't know' to at least one question were excluded from the score, as were those with at least one missing response. Taken together, the data from these scales were such that high scores reflected low popularity and peer problems.

## Locus of control

A shortened version of the Nowicki-Strickland Internal-External scale for pre-school and primary children was administered to the children at 8½ years. In order to overcome some literacy difficulties, the 12 questions were read out to the child by the examiner and the child was asked to respond with a yes/no answer. The scores were derived from summing the number of answers that indicated an external locus of control orientation. Therefore the possible scores ranged from 0–12 with high scores indicating more external locus of control, and low scores indicating more internal locus of control.

## Negative emotionality

This construct was assessed through four questionnaire-based measures. Firstly, a temperament index administered at four weeks that measured emotionality. This scale consisted of items describing the child as 'grizzly, fretful, demanding and angry'. For each item a four-point likert-type scale was used to indicate the extent to which the description matched the infant from 0 = not like to 4 = very like. For these four items possible scores ranged from 0 to 16 with 16 indicating a higher level of difficultness.

The second scale was the mood scale from the Carey's Toddler Temperament Questionnaire (Carey and McDevitt, 1977) that was administered at six months and again at age 2. This index consists of the sum of ten items including 'he is fussy on waking up (frowns, complains, cries)'. Each item is scored according to a six-item likert-type scale from 1 = almost never, to 6 = almost always. Possible scores range from 10 to 60 with high scores indicating more negative mood.

A third scale consisted of the emotionality index of Buss and Plomin's EAS Temperament Questionnaire (Buss and Plomin, 1984). This was administered at 38 months. This index consisted of

five items including 'reacts intensely when upset'. These items were scored according to a five-item likert-type scale ranging from 0 = not at all like him/her, to five exactly like him/her. Possible scores ranged from five to 25 with high scores indicating higher levels of emotionality.

Finally, a question regarding the number of temper tantrums that the child had was included from a battle of wills questionnaire (see Needleman, Stevenson and Zuckerman, 1991). This question was asked at 1½; 2½; and 3½ years.

## Parenting

Six assessments of maternal parenting were taken in the first 3½ years of the child's life. At six months, 1½, 3 and 3½ years a parental interaction score was derived from ten items reflecting different activities that a parent might participate in with their child such as bathing, feeding, putting to bed, singing, and so on. For each item mothers reported the frequency that they participated in such activities from 4 = often to 0 = never. The overall maternal interaction score was derived at each time point by summing the scores of the ten items. Thus a high score reflects a higher level of maternal interaction.

At eight months and 21 months post-partum, mothers completed a questionnaire concerning maternal bonding. This questionnaire consisted of two subscales, a maternal enjoyment of baby, and maternal confidence subscale. The maternal enjoyment of baby subscale comprised five items such as 'I really enjoy my baby' and 'it is a great pleasure to watch my baby develop'. The maternal confidence subscale consisted of six items such as 'I feel confident with my baby' and 'I feel constantly unsure if I'm doing the right thing for my baby'. For each item, participants rated how applicable the statement is to their personal feelings from 1 = never feel to 4 = exact feeling. The overall 'maternal bonding' score was derived from summing the two subscale scores with potential scores ranging from 4–44 with higher scores illustrating closer bonding to the child.

## Prosocial behaviour

Empathy was assessed using the SDQ 'prosocial' scales at age 4 and age 6¾. This scale consisted of five items. Items included 'she has been considerate of other people's feelings'. As with all SDQ scales a three-point likert-type scale indicates the extent to which the item matches the behaviour of the child from 1 = not like him/her to 3 = certainly like him/her. High scores represent greater levels of prosocial behaviour.

## School enjoyment

The variables relating to attitudes to school reflect two separate measures. At 4½ years and 7½ years, mothers completed questionnaires that included items concerning their child's enjoyment of school. This scale consisted of seven items such as 'child looks forward to going to school', 'child enjoys school' 'child is stimulated by school', 'child is frightened by school (reverse coded)', 'child talks about new school friends', 'child is bored by school (reverse scored)', and 'child likes his teacher'. In each instance parents rate how often the item is a correct representation of their child's experience from 1 = not at all, to 4 = always (reversed for reverse scored items). The overall school enjoyment variable is derived from summing the item scores with high scores reflecting a more positive school experience.

The third school-related variable comes from the age 8½ friends and peers interview in which details of bullying involvement were the primary focus. Initial questions, however, enquired about the child's school, and included one question 'how much do you like school?' Children's responses were coded on a likert-type scale from 1 = very much to 4 = do not like school. For the purpose of this study, scores were reversed so that high scores indicated more favourable opinions of school.

## Self-esteem

Self-esteem was measured using a 12-item shortened form of Harter's Self-Perception Profile for children (Harter, 1985) comprising the global self-worth and scholastic competence subscales. Each item consisted of two statements, one negative and one positive, for example, 'some children are often unhappy with themselves', 'other children are pretty pleased with themselves'. Participants had

to indicate for each statement whether it was ‘sort of true for me’ or ‘really true for me’. Scoring was as follows: Negative statements - really true for me = 1; sort of true for me = 2; Positive statements - sort of true for me = 3; really true for me = 4. Items were coded so that when summed, high scores on each subscale reflected higher self-esteem. Scores ranged from 0–24 on each subscale.

## Shyness

Shy and fearful temperament was assessed through two measures: the approach index of the Carey TTQ, assessed at six months and at age two years and the shyness scale of the EAS administered at three years. The approach index of the TTQ included items such as ‘his initial reaction to seeing the doctor is acceptance’ and, consistent with the other TTQ items, a six-item likert-type scale is used. The EAS shyness index included items such as ‘she is very friendly with strangers’ and items were scored according to a five-item likert-type scale ranging from 0 = not at all like him/her, to 5 = exactly like him/her.

# Appendix C. Details of statistical analyses

## Prevalence of anti-social subgroups

Cramer's V statistic was used to identify gender differences in the composition of the anti-social behaviour subgroups. A significant effect of gender was found: V = 0.267; p value =.000.

## Gender differences in the extent of anti-social behaviour

Mann-Whitney U statistics were used to examine whether there were significant differences in the amount of anti-social behaviour reported by males and females. The 8½ and 10½ year data are summarised below.

