Photo redacted due to third party rights or other legal issues

GROWING UP IN SCOTLAND:
The impact of children's early activities on cognitive development

GUS
GROWING UP IN SCOTLAND

smarter scotland
SCOTTISH GOVERNMENT

GROWING UP IN SCOTLAND:
The impact of children's early activities on cognitive development

The Scottish Government, Edinburgh 2009

ISBN (web only): 978-0-7559-1968-0

The Scottish Government
St Andrew's House
Edinburgh
EH1 3DG

Produced for the Scottish Government by RR Donnelley B59787 3/09

Published by the Scottish Government, March, 2009

GROWING UP IN SCOTLAND:
The impact of children's early activities on cognitive development

Catherine Bromley*

*Scottish Centre for Social Research

Prepared for the Scottish Government: Children, Young People and Social Care Directorate by the Scottish Centre for Social Research

GROWING UP IN SCOTLAND:

The impact of children's early activities on cognitive development

Contents

Tables

Figures

Introduction

This report uses data from the first three waves of the Growing Up in Scotland study (GUS) to explore children's cognitive ability. Assessments of children's language development (using a naming vocabulary task) and problem solving skills (using a picture similarities tasks) were carried out at age 34 months.

Previous studies have established that early cognitive ability influences later outcomes, for example early poor cognitive ability can have a negative impact on outcomes in the realms of education, employment, health and social development. Using cohort studies such as GUS to measure cognitive ability, and how it differs within the population, can help build a better understanding of the dynamics of children's development and to identify stages at which interventions might have a positive influence on later outcomes.

Previous research has also uncovered a number of factors influencing children's cognitive ability that operate at a number of levels. These include factors related to the child such as gender, birth weight and other measures of their development in the womb. Socio-demographic factors such as household income, parental ethnicity, social class and education level have also been shown to be associated with children's cognitive development. Other evidence suggests that children's activities and parenting approaches and styles also figure. This report attempts to explore a number of these different factors with the aim of answering the following questions:

Do children's early activities have an influence on cognitive development in addition to socio-demographic factors?

Do children's early activities moderate the effect of socio-demographic factors on cognitive development?

The report starts by introducing some measures of children's activities, including what parents think of those activities. It also shows how activities vary across socio-demographic groups. It then illustrates how cognitive ability scores are associated with socio-demographic factors and with activities. The final stage of the analysis attempts to differentiate between the influences that socio-demographic factors and activities have on cognitive ability in order to answer the two questions above.

Children's activities

- At 10 months of age most children experienced the following on a daily basis: playing indoor or outdoor games (94%), singing or having rhymes recited to them (90%), looking at books or being read stories (66%). Only a minority of children (25%) had visited a library by the age of 10 months.
- Children living in the most deprived 15% of areas were less likely to have been read to on a daily basis at 10 months of age than children in the rest of Scotland (54% versus 69%). Similar patterns were evident between children whose families had the lowest and highest incomes (55% and 78% respectively), and between children whose mothers had no qualifications and those whose mothers had degrees (51% and 78% respectively).
- By the age of 22 months 79% of children looked at books or read stories every day, 58% recited rhymes or sang songs, 52% ran around or played outdoors, 28% did activities like painting or drawing and 30% played at recognising letters, words, numbers or shapes.
- Children were classified according to how many activities they had carried out per day at age 22 months. Children from less advantaged households were the least likely to be classified as being in the most active group of children and were the most likely to be in the least active group.
- The survey also measured how many events or places children had been to in the past year when they were aged 22 months. The activities ranged in popularity from just 5% having been to the cinema and 17% to a sporting event to 73% who had been to a zoo, farm or aquarium and 83% who had been to a swimming pool. Children had been to an average of three of the eight events/places asked about while only 4% had never been to any.
- The children most likely to have been to none or just one of the events or places asked about were those: in the most deprived 15% of areas, in the lowest income households, in families with no parent working full-time, with mothers aged under 20 at time of their birth, whose mothers have few or no qualifications.
- Parents were asked how important they thought it was for their children to experience various activities when their child was aged 22 months. The activities most likely to be rated as very important were: running around or playing outside (84%); educational activities such as reading, drawing or painting (82%); social activities such as visiting friends or having visitors (74%); exercise such as swimming, dancing or gymnastics (64%). Two activities were not rated as strongly: cultural activities such as museum visits (18%) and watching TV (6%).

- All the activities, except for watching TV, were used to create a scale measuring how many activities in total parents rated as very important. The average number rated as very important was just over 3, just 5% rated none of them as important and 14% said all five were. Two-parent families with neither parent working full-time were the most likely to say that one or none of the activities were very important, followed by families in the lowest income households and mothers with no qualifications.
- Over half of parents were very happy (19%) or quite happy (37%) with the range of activities available to their child when aged 22 months. In contrast, 28% would have liked their child to have a slightly wider range and 16% wanted a much wider range of activities. Demand for a much wider range of activities was greatest among the most disadvantaged groups: in the 15% most deprived of areas, with the lowest household incomes, in families where no adult works more than 16 hours a week, mothers aged under 20 when their child was born, and mothers with few or no qualifications.

Factors influencing cognitive development

- Large variations in cognitive scores were evident at age 34 months with children from less advantaged families outperformed by their more affluent counterparts on both assessments.
- Children who had been identified at 22 months as having developmental difficulties had lower cognitive ability scores than children with no developmental difficulties. Children born with low birth weight and boys also had lower than average ability scores.
- Children whose mothers have no qualifications scored less well than those with degree-educated mothers (who perform particularly well, especially on the naming vocabulary assessment). Children with older mothers (30 years or above) perform better than those with younger mothers.
- Children in households with four or more children have lower ability scores than those with fewer or no siblings. Low household income levels and unemployment/low working hours are also significant factors associated with poorer performance.
- Those in the 15% most deprived areas of Scotland have lower scores than those in the rest of Scotland.
- Children who were read to often, and those who had visited a library by the time they were 10 months old, scored higher on both assessments than children who had comparably less experience of these activities (though the impact was less pronounced for the picture similarities assessment than for the naming vocabulary).

- At age 22 months the number of days in the past week children had played educational games, their overall daily activity levels and the number of places or events they had visited in the past year were all associated with cognitive ability. The more activities children had experienced the higher their ability scores.
- Ability scores were higher among children whose parents rated four or five activities as very important, and whose parents were satisfied with the range of their activities, than for children whose parents attached less importance to activities or were dissatisfied with their range.
- The association between activity levels and cognitive ability might simply be a reflection of the fact that children with high activity levels tend to be from more socially advantaged backgrounds; this is explored further below.

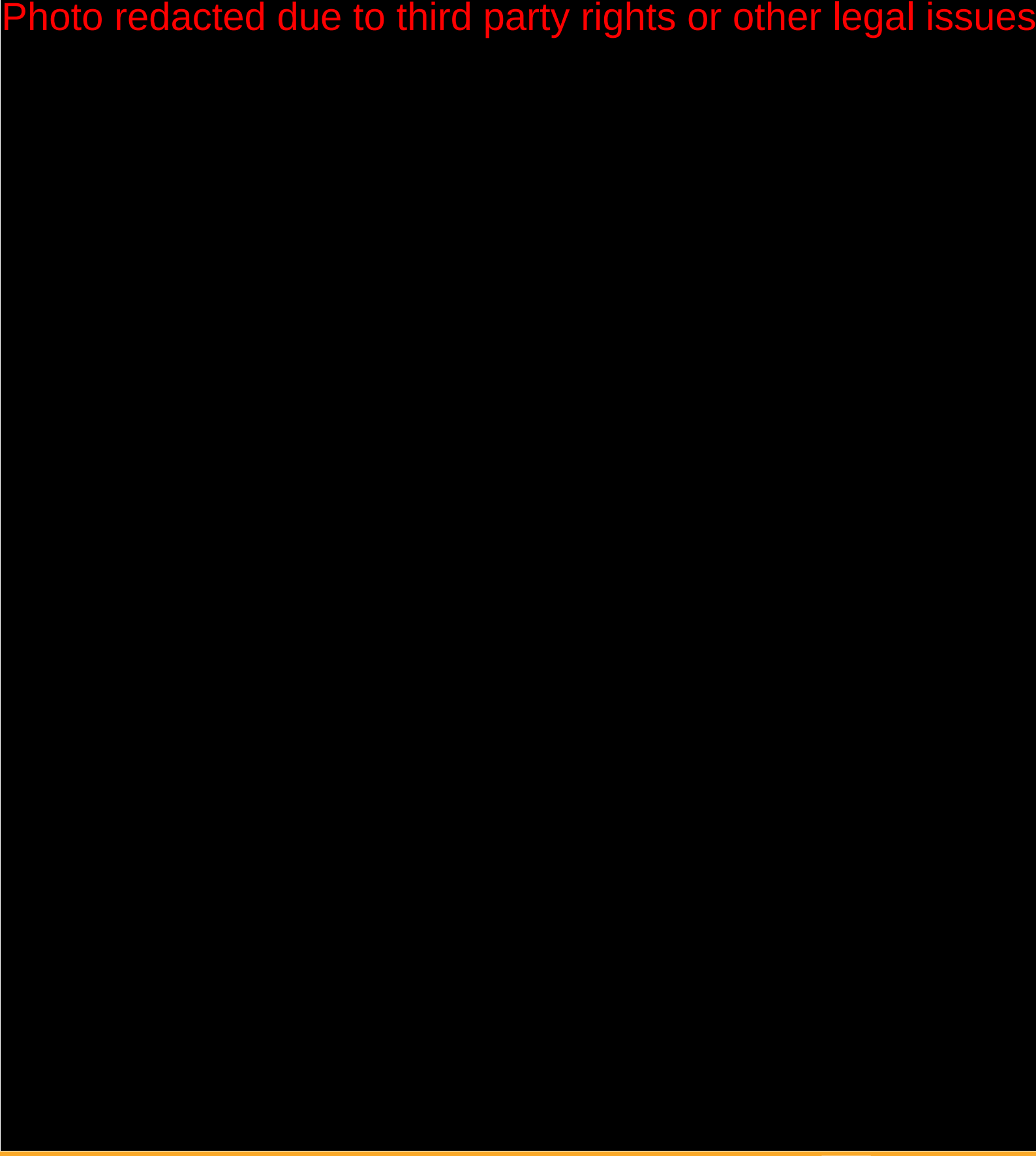
The relative importance of children's activities and socio-demographic factors

- To answer the two questions set out above, multivariate analysis was carried out to explore whether any of the activity measures were independently associated with cognitive ability scores once a range of socio-demographic factors were controlled for.
- The analysis considered each of the cognitive ability assessments separately and looked at the influence of:
  - socio-demographic factors alone;
  - activity measures and socio-demographic factors together; and
  - activity measures and socio-demographic factors in a sub-set of less advantaged children.
- For the naming vocabulary assessment, area deprivation and family composition/ employment type were no longer significant when all socio-demographic factors were considered together. Three activity measures were independently associated with ability when all factors were considered: being read to every day at age 10 months, being in the most active group at age 22 months for daily activities, and visiting a wide range of events/places at age 22 months. The last two activity measures were still significant when the analysis focused on less advantaged children.
- For the picture similarities assessment, mother's education was no longer significant when all socio-demographic factors were considered together, while age of mother at birth and family composition/employment type were no longer significant once all factors were considered. Two activity measures were independently associated with ability when all factors were considered: being in the most active group at age 22 months for daily activities, and visiting a wide range of events/places at age 22 months. The daily activity measure was still significant when the analysis focused on less advantaged children.

Conclusions

Collectively, these findings suggest that activities do have an influence on children's cognitive development and that they can moderate – though by no means eradicate – the effect of socio-demographic disadvantage. The important issue for children is the extent and range of activities they do, rather than any specific pursuits. It is also important to stress that many of the activities included in this analysis have few or no monetary costs; parents should not feel that their child needs to participate in expensive hobbies or classes in order to benefit from the advantage that activities confer.