***Table C2.1: Comparisons in the anti-social behaviour scores of males and females***

| | **Male Mean (M) Standard Deviation (SD)** | **Female M (SD)** | **U value** |
|---|---|---|---|
| 8½ years | 0.43 (0.96) | 0.23 (0.70) | 4,762,869.000*** |
| 10½ years | 0.36 (0.78) | 0.09 (0.36) | 4,875,950.500*** |

***p<.001

## The prevalence of anti-social behaviour by group

To determine whether the children that reported anti-social behaviour at both time points reported more anti-social and other problem behaviours than the children who reported at age 8½ only and the children who reported at age 10½, only Mann-Whitney U tests were used. In both cases it was found that those reporting at both time points reported more anti-social behaviour: at age 8½: both time point children: Mean = 1.85, Standard Deviation = 1.17; age 8½ only: Mean = 1.45, SD = 1.02; U = 120932.500; p =.000; at age 10½: both time point: Mean = 1.59, SD = 1.09; age 10½ only: Mean = 1.27, SD = .68; U = 72193.500; p = .000.

## Differences across behaviours between groups

***Table C2.2: Differences in anti-social behaviours reported at age 8½ by children reporting anti-social behaviour at both time points and children reporting at age 8½ only***

| | **% and (n) of children reporting at age 8½ only** | **% and (n)of children reporting at both time points** | **Chi Squared** |
|---|---|---|---|
| Stole skateboard | 3.8 (34) | 4.6 (16) | .346 |
| Stole from shop | 18.1(160) | 19.7 (69) | .388 |
| Stole from house | 13.5 (119) | 14.2 (50) | .114 |
| Stole from car | 5.2 (46) | 5.4 (19) | .027 |
| Drank alcohol | 18.1 (160) | 30.2 (106) | 21.674*** |
| Smoked cigarettes | 9.5 (84) | 19.9 (70) | 25.401*** |
| Set fire to property | 3.6 (32) | 8.0 (28) | 10.443** |
| Carried a weapon | 32.2 (285) | 49.3 (173) | 31.469*** |
| Broke into building | 2.0 (18) | 2.6 (9) | .340 |
| Stole purse | 4.4 (39) | 4.0 (14) | .100 |
| Cruel to animals | 33.4 (296) | 27.6 (27) | .027* |

*p<.05; **p<.01; ***p<.001

***Table C2.3: Relative risk ratios and 95 per cent confidence intervals (CIs) reflecting the likelihood of further involvement in anti-social and other problem behaviours at age 10½ based on anti-social acts at age 8½***

| Activity | Relative risk | 95% Confidence Interval (CI) |
|---|---|---|
| Stole bike/skateboard | 1.136 | .751 – 1.718 |
| Taken from a shop without paying | 1.073 | .861 – 1.339 |
| Stolen from house/garden/garage | 1.045 | .812 – 1.344 |
| Stolen from a car | 1.034 | .700 – 1.525 |
| Drank alcohol | 1.575 | 1.311 – 1.892* |
| Smoked a cigarette | 1.755 | 1.437 – 2.144* |
| Told off by teacher | 1.607 | 1.048 – 2.465* |
| Set fire to property | 1.703 | 1.280 – 2.267* |
| Carried a weapon in case of a fight | 1.652 | 1.387 – 1.967* |
| Entered a building to steal | 1.181 | .688 – 2.029 |
| Snatched a purse/wallet | .930 | .588 – 1.470 |
| Cruel to an animal or bird | .819 | .670 – 1.001 |

*Significant as 95 per cent CI's do not pass through 1.

***Table C2.4: Differences in anti-social behaviours reported at age 10½ by children reporting at both time points and children reporting at age 10½ only***

| | % and (n) of 10 ½ only children | % and (n) of Both time point children | Chi squared |
|---|---|---|---|
| Truanted | 9.0 (44) | 8.3 (29) | .139 |
| Destroyed something | 5.9 (29) | 8.3 (29) | 1.728 |
| Set fire to something | 3.9 (19) | 6.6 (23) | 3.060 |
| Stolen something | 5.3 (26) | 11.4 (40) | 10.430** |
| Got into fight | 74.8 (366) | 75.5 (265) | .046 |
| Cruel to animals | 3.5 (17) | 8.5 (30) | 9.946** |
| Smoked cigarettes | 6.5 (32) | 10.3 (36) | 3.835* |
| Drank alcohol | 7.6 (37) | 15.7 (55) | 13.756*** |
| Smoked cannabis | 0 | 0 | - |

*p<.05; **p<.01; ***p<.001

## Characteristics associated with anti-social behaviour subtype

The final two aims of the study were to determine whether anti-social behaviour group membership is associated with scores on a variety of family adversity and child individual characteristics assessed longitudinally from birth, and moreover, whether certain characteristics are more important in discriminating between anti-social behaviour groups.

In order to address the first part of this question, a series of four (group) by two (gender) multivariate analyses of variance were conducted. In each MANOVA, variables that represent the same construct assessed at different time points were analysed together and treated as new dependent variables. Although MANOVA protect against type I errors (i.e. rejecting the null hypothesis even when it is true), each of the resulting univariate ANOVA were corrected for repeated testing using a Bonferroni adjustment. Where necessary the data were transformed to correct for non-normal distributions and facilitate parametric analyses. For ease of interpretation non-transformed means and standard deviations are presented where appropriate. The descriptive statistics and resulting F ratio with significance levels obtained for all of the univariate ANOVAs are presented in Table C2.5. Games-Howell post-hoc tests were used to examine pairwise differences between groups.

The multivariate results of each MANOVA are summarised below.

## 1. Family adversity

The multivariate statistics indicated that there was a significant main effect of group (F statistic (9, 5379) = 31.314; p value = 0.000), gender (F(3, 5377) = 5.556; p = 0.001.) and a significant group by gender interaction (F(3, 5379) = 7.193; p = 0.000) with levels of family adversity.

## 2. Negative emotionality

A MANOVA was conducted on the five negative emotionality measures that consisted of difficultness at 4 weeks, mood at six months and at two years, Emotionality at three years and a mean aggregate temper tantrums score across 3½ years post-partum. The multivariate analyses revealed a significant main effect of group (F(5, 4600) = 3.430; p = 0.004) and a significant main effect of gender (F(5, 4598) = 3.945; p = 0.001). However the interaction between group and gender was not significant (F(5, 4600) = 1.705; p = 0.130).