The overall amount of variation in children's scores explained by the analysis was relatively low, but typical for analysis of a social survey. Other factors that haven't been explored here are also likely to be important, including genetic factors.



chapter
1
INTRODUCTION

One of the Scottish Government's five strategic objectives focuses on developing skills and raising achievement as a means to drive economic growth. The policy implications resulting from this report feed directly into this 'Smarter Scotland' objective as set out in the *National Performance Framework* (Scottish Government, 2007):

> *"A smarter Scotland will identify and address risks to its children, young people and families, so they can develop and flourish."*

This report uses data from the Growing Up in Scotland study (GUS) to explore children's cognitive ability, as measured by two assessments carried out at age 34 months. Two of the outcomes associated with the Smarter Scotland objective are particularly pertinent in the context of a report on children's outcomes in the first few years of life. These are: "our children have the best start in life and are ready to succeed" and "we have improved the life chances for children, young people and families at risk". Early identification of factors that hinder children's development is critical so that effective steps can be taken to address the consequences of early disadvantage for those children affected as well as to help minimise the risk that those factors will continue to disadvantage children in the future. The joint policy statement "Early Years and Early Intervention" (Scottish Government and COSLA, 2008) set out the principles of a framework for dealing with disadvantage in Scotland by prioritising action in the early years. As will be evident from the outset, child outcomes are highly socially patterned even from the very first few days of a child's life. GUS can help to identify and quantify the variable ways in which child development is related to children's social backgrounds.

GUS is an important longitudinal research project aimed at tracking the lives of a cohort of Scottish children from the early years, through childhood and beyond. Its principal aim is to provide information to support policy-making, but it is also intended to be a broader resource that can be drawn on by academics, voluntary sector organisations and other interested parties. Focusing initially on a cohort of 5,217 children aged 0-1 years old (the birth cohort) and a cohort of 2,859 children aged 2-3 years old (the child cohort), the first wave of fieldwork began in April 2005 and annual data collection from both cohorts has been undertaken since that time.[1] The analysis in this report concerns children in the birth cohort.

1 Further information on the design, development and future of the project is available from the study website: www.growingupinscotland.org.uk

This report comprises four main sections plus a conclusion which address the following two questions:

> Do children's early activities have an influence on cognitive development in addition to socio-demographic factors?

> Do children's early activities moderate the effect of socio-demographic factors on cognitive development?

The first section (Chapter 2) outlines the cognitive ability measures used in the study and includes some discussion of previous analyses of this concept. Chapter 3 introduces the measures of children's activities and parental attitudes towards them that are used to help answer the two central questions. This chapter also presents differences by a number of socio-demographic measures. Chapter 4 outlines the relationships between socio-demographic factors, children's activities and parents' attitudes, and cognitive ability measures. The analysis concludes in Chapter 5 which examines whether there are independent relationships between both the socio-demographic factors and the activity measures and cognitive ability.

All of the statistics have been weighted by a specially constructed weight to adjust for non-response and sample selection. Both weighted and unweighted sample sizes are given in each table. All analyses have been weighted and have had standard errors adjusted to take account of the cluster sampling.

CHAPTER 1

Introduction

chapter

2

COGNITIVE DEVELOPMENT

2.1 Introduction

There are many aspects to children's development. These include: their physical growth; the development of social and emotional understanding; the formation of relationships with their carers, wider family and peers; and their cognitive development. This latter aspect itself comprises a number of facets, such as visual perception, memory, language and higher executive functions such as planning and decision making. These developmental achievements are highly interdependent; many of the cognitive functions children acquire depend on a certain degree of maturation within the growing brain before they can be performed adequately, or in some cases, at all. Similarly, children's ability to form words and start to speak is linked to physical changes in the palate and tongue as well as neurological changes within the brain. The Growing Up in Scotland study has included a number of measures designed to capture some of these developmental milestones over the years, ranging from reasonably straightforward measures of height and weight, to somewhat more complex measures of children's motor skills, and more recently, their conceptual understanding. This chapter describes these measures of cognitive ability, outlines their importance for other developmental outcomes, and highlights some of the existing literature about factors influencing cognitive ability.

2.2 Measures of cognitive development

Cognitive ability was measured in the GUS birth cohort at age 34 months via two assessments: the naming vocabulary and picture similarities subtests of the British Ability Scales Second Edition (BAS II). These two assessments measure, respectively, language development and problem solving skills. Each subtest is part of a cognitive assessment battery designed for children aged between 2 years and 6 months and 17 years and 11 months (Elliott, 1996). The assessments are individually administered. Numerous tests of ability and intelligence exist but the BAS is particularly suitable for administration in a non-clinical setting such as within a social survey like GUS.

Hill (2005) provides a useful and succinct history of the development of the BAS and its strengths relative to other measures of intelligence. These strengths include: its development in Britain using a domestic reference population, the fact it is comprised of a number of stand-alone components (surveys rarely have time for lengthy tests to be administered), its theoretical grounding, its explicit concern to measure ability rather than intelligence, and the fact that although versions of the scale can be administered up to the age of 17 years and 11 months each of its age-specific versions were specifically designed for their corresponding age group.

Its origins lie in the 1960s when the then Department for Education and Science in London funded a programme to develop a British Intelligence Scale (BIS). This was in response to concerns about existing measures of ability that had been developed in America and were therefore felt to have cross cultural limitations. The BIS was designed to be more theoretically driven than previous measures and was grounded in the work of key developmental psychologists at the time (Bruner, Piaget and Kohler). Elliot steered the final stages of its development, during which time the name changed from the British *Intelligence* Scale to the British *Ability* Scale, signalling its creators' desire to distance it from the more controversial area of intelligence testing. The first version of the scale was published in 1979 and a further revision by Elliot between 1993 and 1996 resulted in the BAS II (Elliott, 1996), as used in the GUS study.

The scales are designed to form a composite measure known as General Conceptual Ability (GCA) with each subtest contributing towards the overall GCA score. The way in which the GCA is determined depends on the age of the children being tested. In the first phase, which spans the period 2 years and 6 months to 3 years and 5 months (the age range within which the GUS cohort fell at the point of testing), the individual scales contribute directly to the GCA score. At later ages three intermediate cluster scores (measuring verbal ability, non-verbal reasoning and spatial ability) are generated and these then feed into the composite GCA. A key feature of the BAS is that each sub-scale is also suitable for use in its own right. Due to time limitations within the GUS interview only two of the four scales were used so an overall GCA score cannot be calculated. As noted above, the two scales used were the **naming vocabulary** assessment and the **picture similarities** assessment.

Naming vocabulary requires the child to name a series of pictures of everyday items and assesses the expressive language ability of children. In the picture similarities assessments children are shown a row of four pictures on a page. They are asked to place a free-standing card with a fifth picture underneath the picture with which the card shares a similar element or concept. The picture similarities assessment measures a child's problem solving ability. There are 36 items in total in the naming vocabulary assessment and 33 items in the picture similarities assessment. However, to reduce burden and to avoid children being upset by the experience of repeatedly failing items within the scale the number of items asked to each child is dependent on their performance. For example, one of the criteria for terminating the naming vocabulary assessment is if five successive items are answered incorrectly.

The analysis reported here used normative BAS scores, derived from the standard BAS tables and defined with reference to the standardisation samples used in developing the assessments. These normative scores were converted into T-scores based on the values in the standardisation sample for the applicable age band. T-scores range from 20 to 80 and have a mean of 50. A child with a T-score of 50 is therefore placed at the mean value for their age. Higher scores on either scale denote an increase in cognitive ability and, conversely, lower scores indicate a reduced level of ability. Table 2.1 presents the mean T-scores for the two scales and shows how the scores are distributed across the population.

The analysis presented in Chapter 4 of this report explores the difference in mean scores at age 34 months according to key socio-demographic factors, patterns of children's activities at age 10 and 22 months, and parents' attitudes towards these activities.

Table 2.1 British Ability Scale Naming Vocabulary and Picture Similarities scores at age 34 months

	Scale	
	Naming vocabulary	Picture similarities
Mean	51.6	49.7
Standard error	.30	.26
10th percentile	37	36
25th percentile	43	44
50th percentile	52	50
75th percentile	59	55
90th percentile	67	63
Bases		
Weighted	*3919*	*3917*
Unweighted	*3949*	*3947*

2.3 Why measure cognitive development?

Previous cohort studies that have included measures of child development have established that early cognitive ability influences later outcomes. For example, analysis by Feinsten (2003) of the 1970 Birth Cohort Study (BCS) showed that assessments of ability at 22 and 42 months predicted educational outcomes at age 26 years. This analysis also demonstrated that low scoring children from high socio-demographic status families were more likely to have progressed and improved their position in later years than similarly scoring children from more disadvantaged backgrounds who tend to stay at the bottom end of the distribution. The wider research literature also suggests that early poor cognitive ability can have a negative impact on other outcomes in the realms of education, employment, health and social development (Duncan and Brooks-Gunn, 1997; Essen and Wedge, 1978; Rutter and Madge, 1976; Schoon, 2006; cited in Jones and Schoon, 2008). Using cohort studies such as GUS to measure cognitive ability, and how it differs within the population, can help build a better understanding of the dynamics of children's development and to identify stages at which interventions might have a positive influence on later outcomes.

2.4 Factors influencing cognitive development

Previous research has uncovered a number of factors influencing children's cognitive ability that operate at a number of levels. For example, individual differences within children, such as their gender (Jones and Schoon, 2008) and birth weight (Shenkin, Starr and Deary, 2004), other gestational or early development indicators such as head circumference (Silva, Metha and O'Callaghan, 2006) as well as family/household level factors such as income level, ethnicity, parental education and social class (Jones and Schoon, 2008; Silva, Metha and O'Callaghan, 2006). Chapter 4 illustrates the relationships found in this study between a selection of individual and household level factors and children's cognitive ability at age 34 months.

Previous country-level analysis of the second sweep of the Millennium Cohort Study (MCS) conducted when the cohort members were of a similar age to the children covered in this report suggested that children in Scotland had slightly higher (though statistically significant) ability scores, as measured by the BAS vocabulary assessment, than their counterparts elsewhere in the UK (Dex, 2008). This analysis concluded that differences between the countries could not be explained by socio-demographic factors. However, the results presented here suggest that the ability scores for children in Scotland are closer to the UK average than those found in the MCS Scottish sample. The GUS sample is considerably larger than the MCS sample so it is possible that this apparent 'Scotland effect' was a consequence of the larger sampling error that will be associated with the MCS estimate. As the authors also note, the second sweep of the MCS was subject to differential non-response in Scotland that resulted in the sample having an overrepresentation of more affluent families. Although the previous analysis controlled for a number of possible sources of bias, such as mother's education level and household income, no statistical model can ever account for all sources of bias. This may also have contributed to the previous finding.

There is a large body of evidence that suggests parenting styles and children's activities have a powerful influence on cognitive ability as well as other developmental outcomes (see Lugo-Gill and Tamis-LeMonda, 2008, for an overview of the literature in this area). However, the strong interrelationship between parenting styles, activities and socio-demographic factors – for example parents' willingness to read to their children and their own educational background – means that any analysis that attempts to explore the impact of activities needs to take account of these wider influences. The analysis presented in Chapter 5 of this report does this by exploring the independent effect all these factors have on cognitive ability at age 34 months in an attempt to establish whether children's activities can moderate the well-established effects of socio-demographic factors on children's outcomes. The next chapter outlines the measures of children's activities that will be used in this analysis.

chapter

3 CHILDREN'S ACTIVITIES

3.1 Key findings

- At 10 months of age most children experienced the following on a daily basis: playing indoor or outdoor games (94%), singing or having rhymes recited to them (90%), looking at books or being read stories (66%). Only a minority of children (25%) had visited a library by the age of 10 months.
- Children living in the most deprived 15% of areas were less likely to have been read to on a daily basis at 10 months of age than children in the rest of Scotland (54% versus 69%). Similar patterns were evident between children whose families had the lowest and highest incomes (55% and 78% respectively), and between children whose mothers had no qualifications and those whose mothers had degrees (51% and 78% respectively).
- By the age of 22 months 79% of children looked at books or read stories every day, 58% recited rhymes or sang songs, 52% ran around or played outdoors, 28% did activities like painting or drawing and 30% played at recognising letters, words, numbers or shapes.
- Children were classified according to how many activities they had carried out per day at age 22 months. Children from less advantaged households were the least likely to be classified as being in the most active group of children and were the most likely to be in the least active group.
- The survey also measured how many events or places children had been to in the past year when they were aged 22 months. The activities ranged in popularity from just 5% having been to the cinema and 17% to a sporting event to 73% who had been to a zoo, farm or aquarium and 83% who had been to a swimming pool. Children had been to an average of three of the eight events/places asked about while only 4% had never been to any.
- The children most likely to have been to none or just one of the events or places asked about were those: in the most deprived 15% of areas, in the lowest income households, in families with no parent working full-time, with mothers aged under 20 at time of their birth, whose mothers have few or no qualifications.
- Parents were asked how important they thought it was for their children to experience various activities when their child was aged 22 months. The activities most likely to be rated as very important were: running around or playing outside (84%); educational activities such as reading, drawing or painting (82%); social activities such as visiting friends or having visitors (74%); exercise such as swimming, dancing or gymnastics (64%). Two activities were not rated as strongly: cultural activities such as museum visits (18%) and watching TV (6%).

- All the activities, except for watching TV, were used to create a scale measuring how many activities in total parents rated as very important. The average number rated as very important was just over three, just 5% rated none of them as very important and 14% said all five were. Two-parent families with neither parent working full-time were the most likely to say that one or none of the activities were important, followed by families in the lowest income households and mothers with no qualifications.
- Over half of parents were very happy (19%) or quite happy (37%) with the range of activities available to their child when aged 22 months. In contrast, 28% would have liked their child to have a slightly wider range and 16% wanted a much wider range of activities. Demand for a much wider range of activities was greatest among the most disadvantaged groups: in the 15% most deprived of areas, with the lowest household incomes, in families where no adult works more than 16 hours a week, mothers aged under 20 when their child was born, and mothers with few or no qualifications.

3.2 Introduction

This section provides an overview of the kinds of activities that children had experienced at age 10 and 22 months and introduces the measures that are used in the next section to explore the impact of activities on cognitive ability at 34 months. The ways in which activities vary across different family types and by other socio-demographic factors are also presented here to help provide a fuller picture of this aspect of children's lives.

3.3 Defining activities

This report measures three aspects of children's activities:

- activities that children experience,
- the importance parents attach to certain activities, and
- parents' satisfaction with the range of their children's activities.

These measures cannot, of course, capture every aspect of a child's early experiences and their parents' views about them. However, by broadening the focus to include aspects such as the importance parents attach to activities as well as their overall satisfaction with them, the picture painted is somewhat broader than an analysis based only on children's direct experiences would provide.

Surveys such as GUS have many strengths and can provide detailed insights into children's lives, but there are practical limitations on what can be collected within a survey. For example, some studies have also attempted to capture information about parenting styles by including experimental scenarios in which researchers observe parents and children interacting to assess the quality of their engagement directly (Lugo-Gill and Tamis-LeMonda, 2008). These techniques are very common in psychological studies of child development that often have a single purpose and where samples are generally small. In contrast, GUS is designed to cover a wide range of topics and interests, generally via standardised interviews and measures, so although employing these kinds of direct observations of parenting approaches would be desirable, they are not practical. Its large sample size would also make the administration of more sophisticated observational measures such as these impractical. For these reasons the analysis in this report is framed around *children's activities* rather than the broader issue of parenting 'quality', 'approach' or 'style'.

It is also worth noting that GUS collects parental reports of their children's activities which may themselves be subject to error. Parents may be unaware of the full extent of activities that their children experience, especially if they spend some of their time in the care of others, which could lead to under-reporting. Conversely, parents might be mistaken and recall activities that their child hasn't actually done (for example by mistaking them for a sibling or misremembering the time frame within which activities have taken place). However, despite these concerns the following sections demonstrate that it is undoubtedly possible to provide an overview of the extent and variety of children's recent experiences of growing up in Scotland, even if they do not represent the full entirety of that experience.

3.4 Activities at age 10 months

The range of children's activities asked about at sweep 1 of the study, when the children were aged 10 months, was less extensive than has been the case in subsequent sweeps. This is partly due to time pressures and the range of information it was necessary to include at the very first interview but it also reflects the less active nature of children at this young age. Table 3.1 presents a range of activities from sweep 1 and the frequency with which parents reported doing them with their child at that point. The questions used the following format:

How often do you (or your partner) look at books with (child) or read stories with (him/her)?

The first point to note from the table is the high proportions who reported playing games and reciting rhymes or singing songs with their child on a daily basis (over nine in ten in both cases). A lower proportion, two-thirds (66%), reported looking at books or reading stories on a daily basis, though only a very small minority (6%) never did this. In contrast, the majority of parents (75%) had never taken their child to the library by the time they were 10 months old. As such high proportions reported doing the first two activities, their ability to explain variations in children's cognitive ability at 34 months will be very limited. However, the two book based activities will be of more interest for two reasons. Firstly, their frequency is much lower overall so this degree of variation may be related to child outcomes. Secondly, one of the cognitive tests measures vocabulary and it can be hypothesised that early exposure to books might well confer an advantage on children when it comes to their vocabulary development. For these reasons these two indicators are worthy of further exploration.

Table 3.1 Frequency of children's activities at age 10 months

	Activity			
Frequency of activity	Play indoor or outdoor games	Recite nursery rhymes or sing songs	Look at books or read stories	Take child to the library
	%	%	%	%
Every day	94	90	66	*
Once or twice a week	5	7	21	4
Once every 1 or 2 months or less	1	1	7	20
Never	1	1	6	75
Bases				
Weighted	*5215*	*5215*	*5216*	*5214*
Unweighted	*5215*	*5215*	*5216*	*5214*

3.4.1 Reading books and library visits by socio-demographic factors

As Table 3.1 illustrates, reading with children on a daily basis and taking them to a library were by no means universal parenting activities. Table 3.2 presents the proportion of parents who did both these activities and shows how this varied according to a range of socio-demographic factors that were selected to cover a range of possible determinants of children's activities. They include individual level measures relating to the mother's age when the child was born and her education level, as well as some household level measures (income and employment/family type), and a measure of the level of the deprivation in the area where the family lived.

The data for the two activity types is presented in the columns and the socio-demographic factors are presented in the rows so the table should be read from top to bottom. For example, the first column shows that just over half (54%) of parents who live in the 15% most deprived of areas in Scotland read with their child on a daily basis when they were 10 months olds compared with seven in ten (69%) of parents in the rest of Scotland. Similarly sized differentials can be seen for all the other factors, with income and education showing the largest gaps between the highest and lowest incomes (78% and 55%), and between those with degrees and those with no qualifications (78% and 51%), respectively.

Table 3.2 Daily reading and library visits at age 10 months by Scottish Index of Multiple Deprivation, equivalised household income, family and employment type, age of mother at birth and mother's educational attainment

		Activity			
Socio-demographic factors		Look at books /stories with child every day	Has ever taken child to the library	*Bases Weighted*	*Bases Unweighted*
Scottish Index of Multiple Deprivation					
15% most deprived areas	%	54	19	*762/761*	*685/684*
Rest of Scotland	%	69	27	*3722/3721*	*3827/3826*
Equivalised household income quintile					
Up to £8,409	%	55	15	*1003*	*932*
£8,410-13,749	%	60	23	*972*	*956*
£13,750-21,784	%	68	27	*847/846*	*859/858*
£21,785-33,570	%	72	30	*983*	*1016*
£33,571 and above	%	78	32	*866/865*	*919/918*
Income unknown	%	62	21	*546*	*534*
Family and employment type					
Lone parent working >16 hours	%	62	15	*315*	*298*
Lone parent unemployed/ working <16 hours	%	55	15	*742*	*678*
Couple both working >16 hours	%	71	29	*2121/2120*	*2194/2193*
Couple one person working >16 hours	%	67	27	*1704*	*1733/1732*
Couple both unemployed/ working <16 hours	%	56	16	*331*	*310*
Age of mother at birth					
Under 20	%	55	13	*403/402*	*349/348*
20 to 29	%	65	21	*2163*	*2072*
30 to 39	%	69	30	*2409/2408*	*2539/2538*
40+	%	72	32	*170*	*182*
Mother's highest qualification					
Degree	%	78	38	*1276/1275*	*1334/1333*
Vocational below degree	%	66	24	*1664*	*1676*
Higher grade	%	69	24	*379*	*378*
Standard grade	%	55	16	*783/782*	*759/758*
No qualifications	%	51	14	*367*	*352*

Note: Within each base column the first figure is for the looking at books question, the second is for the library question; if only one figure is presented the base is the same for both questions.

3.5 Activities at age 22 months

As noted above, subsequent GUS sweeps have included more questions about children's activities and parent's views of them. At sweep 2 the questions looked in more detail at the kinds of activities children had done in the previous week as well as some less frequent ones in the course of the previous year.

3.5.1 Daily activities

At sweep 1 parents were asked about activities that they had done with their child. At sweep 2 the focus shifted away from parent-child interactions and instead the questions took the following format:

> *Can you tell me on how many days in the last week (child) has done each of the following things either on (his/her) own or with someone else? By 'the last week', I mean the last 7 days.*
>
> *On how many days in the last week has (child) looked at books or read stories?*

For those children who had engaged in an activity, follow-up questions then asked with whom the child had carried out the activity so parental involvement can be ascertained. Although this measure of parental involvement is of general interest, the purpose of this report is to establish what influence activities have on cognitive development so the critical area of interest is simply whether children have experienced activities, rather than in whose company they experienced it. For this reason the following analysis looks at how often children have experienced various activities, regardless of who they were with at the time.

Table 3.3 presents five activities that parents were asked about in descending order of their frequency based on the proportion who said that their child did that activity every day. The main point to note from the table is that all the activities were reportedly done by a majority of children at least once a week while a majority had done the first three activities on a daily basis. Even the least common activity in the table (educational games) had been done on an average of just over three days in the past week.

Table 3.3 Frequency of children's activities in the past week at age 22 months

	Activity				
No. of days in past week	Looked at books/read stories	Recited nursery rhymes or sung songs alone or with someone	Run around or played outdoors	Done activities involving painting or drawing	Played at recognising letters, words, numbers or shapes
	%	%	%	%	%
None	2	13	10	10	32
1 – 3 days	10	16	21	42	25
4 – 6 days	9	13	17	21	13
7 days	79	58	52	28	30
Mean no. of days	6.17	5.00	4.92	3.79	3.27
Standard error of mean					
Bases					
Weighted	*4507*	*4509*	*4496*	*4498*	*4492*
Unweighted	*4509*	*4508*	*4501*	*4502*	*4495*

In contrast to the activities at age 10 months shown in Table 3.1 these five activities show greater variation and are therefore more likely to be of use when it comes to examining their influence on cognitive ability at age 34 months. However, some attempt needs to be made to reduce or summarise the range of activities otherwise the analysis is at risk of becoming unwieldy. One way of summarising the data in Table 3.3 is to count up the number of activities that children had done in the past week and calculate a daily average.[2] Of course, this only covers the activities asked about and cannot reflect the full extent of a child's activities across a week. But, as the table suggests, these activities are on the whole very representative of the kinds of things children aged 22 months get up to regularly so as a means of drawing distinctions between children based on their general activity levels this composite measure is very effective. Doing this places children on a continuum ranging from those who had not carried out any of the five activities on any of the days at one end, to those that had done all five activities on all seven days (a maximum of 35 activities in a week, or 5 in a day). This composite measure can then be further divided into four groups of broadly equal size (quartiles) to provide a measure that allows the 25% most and 25% least active children to be compared.

2 Although the table shows the days of the week grouped into bands, the question asked parents to say how many days in the past week their children had done each activity using a continuous scale from 0 to 7.