## 3. Shyness

A MANOVA was conducted on the three assessments of extraversion: approach at six months and at two years, and shyness at three years. The multivariate analyses yielded a significant effect of group (F(3, 4718) = 5.719; p = 0.001) and a significant main effect of gender (F(3, 4716) = 4.478; p = 0.004). However, the group x gender interaction was non significant (F(3, 4718) = 1.382; p =(not significant)).

## 4. Development

A MANOVA was conducted on the data obtained from four assessments of development conducted at six months, age 1½, 2½, and 3½ . The multivariate analyses revealed no significant main effect of group (F(4, 4872) =1.475; p = 0.207), but a significant main effect of gender was identified (F(4, 4870) = 37.074); p = 0.000). No significant gender x group interaction was found (F(4, 4872) = 1.016; p = 0.398).

## 5. Language

A MANOVA was conducted on the data from two assessments of language at age two and three. A significant multivariate effect was identified for group (F(3, 5008) = 7.756; p =0.001), and gender (F(2, 5008) = 22.396; p = 0.000) and the group x gender interaction was also significant (F(3, 5009) = 3.217; p = 0.022).

## 6. Hyperactivity and conduct problems

A MANOVA was conducted on the hyperactivity and conduct problems data obtained at age 3½, 4 and 6¾. A significant multivariate effect was identified for group (F(6, 4717) = 20.559; p = 0.000), and gender (F(6, 4717) = 3.968; p = 0.001), but no significant multivariate interaction between group and gender was identified (F(6, 4719) = 1.645; p = 0.131).

## 7. Prosocial behaviour and empathy

A MANOVA was conducted on the four assessments relating to prosocial behaviour and empathy. Multivariate analyses revealed a significant effect of group (F(4, 4728) = 10.942; p = 0.000) and gender (F(4, 4726) = 8.678; p = 0.000) and a significant group x gender interaction (F(4, 4728) = 2.852; p = 0.022). However, inspection of the univariate analyses in Table C.7 indicates that none of the group x gender interactions for each specific scale examined were significant.

## 8. Peer problems and friendships

A MANOVA was conducted on the three assessments of peer problems and friendships. The multivariate analysis yielded a significant effect of group (F(3, 4709) = 23.118; p = 0.000) and gender (F(3, 4707) = 2.886; p = 0.034). In addition a significant multivariate group x gender interaction was identified (F(3, 4709) = 3.212; p = 0.022).

## 9. Attention

A MANOVA was conducted on the four attention subscales. Results indicated a significant multivariate effect of group ($F(4, 5002) = 4.889$; $p = 0.001$) and gender ($F(4, 5000) = 16.255$; $p = 0.000$) but the group x gender interaction was non-significant ($F(4, 5002) = 2.479$; $p =$ not significant).

## 10. Intelligence

A MANOVA was conducted on the two WISC subscales: verbal and performance IQ. A significant multivariate effect of group ($F(3, 5209) = 23.795$; $p = 0.000$) and gender ($F(2, 5208) = 11.248$; $p = 0.000$) was identified, but the group x gender interaction was non-significant ($F(3, 5209) = 2.419$; $p = 0.064$).