3.5.2 Daily activities by socio-demographic factors

Table 3.4 uses the same range of socio-demographic factors that was used to explore activities at age 10 months to compare children's activity levels at age 22 months. The first column presents the data for the most active 25% children and the second looks at the least active 25% (the two intervening groups have been omitted to keep the table simple). The socio-demographic factors are presented in the rows. This means that the data can be read from left to right, to compare the two activity groups, as well as from top to bottom to compare the different socio-demographic factors. For example, looking at the income figures shows that 16% of children from the lowest income households were classified as being in the most active group whereas almost twice as many, 31%, were classified as being the least active. Comparison can also be drawn within the same activity group, for example the proportion of children from the lowest income households in the most active group (16%) can be compared with the equivalent proportion of children from the highest income households (34%). The key point to note from the table is that children from less advantaged families were the least likely to be among the most active 25% of children and were the most likely to be among the least active 25%. In short, activity levels increase as affluence and advantage increases.

Table 3.4 Daily activity quartiles at age 22 months by Scottish Index of Multiple Deprivation, equivalised household income, family and employment type, age of mother at birth and mother's educational attainment

		Activity level (based on activities per day in past week)			
Socio-demographic factors		Most active 25% of children	Least active 25% of children	*Bases Weighted*	*Bases Unweighted*
Scottish Index of Multiple Deprivation					
15% most deprived areas	%	20	25	*804*	*667*
Rest of Scotland	%	23	21	*3641*	*3781*
Equivalised household income quintile					
Up to £8,409	%	16	31	*1060*	*913*
£8,410-13,749	%	21	24	*794*	*767*
£13,750-21,784	%	24	17	*799*	*837*
£21,785-33,570	%	24	14	*727*	*779*
£33,571 and above	%	34	12	*846*	*946*
Income unknown	%	17	30	*256*	*244*
Family and employment type					
Lone parent working >16 hours	%	22	19	*322*	*285*
Lone parent unemployed/ working <16 hours	%	17	30	*563*	*454*
Couple both working >16 hours	%	27	14	*1860*	*2000*
Couple one person working >16 hours	%	22	23	*1459*	*1503*
Couple both unemployed/ working <16 hours	%	13	40	*218*	*192*
Age of mother at birth					
Under 20	%	18	30	*335*	*260*
20 to 29	%	21	22	*1822*	*1710*
30 to 39	%	24	18	*2118*	*2295*
40+	%	30	23	*149*	*162*
Mother's highest qualification					
Degree	%	28	13	*1199*	*1328*
Vocational below degree	%	24	19	*1643*	*1666*
Higher grade	%	20	16	*365*	*377*
Standard grade	%	19	31	*832*	*752*
No qualifications	%	13	33	*425*	*348*
All children	**%**	**23**	**21**	***4482***	***4486***

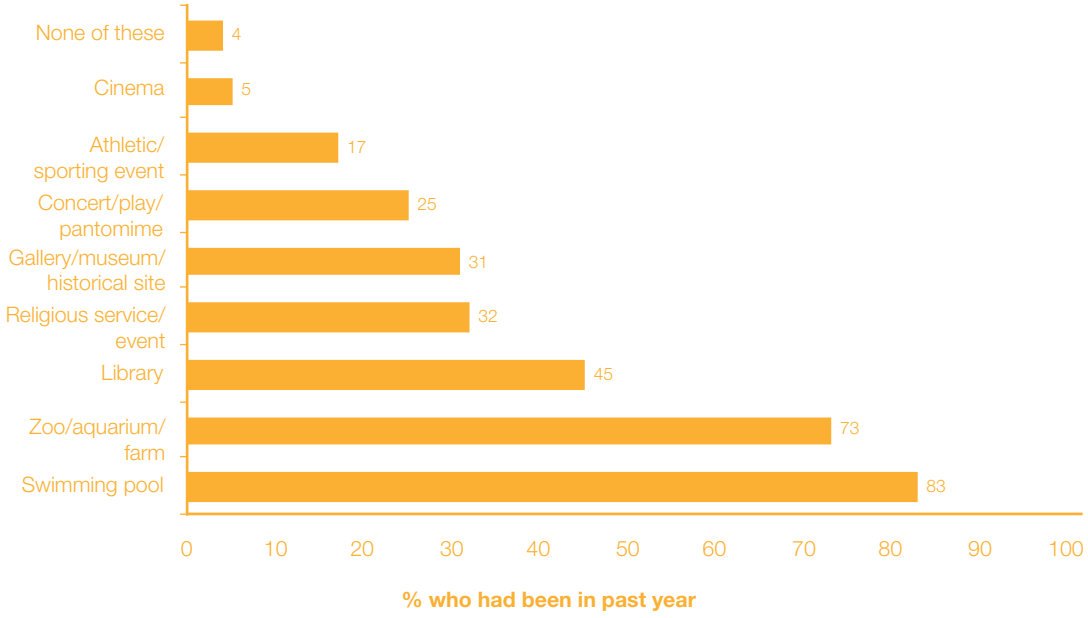
3.5.3 Annual visits and events

Sweep 2 also included questions about a different range of activities some of which tend to take place, if at all, on a less regular basis than the kinds of things looked at above. The question took the form of a showcard with a list of places of events that parents could choose from and used the following introduction:

> *I now have some questions about places or events that (child) might visit or be taken to either by someone in the family, (his/her) childcare provider or someone else. For these questions, we would like you to think about how often (child) has been to the places or events in the last year.*
>
> *First of all can you tell me which of the following places or events (child) has visited since* **(month of interview in previous year)***?*

Figure 3A shows the proportions of children who had been to each type of place or event in the previous year, when they were aged 22 months. Only two of the places or events had been visited by most children – a zoo/aquarium/farm (73%) and a swimming pool (83%) – though it's also worth noting that just 4% of children had not experienced any of these things.

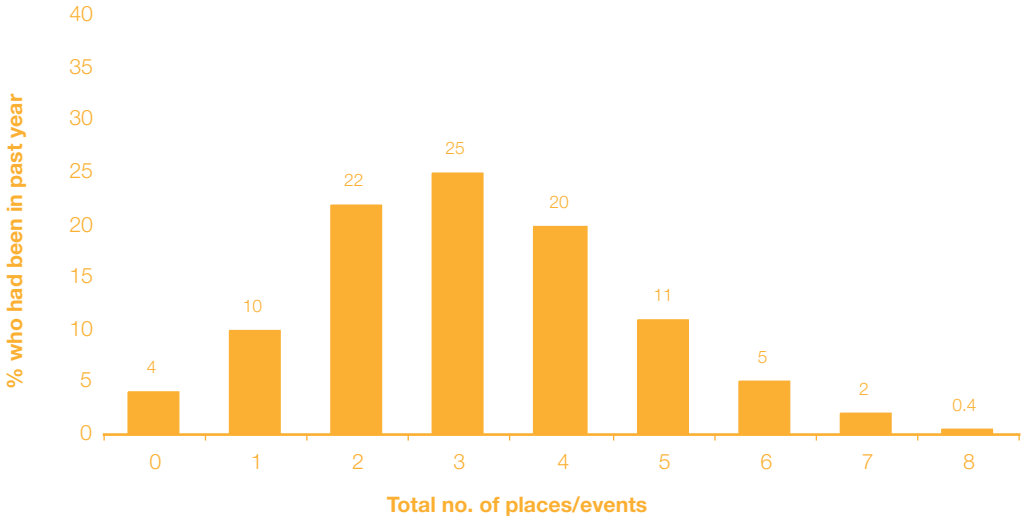
Figure 3A Places or events children had been to in previous year, at age 22 months



Bases: weighted: 4511; unweighted: 4512

As with the daily activities asked about in the survey, this range of places and events is meant to be illustrative of the kinds of activities that children experience rather than an exhaustive picture of their lives. It is also the case that some of the less commonly visited places might have been visited on a large number of occasions by those particular children, while the more common ones (such as a zoo) might have only been a one-off visit so this data cannot be used to draw conclusions on the volume of children's activities. In a similar vein, the study may have omitted to ask about many other types of event that the children could have been to. Despite these limitations, this measure is nonetheless a good indicator of the range and variety of experiences that children have had by the time they are 22 months old. Once again it is helpful to present this information in summary form so the total number of different types of places/events that children had experienced was totalled. Figure 3B shows the number of different places/events and the proportion of children who had experienced them. The graph shows a fairly normal distribution with a slight skew towards the higher numbers though only a very tiny proportion (less than 1%) had experienced all eight of the examples asked about. The mean number of different places/events per child was 3.11.

Figure 3B Number of different places or events children had been to in previous year, at age 22 months



Bases: weighted: 4511; unweighted: 4512

3.5.4 Annual visits and events by socio-demographic factors

This final section about activities that children have participated in looks at the ways in which the total number of places/events in the past year varies by socio-demographic factors. It uses the same approach as seen in Table 3.2 and Table 3.4. As the proportions of children who had been to very few or very many of the types of places were very low the scale has been grouped further and now runs from 0-1 to 5 or more, with 14% in the first category and 18% in the last.

Table 3.5 Total number of different places or events children had been to in previous year, at age 22 months, by Scottish Index of Multiple Deprivation, equivalised household income, family and employment type, age of mother at birth and mother's educational attainment

		No. of places/events in past year						
Socio-demographic factors		**0 or 1**	**2**	**3**	**4**	**5 or more**	*Bases Weighted*	*Unweighted*
Scottish Index of Multiple Deprivation								
15% most deprived areas	%	24	28	23	15	9	*821*	*679*
Rest of Scotland	%	12	21	25	22	20	*3653*	*3794*
Equivalised household income quintile								
Up to £8,409	%	27	30	24	12	8	*1067*	*918*
£8,410-13,749	%	15	27	25	19	13	*798*	*771*
£13,750-21,784	%	11	21	27	22	19	*802*	*839*
£21,785-33,570	%	6	16	26	24	28	*731*	*783*
£33,571 and above	%	5	14	23	29	29	*849*	*950*
Income unknown	%	25	22	25	14	14	*264*	*250*
Family and employment type								
Lone parent working >16 hours	%	15	26	31	18	10	*326*	*288*
Lone parent unemployed/ working <16 hours	%	27	32	23	12	6	*570*	*459*
Couple both working >16 hours	%	8	18	27	23	25	*1867*	*2008*
Couple one person working >16 hours	%	13	21	23	23	19	*1465*	*1508*
Couple both unemployed/ working <16 hours	%	40	31	17	6	6	*222*	*195*
Age of mother at birth								
Under 20	%	24	35	27	11	2	*337*	*262*
20 to 29	%	16	26	28	18	12	*1839*	*1723*
30 to 39	%	11	17	23	23	25	*2126*	*2304*
40+	%	14	14	20	23	28	*149*	*162*
Mother's highest qualification								
Degree	%	4	12	23	29	33	*1204*	*1334*
Vocational below degree	%	12	25	27	20	16	*1650*	*1672*
Higher grade	%	13	18	28	20	20	*366*	*378*
Standard grade	%	21	33	26	13	8	*844*	*761*
No qualifications	%	39	25	19	13	5	*428*	*350*
All children	**%**	**14**	**22**	**25**	**20**	**18**	***4511***	***4511***

As with the previous two tables of this type, the data can be read in two ways. Firstly, it is possible to compare the activity levels of children within the same socio-demographic group. For example, one in four (24%) children who live in the 15% most deprived areas in Scotland had visited one or none of these places/events in the past year whereas just one in ten (9%) had visited five or more. Secondly, the experiences of children from different socio-demographic groups can be contrasted. Still looking at area deprivation, the table shows that children in the 15% most deprived areas of Scotland were twice as likely as those in the rest of Scotland to have visited none or just one of the places/events (24% and 12% respectively). At the other end of the scale they were half as likely to have visited five or more (9% and 20% respectively). Once again, children's experiences at age 22 months were strongly influenced by their families' access to resources, such as income, as well as other sources of advantage, such as education.

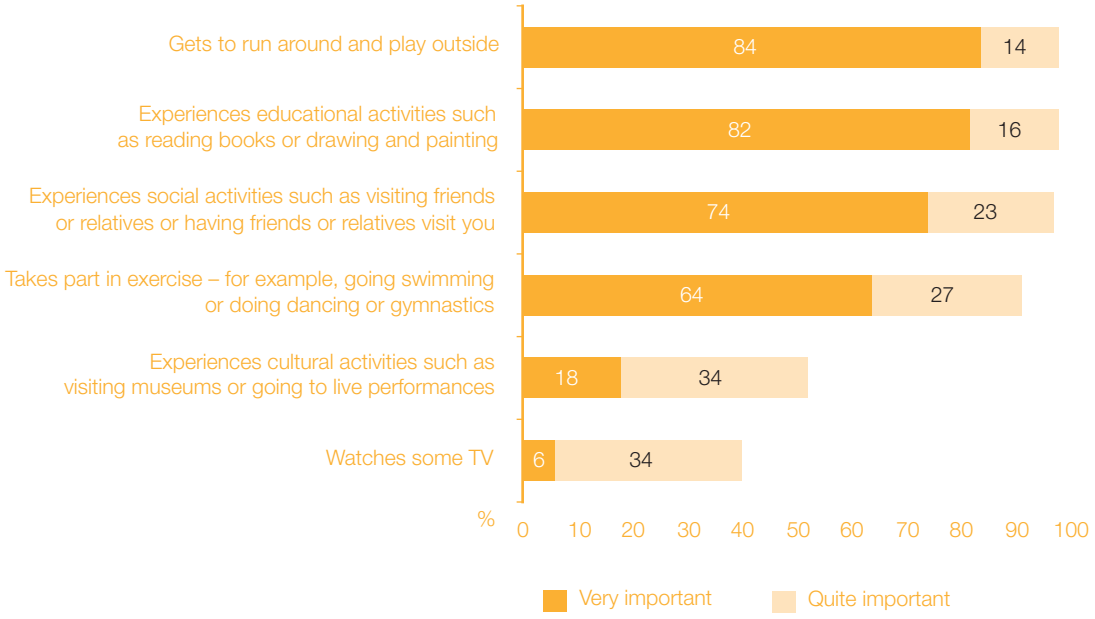
3.6 Parental attitudes towards activities at age 22 months

This section moves away from direct measures of children's activities and instead focuses on the importance that parents attach to some of the activities reported in the preceding sections. The questions asked about a range of activities, some of which correspond with the questions about daily and annual activities explored above, and used the following format:

> *How important is it for you that (child) experiences social activities such as visiting friends or relatives or having friends or relatives visit you?*

Figure 3C shows the levels of importance parents placed on each of the activities asked about. These were examined using factor analysis, a technique that looks for underlying patterns within data to identify common themes. The factor analysis showed that parents' views about the importance of activities were highly correlated. There was, however, one exception: television. This is evident from the results shown below as the proportion who said it was important for their children to watch television was so much lower than for the other activities there is little scope for answers to this question to correspond with the rest of the items asked about (and it is worth noting that the question was only of parents whose children had watched television in the past week whereas the other questions were asked of all parents, another reason why it is unsuitable for use in this scale).

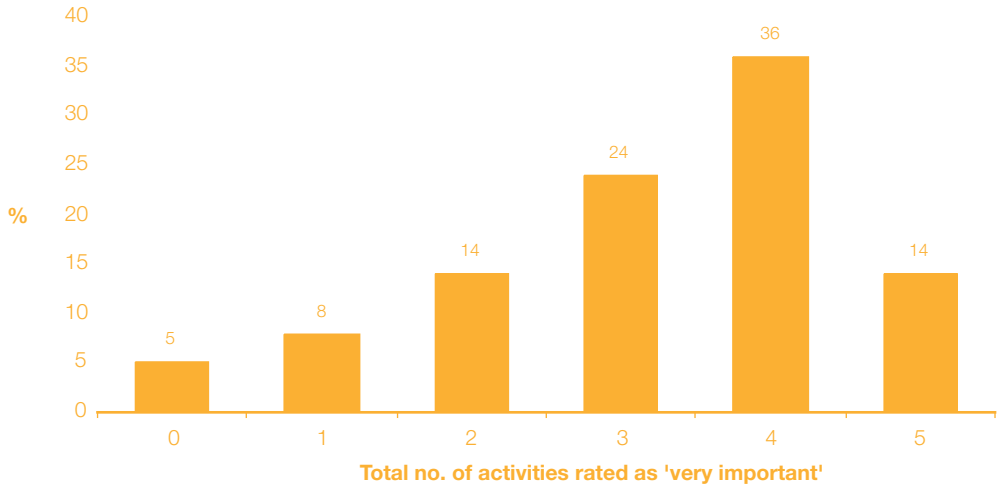
Figure 3C Parents' attitudes towards the importance of different activities for their children, at age 22 months



Bases: weighted: 3620-4511; unweighted: 3631-4509

Each of the ratings could be of interest in their own right when it comes to analysing their impact on later cognitive outcomes. For example, the importance parents attached to educational activities and reading at age 22 months could exert an influence on children's cognitive ability at 34 months if this importance rating means that those parents were more likely to read with their child or play the kinds of educational games that help develop cognitive ability. It is certainly the case that parents who rated this as very important were more likely to have children who did these kinds of activities on a regular basis (32% of parents who rated educational games and reading as important had children who played shapes, letters and numbers games every day compared with 19% of parents who rated such games as quite important). However, not all of the measures have a similar theoretical underpinning and as one of the intentions of this analysis is to explore parents' attitudes to activities more broadly it is also useful to create a summary measure of overall views. This was constructed by summing the total number of items that had been rated as 'very important'. Due to its different nature when compared with the rest of the activities, television was excluded from this summary scale. Figure 3D shows the distribution of parents across the scale. The mean number of activities given the highest rating was 3.2. The data is skewed towards the right of the scale though there is a sharp fall off between the proportions who rated four (36%) and those who rated all five (14%) as very important. In contrast just one in twenty (5%) said none of the activities were very important, and many of these parents will have rated the activities as 'quite important'.

Figure 3D Scale of activities parents rated as 'very important', at age 22 months



Bases: weighted: 4500; unweighted: 4504

3.6.1 Parental attitudes towards activities by socio-demographic factors

This section looks at the scale importance attached to activities by the same socio-demographic factors that were explored in relation to children's participation in activities. Due to the small sample sizes at the extreme ends of the scale the first and second categories (0 and 1) and the last two categories (4 and 5) have been combined.

Table 3.6 Scale of activities parents rated as 'very important', at age 22 months, by Scottish Index of Multiple Deprivation, equivalised household income, family and employment type, age of mother at birth and mother's educational attainment

		No. of places/events in past year					
Socio-demographic factors		0 or 1	2	3	4 or 5	*Bases Weighted*	*Unweighted*
Scottish Index of Multiple Deprivation							
15% most deprived areas	%	16	17	21	46	*813*	*674*
Rest of Scotland	%	11	13	25	51	*3650*	*3791*
Equivalised household income quintile							
Up to £8,409	%	19	18	25	38	*1058*	*912*
£8,410-13,749	%	13	16	24	47	*797*	*770*
£13,750-21,784	%	10	13	25	52	*802*	*839*
£21,785-33,570	%	9	10	24	57	*730*	*782*
£33,571 and above	%	5	8	24	62	*849*	*950*
Income unknown	%	17	17	19	48	*264*	*250*
Family and employment type							
Lone parent working >16 hours	%	13	12	21	54	*326*	*288*
Lone parent unemployed/ working <16 hours	%	19	17	25	38	*567*	*457*
Couple both working >16 hours	%	8	11	24	57	*1866*	*2007*
Couple one person working >16 hours	%	12	13	26	49	*1463*	*1507*
Couple both unemployed/ working <16 hours	%	28	29	16	28	*218*	*192*
Age of mother at birth							
Under 20	%	18	19	23	40	*337*	*262*
20 to 29	%	13	14	23	51	*1833*	*1718*
30 to 39	%	10	12	25	52	*2124*	*2302*
40+	%	13	17	26	43	*149*	*162*
Mother's highest qualification							
Degree	%	6	10	24	60	*1204*	*1334*
Vocational below degree	%	11	13	25	51	*1645*	*1670*
Higher grade	%	10	15	23	52	*365*	*377*
Standard grade	%	16	18	23	43	*842*	*760*
No qualifications	%	24	17	25	34	*42*	*347*
All children	**%**	**13**	**14**	**24**	**50**	***4500***	***4504***

For simplicity the following discussion focuses on those parents who attached very little importance to the activities rather than the much higher proportion who rated most or all of the activities highly. Perhaps the most interesting point to take from Table 3.6 is the fact that some of the patterns that have been quite striking in the previous analyses of children's activities and socio-demographic factors are not replicated here. For example, mother's age at birth and area deprivation appear to be only weakly associated with importance ratings. For example, 18% of younger mothers (aged under 20) when their child was born rated none or one of the activities as very important while the corresponding figure for mothers aged over 40 is only five percentage points lower, at 13%. The equivalent gap between these groups was higher in relation to all three activity measures presented above in Table 3.2, Table 3.4, and Table 3.5. A similar pattern exists for area deprivation; there is less difference between families in the most deprived 15% of areas and the rest of Scotland than was evident in Table 3.2 and Table 3.5. This is not to say that area deprivation and mother's age at birth are not important, all these factors have a statistically significant association with the importance ratings, it is simply that the association is less strong. It appears that household income and family type have a particularly strong association with importance ratings. For example, 28% of couple families where both adults were unemployed or who worked for fewer than 16 hours rated one or only one activity as very important compared with 8% of couple families with two adults employed for more than 16 hours.

3.7 Parental satisfaction with activities at age 22 months

This final section looks at parents' responses to a question about their overall level of satisfaction with the range of activities available to their child. The four answer options offered in the question were:

I am very happy with the range of activities that my child has access to

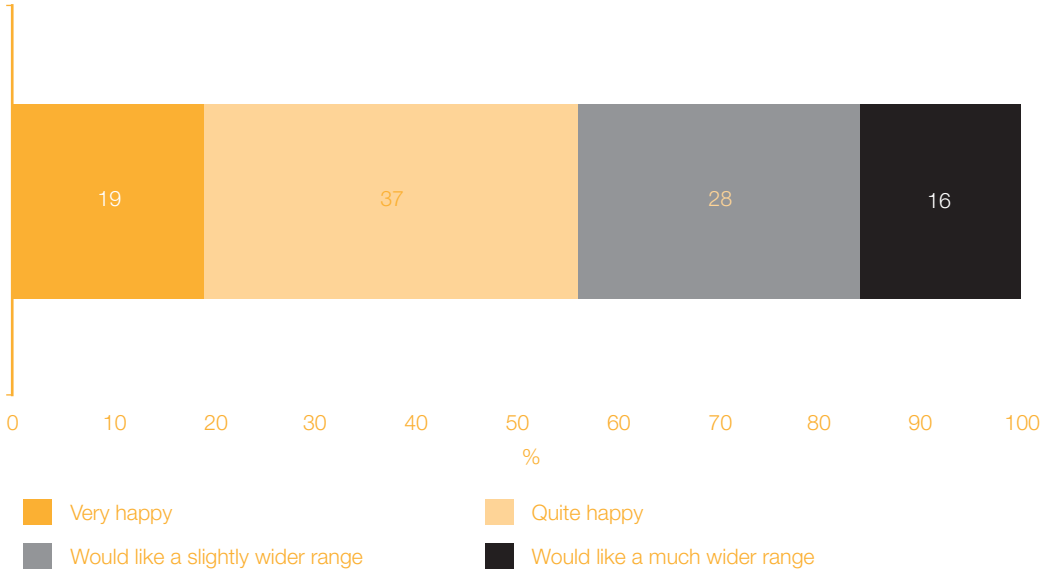
I am quite happy with the range of activities that my child has access to

I would like my child to have access to a slightly wider range of activities

I would like my child to have access to a much wider range of activities

As shown in Figure 3E, over half of parents were either very or quite happy with their children's range of activities, though it is worth highlighting that only one in five (19%) gave the most positive response. At the other end of the scale a similar proportion of parents said they would like their children's range of activities to be much wider (16%).