***Table C2.5: Summary of descriptive statistics and univariate ANOVAs across measures***

| | | Reporting no behaviours | Reporting at age 8½ only | Reporting at age 10½ only | Reporting at both time points | Male | Female | Gender | Group x gender |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean (M) Standard Deviation (SD) (n = 3796) | M (SD) (n = 812) | M (SD) (n = 453) | M (SD) (n = 326) | M (SD) (n = 2657) | M (SD) (n = 2730) | F statistic (1,5379) | F statistic (3,5397) |
| **1. FAI** | **Pregnancy** | .90 (1.28) | .99 (1.26) | 1.27 (1.49) | 1.46 (1.74) | .99 (1.34) | .96 (1.34) | 14.563*** | 7.111*** |
| | **0 – 2 years** | 1.54 (1.75) | 1.70 (1.80) | 1.92 (1.96) | 2.28 (2.14) | 1.65 (1.82) | 1.64 (1.81) | 10.688** | 2.948* |
| | **2 – 4 years** | 1.00 (1.24) | 1.14 (1.32) | 1.19 (1.36) | 1.52 (1.66) | 1.07 (1.31) | 1.07 (1.28) | 10.443** | 2.647* |
| | | (N =3252) | (N = 712) | (N = 377) | (N = 269) | (n = 2284) | (n = 2326) | F(1, 4602) | |
| **2. Negative emotionality** | **Difficult 4 weeks** | 5.88 (3.58) | 6.00 (3.56) | 6.06 (3.50) | 6.06 (3.69) | 6.10 (3.54) | 5.76 (3.61) | .116 | N/A |
| | **Mood 6 months** | 16.13 (5.69) | 16.04 (5.65) | 16.02 (5.87) | 15.42 (6.21) | 15.98 (5.73) | 16.15 (5.72) | .060 | N/A |
| | **Mood 24 months** | 17.78 (5.52) | 18.07 (5.29) | 17.58 (5.48) | 17.64 (5.79) | 17.81 (5.60) | 17.79 (5.41) | .081 | N/A |
| | **Emotionality 38 months** | 12.45 (4.18) | 12.37 (4.18) | 12.08 (3.87) | 12.12 (4.00) | 11.98 (4.00) | 12.80 (4.25) | 13.289*** | N/A |
| | **Temper tantrums** | 4.65 (2.41) | 4.83 (2.40) | 4.92 (2.55) | 4.81 (2.49) | 4.67 (2.43) | 4.75 (2.42) | 7.370* | N/A |
| | | (N =3333) | (N = 730) | (N = 388) | (N = 275) | (n = 2284) | (n = 2326) | F(1, 4718) | |
| **3. Social withdrawal** | **Approach 6months** | 14.89 (6.15) | 14.69 (6.32) | 14.35 (6.10) | 13.72 (6.11) | 14.17 (6.03) | 15.32 (6.26) | 9.314** | N/A |
| | **Approach 24 months** | 20.10 (7.69) | 19.74 (7.29) | 19.36 (7.82) | 18.71 (7.27) | 19.25 (7.57) | 20.55 (7.62) | 3.594 | N/A |
| | **Shyness 38 months** | 12.54 (4.03) | 12.22 (4.30) | 12.05 (3.88) | 11.55 (3.73) | 12.26 (4.06) | 12.53 (4.04) | .067 | N/A |
| | | M (SD) (n = 3458) | M (SD) (n = 733) | M (SD) (n = 402) | M (SD) (n = 288) | M (SD) (n = 2426) | M (SD) (n = 2455) | F(1, 4873) | |
| **4. Development** | **6 months** | 70.18 (14.15) | 69.81 | 69.98 | 70.12 | 69.63 | 70.58 | .748 | N/A |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | (13.85) | (13.40) | (15.27) | (14.10) | (14.12) | | |
| | **18 months** | 81.36 | 80.69 | 81.09 | 79.06 | 79.27 | 82.91 | 50.229*** | N/A |
| | | (9.88) | (9.96) | (9.37) | (10.03) | (9.50) | (9.90) | | |
| | **30 months** | 65.22 | 64.70 | 64.30 | 63.34 | 63.07 | 64.96 | 106.047*** | N/A |
| | | (7.19) | (7.13) | (7.05) | (7.84) | (7.21) | (7.22) | | |
| | **42 months** | 78.84 | 78.18 | 77.11 | 76.19 | 76.16 | 80.79 | 110.773*** | N/A |
| | | (8.12) | (8.31) | (8.37) | (9.15) | (8.83) | (6.98) | | |
| | | (n = 3538) | (n = 766) | (n = 420) | (n = 293) | (n = 2476) | (n = 2541) | F(1,5009) | |
| **5. Language** | **38 months** | 301.76 | 296.37 | 297.97 | 290.76 | 295.93 | 303.91 | 14.465*** | 3.078* |
| | | (31.022) | (37.27) | (33.82) | (38.60) | (36.53) | (28.38) | | |
| | **24 months** | 203.05 | 192.55 | 189.81 | 180.77 | 182.69 | 214.96 | 44.599*** | .505 |
| | | (80.00) | (80.58) | (76.73) | (83.11) | (79.21) | (78.10) | | |
| | | (n = 3368) | (n = 700) | (n = 388) | (n = 274) | (N = 2342) | (n = 2388) | F(1, 4722) | |
| **6. Conduct problems** | **Conduct 42 months** | 3.37 (2.22) | 3.79 (2.38) | 4.01 (2.44) | 4.57 (2.64) | 3.78 (2.42) | 3.47 (2.19) | 6.649* | N/A |
| | **Hyperactivity 42 months** | 2.50 (1.77) | 2.62 (1.86) | 2.85 (1.81) | 3.10 (1.87) | 2.73 (1.85) | 2.43 (1.74) | 1.949 | N/A |
| | **Conduct 47 months** | 1.80 (1.33) | 1.95 (1.43) | 2.02 (1.37) | 2.54 (1.69) | 1.95 (1.41) | 1.88 (1.36) | .014 | N/A |
| | **Hyperactivity 47 months** | 3.66 (2.24) | 3.91 (2.44) | 4.12 (2.13) | 1.80 (2.43) | 4.09 (2.34) | 3.52 (2.23) | 6.461* | N/A |
| | **Conduct 81 months** | 1.44 (1.36) | 1.70 (1.50) | 1.77 (1.52) | 2.33 (1.71) | 1.62 (1.44) | 1.50 (1.42) | .401 | N/A |
| | **Hyperactivity 81 months** | 3.00 (2.21) | 3.53 (2.35) | 3.80 (2.29) | 4.51 (2.52) | 3.60 (2.40) | 2.87 (2.13) | 12.989*** | N/A |
| | | **None** | **Early** | **Late** | **Both** | **Male** | **Female** | **Gender** | **Group x Gender** |
| | | (n = 3371) | (n = 701) | (n = 391) | (n = 274) | (n = 2347) | (n = 2390) | F(4, 4726) | F(4, 2728) |
| **7. Prosocial behaviour** | **Prosocial 42 months** | 15.57 (3.24) | 15.05 (3.43) | 15.23 (3.43) | 14.61 (3.47) | 14.90 (3.53) | 15.41 (3.44) | 18.304*** | 1.689 |
| | **Prosocial 47 months** | 7.19 (1.91) | 6.96 (1.92) | 6.91 (1.93) | 6.58 (1.97) | 6.82 (1.96) | 7.37 (1.84) | 7.894** | 1.873 |
| | **Prosocial 81 months** | 8.32 (1.68) | 7.95 (1.78) | 8.07 (1.67) | 7.50 (1.87) | 7.90 (1.80) | 8.49 (1.58) | 29.437*** | .168 |
| | **Empathy 81 months** | 1.90 (.18) | 1.86 (.21) | 1.88 (.19) | 1.82 (.24) | 1.86 (.21) | 1.90 (.17) | 3.897* | .948 |
| | | (n = 3353) | (n = 709) | (n = 391) | (n = 264) | (n = 2336) | (n = 2381) | F(1, 4709) | F(3, 4709) |
| **8. Peers** | **47 months** | 1.37 (1.39) | 1.46 (1.55) | 1.61 (1.45) | 1.75 (1.58) | 1.55 (1.51) | 1.30 (1.35) | 5.383* | .159 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **81 months** | .91 (1.26) | 1.11 (1.43) | 1.11 (1.75) | 1.42 (1.75) | 1.08 (1.45) | .90 (1.25) | 2.443 | .058 |
| | **Friendships 8 ½ years** | 3.29 (2.28) | 3.87 (2.58) | 3.54 (2.61) | 4.09 (2.74) | 3.54 (2.40) | 3.34 (2.38) | 1.950 | 3.182* |
| | | (n = 3530) | (n = 774) | (n = 415) | (n = 292) | (n = 2422) | (n= 2589) | F(1, 5003) | |
| **9. Attention** | **Selective** | 4.59 (1.55) | 5.13 (1.69) | 5.27 (1.66) | 5.35 (1.88) | 5.36 (1.79) | 4.73 (1.34) | 60.534*** | N/A |
| | **Divided** | 5.32 (13.68) | 7.13 (17.78) | 7.56 (23.09) | 8.99 (23.77) | 7.01 (19.07) | 5.06 (12.61) | .606 | N/A |
| | **Control** | 12.96 (3.12) | 13.09 (2.88) | 13.43 (2.71) | 13.39 (3.10) | 13.17 (2.75) | 12.92 (3.31) | .011 | N/A |
| | **Switching** | 17.28 (6.73) | 17.37 (4.10) | 17.77 (3.79) | 17.95 (3.91) | 17.57 (3.97) | 17.20 (7.49) | .008 | N/A |
| | | (n = 3660) | (n = 803) | (n = 441) | (n = 313) | (n = 2568) | (n = 2649 | F (2,5208) | |
| **10. Intelligence** | **Verbal 8 ½ years** | 109.12 (16.11) | 107.42 (16.37) | 106.76 (17.82) | 104.31 (17.31) | 109.14 (17.01) | 107.61 (15.80) | 22.273*** | N/A |
| | **Performance 8 ½ years** | 101.95 (16.61) | 99.47 (17.10) | 99.45 (17.06) | 94.98 (16.13) | 100.71 (17.16) | 101.16 (16.42) | 3.320 | N/A |