Figure 3E Parental satisfaction with children's range of activities, at age 22 months



Base: weighted: 4460; unweighted: 4464

3.7.1 Parental satisfaction with activities by socio-demographic factors

Having already established that children from more disadvantaged families tend to participate in fewer activities overall it will be interesting to see whether these families were also more likely to want their children to have a wider range of activities. It could be, for example, that parents of children who already experience lots of activities also want their children to do more. Table 3.7 suggests that demand for a wider range of activities is greatest among those in the more disadvantaged groups (who, as already seen, also tend to experience fewer activities): in the 15% most deprived of areas, with the lowest household incomes, in families where no adult works more than 16 hours a week, mothers aged under 20 when their child was born, and mothers with few or no qualifications.

Table 3.7 Parental satisfaction with children's range of activities, at age 22 months, by Scottish Index of Multiple Deprivation, equivalised household income, family and employment type, age of mother at birth and mother's educational attainment

		Parental views of their children's range of activities					
Socio-demographic factors		Very happy	Quite happy	Slightly wider range	Much wider range	*Bases Weighted*	*Unweighted*
Scottish Index of Multiple Deprivation							
15% most deprived areas	%	13	30	31	26	*812*	*671*
Rest of Scotland	%	20	39	27	13	*3613*	*3754*
Equivalised household income quintile							
Up to £8,409	%	11	30	33	27	*1057*	*910*
£8,410-13,749	%	13	36	32	19	*786*	*759*
£13,750-21,784	%	18	41	29	12	*795*	*832*
£21,785-33,570	%	24	43	24	10	*724*	*775*
£33,571 and above	%	31	41	20	8	*841*	*941*
Income unknown	%	23	37	22	18	*258*	*245*
Family and employment type							
Lone parent working >16 hours	%	17	37	26	20	*324*	*287*
Lone parent unemployed/working <16 hours	%	9	29	30	33	*564*	*454*
Couple both working >16 hours	%	22	42	25	11	*1852*	*1992*
Couple one person working >16 hours	%	22	37	28	13	*1442*	*1485*
Couple both unemployed/working <16 hours	%	10	30	35	25	*219*	*193*
Age of mother at birth							
Under 20	%	13	31	32	24	*336*	*261*
20 to 29	%	15	36	31	18	*1816*	*1701*
30 to 39	%	23	39	25	13	*2104*	*2282*
40+	%	26	41	23	11	*146*	*159*
Mother's highest qualification							
Degree	%	30	42	21	7	*1194*	*1325*
Vocational below degree	%	16	37	30	17	*1629*	*1651*
Higher grade	%	21	40	28	11	*366*	*377*
Standard grade	%	13	36	30	21	*826*	*744*
No qualifications	%	13	27	33	28	*426*	*349*
All children	**%**	**19**	**37**	**28**	**16**	***4460***	***4464***

3.8 Summary of measures of activities

As noted in the introduction to this chapter, the analysis of children's activities and parent's attitudes presented here is not meant to be an exhaustive exploration of this topic. Rather, the intention was to identify those measures that had been selected to be used in the analysis of cognitive ability at age 34 months. Arriving at a comprehensive set of measures always presents challenges in terms of ensuring adequate coverage of a topic. Having too many measures could result in findings that are difficult to unpick and interpret, too few and there is a danger that the issue hasn't been explored to its fullest potential. While existing literature in the area is an essential starting point, as is the formation of testable hypotheses, these kinds of selection processes are ultimately a matter of judgement for the analyst.

The measures of activities investigated in the following chapter in relation to cognitive ability are:

- **Activities at age 10 months**
  - Frequency of reading with the child
  - Whether the child ever visits the library
- **Activities at age 22 months**
  - Number of days in the past week the child had played educational games (recognising shapes, numbers, letters)
  - Overall daily activity levels in past week (composite measure based on five activities, in quartiles)
  - Number of different places/events child had been to in past year
- **Parental attitudes at age 22 months**
  - Parent's perceptions of the importance of playing educational games
  - Number of activities parents rated as very important for their child to do
  - Parental satisfaction levels with child's range of activities

Although the range of available indicators at the first sweep, when the children were aged 10 months, is somewhat limited it is important to include some measures from this point. If very early activities such as reading or exposure to libraries are shown to influence cognitive ability at a later stage then this will help signal the point at which policy interventions need to be targeted. Similarly, if certain activities at 22 months prove to be influential then this would suggest other kinds of interventions. The two composite scales of daily activities and visits to different places in the course of a year provide useful summary measures of a child's overall experiences and lifestyle. There is also good reason to investigate the independent effect of activities that are likely to encourage the development of the kinds of skills that are tested in the cognitive ability tests. For this reason playing educational games, and parent's attitudes towards the importance of such games, are also looked at on their own. This investigation of early childhood experiences and cognitive ability is hopefully a useful starting point, others may wish to take the analysis in different directions.

chapter

FACTORS INFLUENCING COGNITIVE DEVELOPMENT

4

4.1 Key findings

- Cognitive ability was measured in children at age 34 months using assessments of their language development (naming vocabulary) and problem solving skills (picture similarities).
- Large variations in cognitive scores were evident at age 34 months with children from less advantaged families outperformed by their more affluent counterparts on both assessments.
- Children who had been identified at 22 months as having developmental difficulties had lower cognitive ability scores than children with no developmental difficulties. Children born with low birth weight and boys also had lower than average ability scores.
- Children whose mothers have no qualifications scored less well than those with degree-educated mothers (who perform particularly well, especially on the naming vocabulary assessment). Children with older mothers (30 years or above) perform better than those with younger mothers.
- Children in households with four or more children have lower ability scores than those with fewer or no siblings. Low household income levels and unemployment/low working hours are also significant factors associated with poorer performance.
- Those in the 15% most deprived areas of Scotland have lower scores than those in the rest of Scotland.
- Children who were read to often, and those who had visited a library by the time they were 10 months old, scored higher on both assessments than children who had comparably less experience of these activities (though the impact was less pronounced for the picture similarities assessment than for the naming vocabulary).
- At age 22 months the number of days in the past week children had played educational games, their overall daily activity levels and the number of places or events they had visited in the past year were all associated with cognitive ability. The more activities children had experienced the higher their ability scores.
- Ability scores were higher among children whose parents rated four or five activities as very important, and whose parents were satisfied with the range of their activities, than for children whose parents attached less importance to activities or were dissatisfied with their range.
- The association between activity levels and cognitive ability might simply be a reflection of the fact that children with high activity levels tend to be from more socially advantaged backgrounds; this is explored further in the next chapter.

4.2 Introduction

This chapter looks at variations in cognitive ability scores across a number of different socio-demographic factors as well as the activities measures outlined in the previous chapter. The intention here is to present an overview of interesting patterns of association based on a selection of factors, rather than to provide an exhaustive exploration of cognitive ability. All of the factors presented below will be considered further in the next chapter where the question of how these all inter-relate will be addressed.

4.3 Socio-demographic factors

The socio-demographic factors considered in this analysis can be classified into four types:

- Child level factors:
  - Birth weight
  - Gender
  - Developmental difficulties identified at 22 months
- Mother level factors:
  - Age at birth
  - Education level
- Household level factors:
  - Number of children in household
  - Equivalised income
  - Family and employment type
- Area level:
  - Scottish index of multiple deprivation

Not only are the above factors strongly associated with activities, as shown in Chapter 3, they are also strongly related to each other. This is explored in the next chapter.

The most striking point to note from all the tables presented below is the extent to which large variations in ability are evident from a very early point in life. At just 34 months of age children from less advantaged families are outperformed by their more affluent counterparts on both the measures (naming vocabulary and picture similarities). Although individual differences in performance are shaped by a vast and complex range of factors, including many genetic or biological factors which are beyond the scope of being captured in a study like GUS, there is compelling evidence that social environment is a hugely critical determinant of outcomes. The implications of this in terms of appropriate policy interventions, and the likely impact that these early developmental differences might have on these children's outcomes later in life, are not insignificant.

4.3.1 Child level factors

Table 4.1 presents the mean T-scores[3] for both ability measures and how they vary by birth weight, gender and whether the child was identified as having some developmental difficulties at age 22 months. This latter measure is based on the Infant-Toddler Checklist component of the Communication and Symbolic Behaviour Scales (CSBS)[4] that was administered at sweep 2. This identifies children whose communication development is of concern, for example that they are not using the kinds of language or gestures expected of a child of their age. The strength of association with both cognitive ability scores is notable – children identified at 22 months as being of concern have much lower scores than children for whom no concerns were identified. This suggests that the CSBS assessment has been a useful tool within GUS for identifying children at risk of later developmental problems. Although they constitute a relatively small group within the population overall, they are an interesting group whose later outcomes are worth monitoring as they age. In addition, as the number of cognitive and developmental assessments carried out in GUS increases over time it might be possible to identify children whose developmental indicators suggest persistent concern and look at the risk factors associated with this status.

The finding that ability scores are lower for boys and those with low birth weights is consistent with evidence from previous studies (as already discussed in section 2.4).

3 T-scores convert the underlying data into normalised scores with a mean of 50, standard deviation of 10, and range from 20-80 (Elliot, 1996).

4 http://www.brookespublishing.com/store/books/wetherby-csbsdp/index.htm

Table 4.1 Average cognitive ability T-scores at age 34 months by child level factors

	Mean score	*Bases*	
Socio-demographic factors	**Naming vocabulary****	*Weighted*	*Unweighted*
Birth weight			
Low	48.1	*256*	*233*
Not low	51.9	*3594*	*3648*
Gender			
Boy	49.3	*1990*	*1995*
Girl	54.0	*1928*	*1954*
Developmental difficulties at 22 months			
Some difficulties identified	44.0	*262*	*248*
No difficulties	52.5	*3284*	*3341*
	Picture similarities**		
Birth weight			
Low	46.5	*256*	*233*
Not low	49.9	*3593*	*3646*
Gender			
Boy	48.6	*1990*	*1994*
Girl	50.8	*1927*	*1953*
Developmental difficulties at 22 months			
Some difficulties identified	45.4	*262*	*248*
No difficulties	50.1	*3284*	*3339*

**Differences significant at less than .001

4.3.2 Mother level factors

Turning now to look at factors related to the children's mothers shows that both age and education are associated with ability scores. Children whose mothers have no qualifications scored less well than those with degree-educated mothers who appeared to perform particularly well, especially in respect of the naming vocabulary scores. Having an older mother (30 years or above) also appeared to confer an advantage.

Table 4.2 Average cognitive ability T-scores at age 34 months by mother level factors

	Mean score	*Bases*	
Socio-demographic factors	**Naming vocabulary****	*Weighted*	*Unweighted*
Mother's highest educational qualification			
Degree	55.5	*1091*	*1245*
Vocational below degree	51.2	*1489*	*1513*
Higher grade	51.3	*306*	*315*
Standard grade	49.6	*688*	*602*
No qualifications	45.6	*332*	*263*
Mother's age at birth			
Under 20	47.5	*294*	*202*
20 to 29	49.9	*1582*	*1461*
30 to 39	53.6	*1888*	*2117*
40+	54.4	*128*	*147*
	Picture similarities**		
Mother's highest educational qualification			
Degree	52.1	*1090*	*1244*
Vocational below degree	49.8	*1487*	*1512*
Higher grade	50.0	*306*	*315*
Standard grade	47.9	*688*	*602*
No qualifications	44.8	*332*	*263*
Mother's age at birth			
Under 20	45.9	*294*	*202*
20 to 29	48.9	*1582*	*1461*
30 to 39	51.0	*1887*	*2115*
40+	49.9	*128*	*147*

**Differences significant at less than .001

4.3.3 Household level factors

The household level factors include a measure of income that has been adjusted to take account of the household size, employment patterns (which can also be a proxy measure of income), and a measure of the total number of children in the family. This latter measure will in part reflect the way in which financial resources are spread within a household, with costs rising as family size increases, but it is also a useful measure of the possible distribution of time resources within a family. One possible hypothesis is that children in large families spend proportionately less time interacting with their parents than children in smaller units. Alternatively, it is possible that the greater opportunity for sibling interactions in larger households confers a developmental advantage on children in such families. Table 4.3 suggests that children in households with four or more children have lower ability scores than those with fewer or no siblings, and that low income levels and unemployment/low working hours are also significant factors associated with poor performance. However, larger family sizes are also commonly associated with lower income households so the analysis will need to be taken a little further to untangle the patterns evident here. The next chapter addresses this.