*p<.05; **p<.01; ***p<.001
N/A = not applicable: tests not reported as no significant multivariate interaction identified

***Table C2.6: Summary of significant individual associations, gender differences and interactions with child gender for all measures (Y = significant; N = non-significant)***

| Construct | Measure | Overall effect | Gender difference | Interaction* |
|---|---|---|---|---|
| Family adversity | FAI Pregnancy | Y | Y | Y |
| | FAI 0–2 years | Y | Y | Y |
| | FAI 2–4 years | Y | Y | Y |
| Negative emotionality | Difficult 4 weeks | N | N | - |
| | Mood 6 months | N | N | - |
| | Mood 2 years | N | N | - |
| | Emotionality 3 years | N | Y | - |
| | Temper tantrums | Y | Y | - |
| Shyness/withdrawal | Approach 6 months | N | Y | - |
| | Approach 2 years | N | N | - |
| | Shyness 3 years | Y | N | - |
| Language | 3 years | Y | Y | Y |
| | 2 years | N | Y | N |
| Behaviour problems | Conduct 3½ years | Y | Y | - |
| | Conduct 4 years | Y | N | - |
| | Conduct 6 yrs 9 months | Y | N | - |
| | Hyperactivity 3½ years | Y | N | - |
| | Hyperactivity 4 years | Y | Y | - |
| | Hyperactivity 6¾ years | Y | Y | - |
| Prosocial behaviour | 3½ years | Y | Y | N |
| | 4 years | Y | Y | N |
| | 6 yrs 9 months | Y | Y | N |
| | Empathy 6 ¾ years | Y | Y | N |
| Peers | 4 years | Y | Y | N |
| | 6¾ years | Y | N | N |
| | Friendships 8½ years | Y | N | Y |
| Cognitive ability | Development 6 months | N | N | - |
| | Development 1½ years | N | Y | - |
| | Development 2½ years | N | Y | - |
| | Development 3½ years | N | Y | - |
| Attention | Selective 8½ years | N | Y | - |
| | Divided 8½ years | Y | N | - |
| | Control 8½ years | Y | N | - |
| | Switching 8½ years | N | N | - |
| Intelligence | Verbal 8½ years | Y | Y | - |
| | Performance 8½ years | Y | N | - |

*Interactions are not presented for variables that did not achieve a significant multivariate interaction

## Characteristics associated with resilience

An initial step in the analysis was to examine the pairwise correlations between the variables. To account for multiple testing, only those correlations of at least r = 0.20 are treated as significant in order to minimise the potential for type one errors. From these data it was evident that most of the significant associations occur between variables within the same conceptual block of variables. For example, prosocial behaviour at 47 months is more strongly and significantly positively correlated with prosocial behaviour at 81 months and empathy at 81 months, but has relatively little association with intelligence assessed at 8½ years. However, some inter-block associations are significant. For example, prosocial scores are negatively associated with peer problem scores and positively associated with school enjoyment at 54 and 91 months. This indicates that children who behave in a manner that is mindful of other people have better peer relationships and also greater school enjoyment. High peer problem scores at 81 months are negatively associated with school enjoyment at 91 months indicating that children who have poor friendships at 81 months are less likely to enjoy school a year later. High verbal intelligence and total intelligence scores are negatively associated with locus of control indicating that more intelligent children are more likely to believe that they have the ability to control issues in their lives. Both scholastic competence and global self-worth at 8½ years are associated with liking school at 8½ years. High family adversity scores during the 0–2 year post-partum period are positively associated with having a close relationship with a father figure. Finally, high family adversity during 0–2 years is negatively associated with maternal bonding assessed at eight months post-partum indicating that mothers who experience high levels of family-based stress report lower levels of bonding with their child.

The second step in the analysis was to compare the mean scores of the resilient and remaining high-risk groups across all independent variables. Table C3.1 shows that in contrast to the remaining high-risk children, the resilient children were slightly younger when they attended the clinic at which the anti-social behaviour data were collected. They were also significantly more prosocial at 81months, had significantly fewer peer problems reported by their parents at 81m, achieved significantly higher performance IQ scores at 8½, had significantly higher global self-worth scores at age 8½, were rated as enjoying school more at 54 and 91 months by parents and also were more likely to report liking school at age 8½. The groups differed on few of the parenting measures. The resilient group had mothers at 18 months who scored significantly higher on parenting and mothers who at 21 months reported less positive parenting experiences. Finally, the resilient group experienced significantly lower levels of adversity throughout all three assessment periods.