Table 4.3 Average cognitive ability T-scores at age 34 months by household level factors

	Mean score	*Bases*	
Socio-demographic factors	**Naming vocabulary****	*Weighted*	*Unweighted*
Number of children in household			
One	53.2	*1326*	*1289*
Two	51.9	*1764*	*1841*
Three	49.2	*631*	*637*
Four or more	46.4	*198*	*182*
Equivalised household income quintile			
Up to £8,409	46.0	*871*	*719*
£8,410-13,749	50.5	*785*	*761*
£13,750-21,784	53.0	*685*	*723*
£21,785-33,570	54.6	*742*	*820*
£33,571 and above	56.0	*604*	*693*
Income unknown	51.8	*231*	*233*
Family and employment type			
Lone parent working >16 hours	51.1	*304*	*272*
Lone parent unemployed/working <16 hours	45.6	*440*	*339*
Couple both working >16 hours	54.3	*1712*	*1863*
Couple one person working >16 hours	51.1	*1291*	*1330*
Couple both unemployed/working <16 hours	45.2	*161*	*134*

**Differences significant at less than .001

Table 4.3 Average cognitive ability T-scores at age 34 months by household level factors – continued

	Mean score	*Bases*	
Socio-demographic factors	**Picture similarities****	*Weighted*	*Unweighted*
Number of children in household			
One	50.3	*1325*	*1289*
Two	50.2	*1763*	*1839*
Three	48.1	*631*	*637*
Four or more	46.8	*198*	*182*
Equivalised household income quintile			
Up to £8,409	45.5	*870*	*718*
£8,410-13,749	49.4	*785*	*761*
£13,750-21,784	50.3	*685*	*722*
£21,785-33,570	51.9	*741*	*819*
£33,571 and above	52.7	*605*	*699*
Income unknown	50.0	*231*	*233*
Family and employment type			
Lone parent working >16 hours	50.2	*304*	*272*
Lone parent unemployed/working <16 hours	44.3	*439*	*338*
Couple both working >16 hours	51.2	*1712*	*1863*
Couple one person working >16 hours	50.1	*1290*	*1329*
Couple both unemployed/working <16 hours	44.7	*161*	*134*

**Differences significant at less than .001

4.3.4 Area deprivation

This final socio-demographic indicator uses a neighbourhood level measure of deprivation so goes beyond the confines of individual or household circumstances. Table 4.4 compares the scores of children living in the 15% most deprived of areas in Scotland with those in the rest of the country. For both assessments children in the 15% most deprived areas have lower scores than those in the rest of Scotland.

Table 4.4 Average cognitive ability T-scores at age 34 months by Scottish Index of Multiple Deprivation

	Mean score	*Bases*	
Socio-demographic factors	**Naming vocabulary****	*Weighted*	*Unweighted*
Scottish Index of Multiple Deprivation			
15% most deprived areas	48.2	*662*	*534*
Rest of Scotland	52.3	*3257*	*3415*
	Picture similarities**		
Scottish Index of Multiple Deprivation			
15% most deprived areas	46.0	*660*	*533*
Rest of Scotland	50.5	*3256*	*3414*

**Differences significant at less than .001

4.4 Children's activities

The reasoning behind the selection of the following activities is set out in Chapter 3 and will not be repeated here. However, a reminder of the measures being explored is useful:

- **Activities at age 10 months**
  - Frequency of reading with the child
  - Whether the child ever visits the library
- **Activities at age 22 months**
  - Number of days in the past week the child had played educational games (recognising shapes, numbers, letters)
  - Overall daily activity levels in past week (composite measure based on 5 activities, in quartiles)
  - Number of different places/events child had been to in past year
- **Parental attitudes at 22 months**
  - Parent's perceptions of the importance of playing educational games
  - Number of activities parents rated as very important for their child to do
  - Parental satisfaction levels with child's range of activities

As was the case with the socio-demographic factors discussed above, the patterns of association between activities, parental views and cognitive ability scores are striking. However, a similar – or indeed stronger – note of caution needs to be flagged here in terms of what these results do and do not mean. While it is very evident that ability scores increase in line with rising activity levels, there is not sufficient proof that one causes the other. The results presented below are only part of the investigation into why children's outcomes differ so markedly, the discussion in the next chapter expands on this and goes further by identifying the influence these activity measures have once other socio-demographic factors have been taken into consideration. This section should not, therefore, be read in isolation without reference to the analysis still to come. With this in mind the following commentary simply highlights the key findings from the tables and does not go into extensive detail about their possible implications.

4.4.1 Activities at 10 months

Both measures of early 'literary' activity show an association with ability scores, with children who were read to often, and those who had visited a library by the time they were 10 months old, scoring higher on both assessments than children who had comparably less experience of these activities. Although statistically significant, the absolute size of the difference between the picture similarity scores for children who had been to a library and those who had not is actually quite small so its overall impact is probably marginal. This type of finding is common in studies with large samples such as GUS.

Table 4.5 Average cognitive ability T-scores at age 34 months by activities at 10 months

	Mean score	*Bases*	
Activities at 10 months	**Naming vocabulary****	*Weighted*	*Unweighted*
Frequency of reading/looking at books with child			
Every day	53.0	*2560*	*2653*
Once or twice a week	50.5	*790*	*772*
Once every one or two months or less	47.7	*277*	*258*
Never	45.1	*225*	*201*
Whether child ever visits library			
Has been	53.5	*1003*	*1079*
Has never been	51.0	*2848*	*2803*
	Picture similarities**		
Frequency of reading/looking at books with child***			
Every day	50.5	*2558*	*2653*
Once or twice a week	48.6	*790*	*772*
Once every one or two months or less	48.1	*277*	*258*
Never	45.5	*225*	*201*
Whether child ever visits library			
Has been	50.6	*1002*	*1077*
Has never been	49.3	*2848*	*2803*

**Differences significant at less than .001

4.4.2 Activities at 22 months

All three activity measures at 22 months show significant associations with ability scores and the magnitude of the differences between groups is also quite notable. For example, the mean naming vocabulary t-score for the 25% most active children (based on their activities in the previous week) is 56.0 compared with 45.1 for children in the 25% least active group.

Table 4.6 Average cognitive ability T-scores at age 34 months by activities at 22 months

	Mean score	*Bases*	
Activities at 22 months	**Naming vocabulary****	*Weighted*	*Unweighted*
No. of days child played educational games in past week			
Every day	53.8	*1138*	*1149*
Four-six days	53.6	*528*	*541*
One to three days	51.5	*971*	*986*
None	48.9	*1204*	*1196*
Overall daily activity level quartile			
First quartile (most active 25%)	56.0	*895*	*932*
Second quartile	53.1	*1112*	*1136*
Third quartile	51.2	*1068*	*1093*
Fourth quartile (least active 25%)	45.1	*760*	*706*
Number of different places/events visited in past year			
Five or more	55.3	*725*	*814*
Four	53.9	*799*	*849*
Three	51.5	*983*	*993*
Two	50.0	*840*	*790*
None/one	45.9	*507*	*438*

**Differences significant at less than .001

Table 4.6 Average cognitive ability T-scores at age 34 months by activities at 22 months – continued

Activities at 22 months	Mean score	Bases	
	Picture similarities**	*Weighted*	*Unweighted*
No. of days child played educational games in past week			
Every day	50.7	*1139*	*1150*
Four-six days	51.0	*528*	*541*
One to three days	49.5	*970*	*985*
None	48.3	*1202*	*1194*
Overall daily activity level quartile			
First quartile (most active 25%)	52.1	*896*	*933*
Second quartile	50.8	*1110*	*1134*
Third quartile	49.3	*1067*	*1092*
Fourth quartile (least active 25%)	45.9	*760*	*706*
Number of different places/events visited in past year			
Five or more	52.1	*723*	*812*
Four	51.2	*800*	*850*
Three	49.8	*983*	*993*
Two	48.1	*838*	*789*
None/one	46.1	*507*	*438*

**Differences significant at less than .001

4.4.3 Parental attitudes towards, and satisfaction with, activities at 22 months

Table 4.7 looks at parent's assessments of the importance of activities and their satisfaction with their children's range of activities. While the item measuring the importance of reading and educational games is of substantive interest, given its high correspondence with the kinds of abilities assessed in these two cognitive tests, it is a less useful discriminator of views than the composite measure of broader views about the importance of activities. This is unsurprising as a very high proportion of parents rated educational games as very important. Nevertheless, even amongst those who said this was important the degree of importance they attached to it (very or quite) was correlated with ability scores.

Table 4.7 Average cognitive ability T-scores at age 34 months by parental attitudes at 22 months

	Mean score	Bases	
Parental attitudes	Naming vocabulary**	*Weighted*	*Unweighted*
Importance of playing educational games/reading with child+			
Very important	52.5	*3198*	*3263*
Quite important	47.5	*598*	*574*
No. of activities rated as important			
Four or five	53.5	*1958*	*2026*
Three	51.7	*933*	*957*
Two	48.9	*514*	*495*
One or none	46.7	*442*	*402*
Satisfaction with child's activities			
Very happy	53.3	*736*	*794*
Quite happy	52.7	*1431*	*1478*
Would like a slightly wider range	50.6	*1048*	*1032*
Would like a much wider range	49.1	*594*	*538*
	Picture similarities**		
Importance of playing educational games/reading with child+			
Very important	50.3	*3197*	*3261*
Quite important	47.1	*598*	*574*
No. of activities rated as important			
Four or five	50.8	*1957*	*2024*
Three	49.5	*934*	*958*
Two	49.0	*513*	*494*
One or none	46.0	*442*	*402*
Satisfaction with child's activities			
Very happy	51.3	*736*	*794*
Quite happy	49.8	*1430*	*1476*
Would like a slightly wider range	49.2	*1048*	*1032*
Would like a much wider range	48.3	*593*	*538*

+The sample sizes for the rest of categories are too small to report

**Differences significant at less than .001

4.5 Conclusion

This chapter has provided an overview of the relationship between cognitive ability and socio-demographic factors and children's activities. The results confirm much of what the existing literature suggests about the kinds of factors that influence cognitive outcomes. For example, children's individual characteristics such as their gender, birth weight and developmental history are all associated with their cognitive ability at age 34 months with boys, low birth weight babies and children who had experienced developmental difficulties in the first year of life all found to have below average ability scores. Children whose mothers were aged under 20 when they were born or who have low levels of educational achievement (two factors that are themselves strongly linked) also performed below the average. Household and area level indicators of disadvantage, such as low income, unemployment or area deprivation also showed negative associations with ability scores. The range of activity measures defined in the previous chapter were also found to be associated with cognitive ability; children who experience a wide range of activities and those whose parents consider this to be important had higher than average ability scores. Whether the fact that children from more advantaged backgrounds also experience more activities is the underlying explanation for this apparent association between activities and cognitive outcomes remains to be seen. The next chapter aims to untangle this.

chapter

5

THE RELATIVE IMPORTANCE OF CHILDREN'S ACTIVITIES AND SOCIO-DEMOGRAPHIC FACTORS

5.1 Key findings

- The two questions addressed in this report are: do children's early activities have an influence on cognitive development in addition to socio-demographic factors?; and, do children's early activities moderate the effect of socio-demographic factors on cognitive development?
- To answer these questions multivariate analysis was carried out to explore whether any of the activity measures were independently associated with cognitive ability scores once a range of socio-demographic factors were controlled for.
- The analysis considered each of the cognitive ability assessments separately and looked at the influence of:
  - socio-demographic factors alone,
  - activity measures and socio-demographic factors together, and
  - activity measures and socio-demographic factors in a sub-set of less advantaged children.
- For the naming vocabulary assessment area deprivation and family composition/employment type were no longer significant when all socio-demographic factors were considered together. Three activity measures were independently associated with ability when all factors were considered: being read to every day at age 10 months, being in the most active group at age 22 months for daily activities, and visiting a wide range of events/places at age 22 months. The last two activity measures were still significant when the analysis focused on less advantaged children.
- For the picture similarities assessment mother's education was no longer significant when all socio-demographic factors were considered together, while age of mother at birth and family composition/employment type were no longer significant once all factors were considered. Two activity measures were independently associated with ability when all factors were considered: being in the most active group at age 22 months for daily activities, and visiting a wide range of events/places at age 22 months. The daily activity measure was still significant when the analysis focused on less advantaged children.
- Collectively these finding suggest that activities do have an influence on children's cognitive development and that they can moderate the effect of socio-demographic disadvantage. The individual factors associated with ability were different for the two assessments.
- The overall amount of variation in children's scores explained by the analysis was relatively low, but typical for analysis of a social survey, other factors that haven't been explored here are also likely to be important, including genetic factors.