***Table C3.1: Descriptive statistics and comparisons between the resilient and remaining high-risk children***

| Factor | Characteristic | Non-resilient | | | Resilient | | | t-test | p-value |
|---|---|---|---|---|---|---|---|---|---|
| | | N | Mean | SD | N | Mean | SD | | |
| Family characteristics | Attachment to mother 7.5 yrs | 78 | 1.06 | 0.25 | 590 | 1.08 | 0.27 | -0.38 | 0.702 |
| | Attachment to father 7.5 yrs | 78 | 1.42 | 0.50 | 590 | 1.36 | 0.48 | 1.10 | 0.273 |
| | Parenting score 6m | 88 | 9.89 | 1.82 | 685 | 10.14 | 1.66 | -1.36 | 0.176 |
| | Enjoyment baby 8m | 88 | 12.60 | 2.44 | 673 | 12.91 | 2.40 | -1.14 | 0.255 |
| | Maternal bonding 8m | 87 | 27.07 | 4.19 | 669 | 27.51 | 4.17 | -0.92 | 0.359 |
| | Parenting score 1.5 years | 86 | 38.58 | 6.56 | 672 | 39.83 | 5.30 | -2.00 | **0.046*** |
| | Positive experiences 1 year 9m | 79 | 6.77 | 2.63 | 644 | 6.28 | 1.80 | 2.15 | **0.032*** |
| | Negative experiences 1 year 9m | 77 | 19.81 | 3.14 | 626 | 20.00 | 2.96 | -0.54 | 0.589 |
| | Parenting score 3 yrs | 79 | 23.86 | 3.82 | 640 | 24.47 | 3.48 | -1.45 | 0.147 |
| | Mother-child interaction score 3.5 yrs | 81 | 27.14 | 5.59 | 632 | 28.08 | 5.24 | -1.51 | 0.132 |
| | FAI Pregnancy | 97 | 4.57 | 1.78 | 740 | 3.91 | 1.24 | 4.67 | **0.000***** |
| | FAI 0-2y | 95 | 4.89 | 2.68 | 730 | 4.28 | 2.28 | 2.41 | **0.016*** |
| | FAI 2-4y | 85 | 3.46 | 2.06 | 669 | 2.58 | 1.61 | 4.58 | **0.000***** |
| Extra familial characteristics | School enjoyment 4.5 yrs | 73 | 16.97 | 2.89 | 552 | 18.08 | 2.50 | -3.50 | **0.001**** |
| | School enjoyment 7.5 yrs | 75 | 15.20 | 3.41 | 580 | 16.97 | 3.31 | -4.33 | **0.000***** |
| | School enjoyment 8.5 yrs | 87 | 2.43 | 0.95 | 725 | 2.03 | 0.87 | 3.95 | **0.000***** |
| | Attachment to teacher 7.5 yrs | 78 | 1.91 | 0.29 | 590 | 1.92 | 0.27 | -0.42 | 0.677 |
| | Total no. attachments 7.5 yrs | 78 | 2.73 | 1.38 | 590 | 2.70 | 1.39 | 0.16 | 0.870 |
| Child characteristics | Age (weeks) | 97 | 457.65 | 21.00 | 740 | 452.65 | 16.79 | 2.67 | **0.008**** |
| | SDQ Prosocial 4 yrs | 78 | 6.72 | 1.84 | 612 | 6.89 | 1.97 | -0.74 | 0.459 |
| | SDQ Prosocial 6 yrs 9m | 74 | 7.45 | 1.79 | 606 | 8.04 | 1.79 | -2.68 | **0.008**** |
| | Empathy 6 yrs 9m | 74 | 1.82 | 0.22 | 604 | 1.84 | 0.21 | -1.00 | 0.318 |
| | SDQ Peer problems 4 yrs | 78 | 2.23 | 1.87 | 612 | 1.85 | 1.52 | 2.04 | **0.041*** |
| | SDQ Peer problems 6 yrs 9m | 74 | 1.72 | 2.06 | 605 | 1.44 | 1.59 | 1.36 | 0.174 |
| | Friendships 8.5 yrs | 87 | 4.16 | 3.13 | 718 | 3.64 | 2.63 | 1.71 | 0.087 |
| | WISC Verbal 8.5 yrs | 94 | 98.89 | 18.04 | 718 | 101.21 | 16.47 | -1.27 | 0.206 |
| | WISC Performance 8.5 yrs | 89 | 92.21 | 18.44 | 667 | 96.32 | 16.14 | -2.22 | **0.027*** |
| | Locus of control 8.5 yrs | 83 | 6.39 | 2.17 | 648 | 6.45 | 2.01 | -0.26 | 0.794 |
| | Scholastic competence 8.5 yrs | 85 | 16.67 | 3.87 | 683 | 16.34 | 3.70 | 0.78 | 0.436 |
| | Global self-worth 8.5 yrs | 85 | 17.64 | 3.91 | 688 | 18.77 | 3.45 | -2.81 | **0.005**** |

*p<.05, **p<.01, ***p<.001

## Characteristics predictive of resilience

A three-stage logistic regression analysis strategy was employed. In the first stage, a series of univariable logistic regression analyses were conducted predicting involvement in at least two anti-social activities from each of the independent characteristic variables examined in this study. An initial examination of the Odds Ratio (OR) indicated that girls were over 16 times more likely to be resilient than were boys (OR = 16.04, 95%CI = 2.25 – 114.52, p value = 0.005). In addition, resilient children were found to be significantly younger than the non-resilient children (Resilient [mean age = 452.65 weeks, standard deviation (sd) = 16.79], remaining high risk [mean age = 457.65 weeks, sd = 21.00], p = 0.008). As a result all univariable and subsequent multivariable logistic regression analyses were conducted including interaction terms for child gender, and controlling for family adversity during pregnancy and child age at the time of reporting anti-social behaviour. In all regression analyses the explanatory variables were standardised. As a result of the standardisation, the ORs from these analyses were more comparable allowing some assessment of effect sizes. The results of this initial univariable analysis are presented in Table C3.2

The data presented in Table C3.2 indicate that several independent variables were significantly associated with resilience when considered as individual variables. In addition, several significant interactions with child gender were also identified.

***Table C3.2: Univariable logistic regressions***

| Factor | Characteristic | N | Direct (p values for slope estimate) | Interaction (p values for slope estimate) | Odds Ratio | 95% CI's | |
|---|---|---|---|---|---|---|---|
| Family characteristics | Attachment to mother 7½ yrs | 668 | .955 | .668 | 1.01 | .78 | 1.31 |
| | Attachment to father 7½ yrs | 668 | .275 | **.027*** | **.87** | **.68** | **1.11** |
| | Parenting score 6m | 773 | .216 | .347 | 1.14 | .92 | 1.42 |
| | Maternal bonding 8m | 756 | .660 | .163 | 1.05 | .84 | 1.31 |
| | Parenting score 1½ years | 758 | .470 | .135 | 1.08 | .88 | 1.32 |
| | Positive parenting experiences 1year 9m | 723 | **.012*** | **.019*** | **.81** | **.68** | **.95** |
| | Negative parenting experiences 1year 9m | 703 | .946 | .270 | 1.01 | .79 | 1.28 |
| | Parenting score 3 yrs | 719 | .627 | .219 | 1.06 | .85 | 1.32 |
| | Mother-child interaction score 3½ yrs | 713 | .512 | .054 | 1.08 | .86 | 1.35 |
| | FAI 0-2 | 825 | .548 | .176 | .93 | .74 | 1.17 |
| | FAI 2-4 | 754 | **.002**** | .138 | **.70** | **.56** | **.87** |
| Extra-familial characteristics | School enjoyment 4½ yrs | 625 | **.001**** | .337 | **1.52** | **1.20** | **1.94** |
| | School enjoyment 7½ yrs | 655 | **.001**** | .587 | **1.47** | **1.17** | **1.84** |
| | School enjoyment 8½ yrs | 811 | **.000***** | .541 | **1.45** | **1.18** | **1.77** |
| | Attachment to teacher 7½ yrs | 668 | .575 | .059 | 1.08 | .83 | 1.40 |
| | Total number of attachments | 668 | .698 | .914 | .95 | .73 | 1.24 |
| Child characteristics | Prosocial behaviour 4 yrs | 690 | .982 | .347 | 1.00 | .76 | 1.30 |
| | Prosocial behaviour 6 yrs 9m | 680 | .077 | .810 | 1.27 | .97 | 1.66 |
| | Peer problems 4 yrs | 690 | .298 | .882 | .88 | .69 | 1.12 |
| | Peer problems 6 yrs 9m | 679 | .854 | .507 | .98 | .77 | 1.24 |
| | Friendships 8½ yrs | 805 | .053 | .557 | .82 | .67 | 1.00 |
| | Verbal IQ 8½ yrs | 812 | .252 | **.027*** | **1.16** | **.90** | **1.48** |
| | Performance IQ 8½ yrs | 756 | .145 | .483 | 1.21 | .94 | 1.57 |
| | Locus of control 8½ yrs | 731 | .678 | .270 | .95 | .73 | 1.22 |
| | Scholastic competence at 8½ yrs | 768 | .576 | .943 | .93 | .72 | 1.20 |
| | Self-esteem 8½ yrs | 773 | **.018*** | .528 | **1.33** | **1.05** | **1.68** |

*p<.05; **p<.01;***p<.001

In the second stage of the analysis, all of those variables that were identified in step one as being significant predictors of involvement in at least two anti-social activities were entered into further logistic regression analyses in blocks that represented those groups of child-based characteristics identified from the literature. This intra-block analysis identified those variables within each group of child-based characteristics that were significantly associated with involvement in anti-social behaviour after controlling for the other variables within each block. In the multivariable analyses (steps two and three), reduced models were identified to allow the maximum amount of data to be used to estimate effect sizes. This was achieved via a backwards elimination process from the initial model of all candidate variables. Following this stage, excluded variables were then tested for re-entry. This allowed a final check on the effect of variables particularly those excluded at early stages where the least amount of data was available. (ORs and p values for non-significant variables were estimated by temporarily adding this variable to the final model. As a consequence the number of cases for these variables will be different and lower than for those variables remaining in the final intra-block or inter-block models).

As the attitudes to school block of variables was the only block in which more than one variable was univariately predictive of resilience, the three attitudes to school variables were entered as one block predicting resilience. This enabled the strongest of these predictors to be identified. The results of this analysis showed that both enjoyment of school at 4.5 years (N = 607; OR =1.46; 95%CI: 1.14 – 1.88; p = .003; p(int) = 0.336 not significant and liking school at 8.5 years (N = 607; OR = 1.39; 95%CI: 1.09 – 1.78; p = 0.009; p (int) = 0.815 ns) predicted resilience independently, whereas school enjoyment at 7.5 years (N = 513; OR = 1.18; 95%CI: 0.88 – 1.57; p = 0.264 ns; p(int) = 0.948 ns) did not predict resilience independently of the other indicators of school enjoyment.

The final step in the analysis took those variables identified from each separate block as significant predictors of anti-social behaviour in step one, and regressed them onto anti-social behaviour as one block of variables. This inter-block analysis identified those variables that remained significant predictors of involvement in at least two anti-social activities independently of those identified through the intra block analysis. The results of this analysis are presented in Table C3.3 below.

***Table C3.3: Results of multivariable regression analysis***

| | | | **Direct** | | | **Interaction** | |
|---|---|---|---|---|---|---|---|
| Factor | Characteristics | N | OR | 95% Confidence Interval (CI) | p-value | Odds Ratio | p-value |
| Child characteristics | Verbal IQ 8½ yrs | 506 | 0.95 | 0.68-1.32 | 0.739 | | |
| | Global self worth 8½ yrs | 488 | 1.28 | 0.93-1.76 | 0.131 | | |
| Extra familial characteristics | School enjoyment 4½ yrs | **522** | **1.79** | **1.34-2.39** | **0.000*** ** | 0.78 | 0.095 |
| | School enjoyment 8½ yrs | **522** | **1.44** | **1.11-1.86** | **0.006** ** | 0.95 | 0.675 |
| Family characteristics | Attachment to father 7½ yrs | **522** | **0.86** | 0.64-1.15 | 0.301 | **1.35** | **0.040*** |
| | Positive parenting experiences 1 year 9m | 488 | 0.90 | 0.72-1.13 | 0.378 | | |
| | FAI 2-4y | 511 | 0.83 | 0.61-1.11 | 0.206 | | |
| Confounders | Age | 522 | 0.75 | 0.54-1.03 | .075 | | |
| | FAI pregnancy | 522 | 0.64 | 0.46-0.90 | .011* | | |

*p<.05; **p<.01;***p<.001

It must be noted that although liking school at age 8½ was associated with a 44 per cent increase in the likelihood that children were resilient, as both resilience and liking school were assessed at the same time point, it is beyond these data to determine that reports of liking school causally affected the odds of being resilient.

The significant interaction between child gender, closeness to father and resilience identified in the univariable regression analysis remained significant independently of the effect of the other independent variables. This interaction suggested that for boys, attachment to a father figure at 91

months improved resilience (OR=1.16 [0.84, 1.61]) while for girls the converse was true (OR=0.63 [0.39, 1.03]).

## Gender: boys only sample

Due to the potential bias in the results presented by the significant interaction between resilience and gender, the analysis was conducted on the data from the boys only. The results of the regression models are presented here.

Table C3.4 shows the univariable associations between each independent variable and resilience.

***Table C3.4 Univariable logistic regression analysis***

| Factor | Characteristics | N* | Odds ratio | 95% Confidence Interval (CI) | | p-value |
|---|---|---|---|---|---|---|
| Family characteristics | Attachment to mother 7½ yrs | 330 | 1.06 | 0.76 | 1.49 | 0.712 |
| | Attachment to father 7½ yrs | 330 | 1.16 | 0.88 | 1.53 | 0.295 |
| | Parenting score 6m | 383 | 1.27 | 0.98 | 1.63 | 0.066 |
| | Enjoyment baby 8m | 375 | 1.26 | 1.00 | 1.59 | 0.054 |
| | Maternal bonding 8m | 373 | 1.23 | 0.97 | 1.57 | 0.089 |
| | Parenting score 4½ yrs | 380 | 1.26 | 1.00 | 1.59 | 0.050 |
| | Positive parenting experiences 1 yr 9 m | 358 | 0.98 | 0.78 | 1.24 | 0.872 |
| | Negative parenting experiences 1 yr 9 m | 347 | 1.16 | 0.89 | 1.52 | 0.264 |
| | Parenting score 3 yrs | 354 | 1.21 | 0.96 | 1.54 | 0.113 |
| | Interaction score 3½ yrs | **348** | **1.34** | **1.02** | **1.77** | **0.036** |
| | FAI 0-2y | 411 | 1.09 | 0.83 | 1.42 | 0.527 |
| | FAI 2-4y | 375 | 0.83 | 0.65 | 1.07 | 0.146 |
| Extra-familial characteristics | School enjoyment 4½ yrs | **299** | **1.36** | **1.04** | **1.77** | **0.023** |
| | School enjoyment 7½ yrs | **319** | **1.38** | **1.08** | **1.76** | **0.009** |
| | School enjoyment 8½ yrs | **400** | **1.36** | **1.06** | **1.74** | **0.014** |
| | Close to teacher 7½ yrs | 330 | 0.84 | 0.55 | 1.28 | 0.408 |
| | Total no. attachments 7½ yrs | 330 | 0.93 | 0.68 | 1.26 | 0.634 |
| Child characteristics | SDQ Prosocial 4 yrs | 340 | 1.13 | 0.84 | 1.52 | 0.427 |
| | SDQ Prosocial 6 yrs 9m | **336** | **1.32** | **1.01** | **1.72** | **0.042** |
| | Empathy 6 yrs 9m | 336 | 1.13 | 0.87 | 1.47 | 0.352 |
| | SDQ Peer problems 4 yrs | 340 | 0.86 | 0.67 | 1.11 | 0.249 |
| | SDQ Peer problems 6 yrs 9m | 335 | 0.90 | 0.72 | 1.14 | 0.387 |
| | Friendships 8½ yrs | 397 | 0.88 | 0.68 | 1.13 | 0.314 |
| | WISC Verbal 8½ yrs | 397 | 0.87 | 0.66 | 1.15 | 0.336 |
| | WISC Performance 8½ yrs | 377 | 1.11 | 0.83 | 1.48 | 0.497 |
| | WISC Total IQ 8½ yrs | 369 | 0.97 | 0.73 | 1.30 | 0.840 |
| | Locus of control 8½ yrs | 358 | 1.10 | 0.82 | 1.47 | 0.536 |
| | Scholastic competence 8½ yrs | 378 | 0.93 | 0.71 | 1.21 | 0.574 |
| | Global self-worth 8½ yrs | 382 | 1.23 | 0.96 | 1.59 | 0.108 |

The results presented in Table C3.4 are in part the same and different to those that were found on the combined sample. As in the combined sample analysis, resilience was predicted by all three assessments of school enjoyment, although in each instance the odds ratios were smaller. In contrast to the combined sample analysis, prosocial behaviour at 6¾ years, parenting at 18 months and mother-child interaction at 3½ years were also significantly associated with resilience. In the original combined sample analysis it was found that global self-worth, positive parenting experiences at 21 months and family adversity during 2–4 years predicted resilience; in the reanalysis on the male sample these characteristics were not found to be significantly associated with resilience on a univariable level.

***Table C3.5. Results of intra-block logistic regression***

| Factor | Characteristic | N | Odds ratio | 95% Confidence Interval (CI) | | p-value |
|---|---|---|---|---|---|---|
| Child characteristics | SDQ Prosocial 6¾ yrs | **336** | **1.32** | **1.01** | **1.72** | **0.042** |
| Extra-familial characteristics | School enjoyment 4½ yrs | 243 | 1.36 | 0.99 | 1.87 | 0.054 |
| | School enjoyment 7½ yrs | **305** | **1.33** | **1.03** | **1.73** | **0.029** |
| | School enjoyment 8½ yrs | **305** | **1.35** | **1.01** | **1.81** | **0.043** |
| Family characteristics | Interaction 3½ yrs | **348** | **1.34** | **1.02** | **1.77** | **0.036** |

It is evident from the results of this analysis that two measures of school enjoyment, at age 7½ and at age 8½ years remain predictive of resilience when entered into a regression model with the third school enjoyment variable.

The final model involved entering prosocial behaviour at 6¾ years, school enjoyment at 7½ years and 8½ years, and parent-child interaction at 3½ years into one logistic regression model. The results of this analysis are presented below in Table C3.6.

***Table C3.6: Final regression model on boys-only sample***

| Factor | Characteristics | N | Odds ratio | 95% CI | | p value |
|---|---|---|---|---|---|---|
| Child characteristics | SDQ Prosocial 6¾ yrs | 267 | 1.22 | 0.89 | 1.69 | 0.219 |
| Extra-familial characteristics | School enjoyment 7½ yrs | **286** | **1.33** | **1.01** | **1.76** | **0.040** |
| | School enjoyment 8½ yrs | 274 | 1.34 | 0.98 | 1.84 | 0.065 |
| Family characteristics | Interaction 3½ yrs | **286** | **1.47** | **1.09** | **1.99** | **0.013** |

Table C3.6 shows that in the final model, maternal reports of school enjoyment at 7½ years and maternal reports of mother-child interaction at age 3½ significantly independently predict resilience. For every one-unit increase in parent reported school enjoyment, the likelihood of resilience increases by 33 per cent. For every one-unit increase in levels of mother-child interaction, the odds of resilience increase by 47 per cent.

The results of this reanalysis indicate that there may indeed be a level of bias in the original analysis that included both genders. However, both sets of analyses implicate school enjoyment, albeit assessed at a different time point, as a significant protective factor against early adversity. It is interesting to note that with regard to the male only data, maternal-child interaction also proves to be protective, and exhibits a stronger effect than school enjoyment. Although a significant interaction with gender but no main effect was identified for attachment to father at 7½ years, the reanalysis on the male only data did not identify this variable to be independently predictive of resilience.

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