5.2 Introduction

This chapter brings together the analyses presented in the two previous chapters and attempts to establish whether children's cognitive ability is still influenced by the activities they experience and their parents' views of those activities when socio-demographic factors are also taken into consideration. The method used to carry out this analysis is described and the results are presented in summary form.

5.3 Approach to the analysis

5.3.1 Overview and limitations

The results in the previous chapter demonstrated the relationships between a range of socio-demographic measures, children's activities and cognitive ability at age 34 months. However, it is also clear from Chapter 3 that activities are themselves highly socially patterned. It is possible, therefore, that the significant associations between activities and cognitive ability are simply a reflection of the socio-demographic composition of the families whose children experience a wide range of activities, rather than the activities themselves exerting an independent influence. It is possible to carry out a form of analysis to disentangle these relationships and help establish whether activities alone can help explain differences in cognitive ability levels, over and above socio-demographic factors. The analysis used for this task was multiple linear regression, a multivariate technique that is able to assess the relationship that one factor has with an outcome measure (e.g. cognitive ability) while simultaneously controlling for the effects of all other factors.

It is important to note that while multivariate techniques can help to identify which factors are independently associated with cognitive ability scores, establishing that these factors cause any differences in cognitive ability is slightly trickier. Some studies struggle to establish causation because they only investigate relationships between factors at one point in time and the sequence of events is not always clear. For example, low levels of physical activity are associated with poor cardiovascular health; however, people with poor health are also more likely to have reduced activity levels as a result of their condition. Whether low physical activity causes poor cardiovascular health can only be answered by tracking people over time with a longitudinal study and comparing the health outcomes of people with different activity levels earlier in life. GUS has the advantage of being a longitudinal study so it will be possible to draw some conclusions about the direction of some relationships; for example rather than looking at activities at the same point in time that the cognitive ability tests were administered this analysis looks at children's activities one or two years before the assessments. However, all analyses, whether longitudinal or based on one point in time, share the limitation that any relationships that are identified may simply mask other underlying associations that have not been considered, either because there is no data about them or because they have not been included in the analysis. So, although the temporal limitations faced by some data analysis are reduced

with a study like GUS, the potential for key explanatory factors to be missing means caution must be drawn when drawing conclusions based on its results.

5.3.2 Regression model stages

The regression analysis of cognitive ability was done in four stages. These are described below.

Stage one

The first stage in the analysis looked at socio-demographic measures to identify which had an independent association with naming vocabulary scores. Not only are socio-demographic factors and children's activities highly correlated, but also many socio-demographic measures are themselves correlated. This stage helps to clarify which of the relationships shown in the simple two-way tables presented in previous chapters are meaningful in their own right and which ones are simply replicating other underlying patterns in the data.

Stage two

The second stage added a longitudinal dimension to the socio-demographic analysis to investigate the impact of persistent disadvantage. Whereas the first stage looked at household income, area deprivation and household type at the point when the cognitive assessments were carried out, this second stage looked at the cumulative impact of a child being in the most disadvantaged category for each of these factors for all of the first three years of life. The three persistent disadvantage measures were based on: the bottom household income quintile, the 15% most deprived areas, and households containing no adult working >16 hours a week. The classification was as follows (using income as an example):

- All three years in bottom income quintile (persistent disadvantage)
- Two out of three years in bottom income quintile
- One out of three years in bottom income quintile
- Never lived in household in bottom income quintile

Stage three

Having established which of the demographic factors have an independent association (based on the results of the previous two stages) the third stage added the suite of child activities measures into the analysis. This stage of the regression was then able to identify which of all these factors were independently associated with cognitive ability scores; this could then be used to answer the first question addressed in this report:

> Do children's early activities have an influence on cognitive development in addition to socio-demographic factors?

Stage four

The third stage was able to identify whether activities have an influence on cognitive ability independent of socio-demographics, but it is not possible to conclude from this whether activities could have the potential to lessen some of socio-demographic differentials evident in children's outcomes. For example, it could simply be that any added contribution conferred by activities exerts its influence among affluent children rather than all children, and therefore exacerbates rather than ameliorates relative disadvantage. To address this, the final stage removed from the analysis three groups of children who have been shown to have a particular advantage in terms of their socio-demographic background and participation in activities. Children falling into any of the following three groups were removed:

- Mothers with degree-level education,
- Households in the 20% least deprived of areas, and
- Households with incomes in the highest quintile.

By removing the children from more advantaged backgrounds from this final stage of the analysis it is possible to investigate whether any independent association found between activities and cognitive ability still exists among relatively less advantaged children. This then helps to answer the second question addressed in this report:

> Do children's early activities moderate the effect of socio-demographic factors on cognitive development?

5.4 Results of multivariate analysis

Table 5.1 and Table 5.2 show the results for each of the four stages of analysis for the naming vocabulary and picture similarity scores, respectively. To keep the interpretation simple the tables only show information about the significance of the association between the overall factors being examined and cognitive ability; they do not go into further detail about the patterns of association between the categories within each factor as well (this is presented in the Appendix). The analysis carries out a test of the statistical significance of the association between each factor and the cognitive ability score of interest, while holding all other factors in the analysis constant. Statistical significance is normally reported using two thresholds:

- the 95% level, which means that there is a one in twenty risk that the association with cognitive ability has occurred by chance rather than being a genuine relationship, and
- the 99% level, where there is a one in a hundred chance that the association is not genuine.

Chance findings are a consequence of having selected a sample of children rather than the entire population as there is always a risk attached that the sample is atypical of the population (though robust sampling techniques and sufficient numbers reduce this risk considerably). The results of the regression analysis of naming vocabulary and picture similarity scores are presented in turn below.

5.4.1 Naming vocabulary

Full significance levels are presented in the Appendix, here the table simply sets out which factors had a significant association with naming vocabulary scores at the 95% and 99% levels, and which factors were not significant. Two asterisks (**) indicate the strongest associations, at the 99% level, one asterisk is used for the 95% level, and n.s. means the association was not significant. Blank cells in the table are used to indicate factors that were not part of that stage of the analysis (e.g. the activities measures are missing from stages one and two).

Table 5.1 Naming vocabulary multiple linear regression – summary results

	Regression stages			
Naming vocabulary	**Stage one**	**Stage two**	**Stage three**	**Stage four**
Independent variables				
Mother's highest qualification	**	**	**	n.s.
Area deprivation	n.s.			
Area deprivation – persistent	-	**	n.s.	n.s.
Equivalised household income quintile	**			
Household income – persistent		**	**	**
Family and employment type	n.s.			
Family and employment type – persistent		n.s.		
Age of mother at child's birth	**	**	*	n.s.
Developmental concern	**	**	**	**
No. of children in family	**	**	**	**
Gender of child	**	**	**	**
Birth weight	**	**	**	*
At 10 months:				
Reading with parent			*	n.s.
Library visits			n.s.	
At 22 months:				
Daily activities			**	**
Educational games			n.s.	
Number of annual visits/events			**	*
Number of activities rated very important			n.s.	
Importance of educational games			n.s.	
Satisfaction with activities			n.s.	
R squared	15.6	15.7	19.5	18.2
Constant	35.7	36.5	31.9	31.2
Significance	.000	.000	.000	.000
Sample size	*3560*	*3534*	*3484*	*1985*

Notes: **=significant at 99%, *=significant at 95%, n.s.=not significant, blanks cells indicate factors not included in the model.

The first stage of the analysis just looked at the socio-demographic factors explored previously in Table 4.1-Table 4.4. It reveals that there is no significant independent association between area level deprivation and family/employment type (a measure that captures the employment status of the household as well as the number of resident parents) and naming vocabulary score, once the other factors are considered at the same time. All other socio-demographic factors are, however, highly significant.

The next stage looks at the influence of socio-demographic factors through a slightly different lens. This time the measures of income, area deprivation and family/employment type are not simply concerned with their impact at one point in time (when the cognitive assessments were carried out) but instead look at the association between experiencing persistent disadvantage and cognitive performance. The findings for income and family/employment type are fairly straightforward: being in a low income household is associated with cognitive ability both persistently and immediately. Conversely, once everything else is accounted for, family/employment type is not significant in either scenario. Area deprivation follows a different pattern. Stage one suggested that living in the 15% most deprived of areas is not significantly associated with cognitive ability, but stage two suggests that doing so persistently for the first three years of life is.

The third stage integrates the socio-demographic and activity factors. This shows that three of the activity measures retain a significant influence once all factors are considered together: being read to daily at 10 months, engaging in lots of activities on a daily basis at 22 months, and visiting a wide range of places/events at 22 months. All but one of the socio-demographic factors (area deprivation) remain significant. The slightly curious performance of area deprivation in these analyses suggests that the interaction between area, household and individual level factors is more complex than this type of analysis can reveal. Other techniques, such as multi-level modelling, that can explore relationships across many levels might be able to provide further insights. Furthermore, the area deprivation persistence measure might also be capturing something about geographic mobility in a way that the other variables might not be. A family can remain in the same housing for three years but see their income and employment status change; for area deprivation to change in this short period of time a change of address would also be necessary. It might therefore be worth conducting further analysis of the impact of changes in family circumstances on developmental outcomes, especially changes that could affect a child's potential to carry out activities, such as periods of maternal ill-health, partnership breakdown or moving house. However, in terms of addressing the critical first question of interest here – whether activities have an influence independent of socio-demographic factors – this analysis is sufficient. While the influence of socio-demographic factors on naming vocabulary scores is very strong, there is evidence to suggest that children who have the benefit of engaging in a wide range of activities are also at an advantage when it comes to their cognitive development. The crucial point to note from this analysis is that the important issue for children is the extent and range of activities they do, rather than specific pursuits, though being read to at an early age appears to confer an advantage in this respect as well (though note its significance level is lower than for the other two activity factors).

As noted above in the outline of the analysis stages, a final step needs to be taken before conclusions can be drawn regarding the second question, that is whether activities can moderate the influence of socio-demographic factors, or whether they instead simply enhance the outcomes of already advantaged children. The fourth stage in the analysis looked at the factors found to be significant at the third stage and explored their association with cognitive ability using a sub-set of children who have not experienced relatively high levels of advantage in terms of their household's income, their area's deprivation level or their mothers' education level. In this analysis mother's education is no longer significant, which is unsurprising as the main effect of this factor appears to be linked to degree level education, and these cases have been excluded from the analysis. Two other factors also become non-significant: mother's age at birth and being read to daily at 10 months (as mother's age at birth is strongly linked to education levels it's also not surprising to see it disappear at this final stage). The other two activity measures of the extent and range of activities children experience do remain significant. We can therefore conclude with greater confidence than is possible on the basis of the stage three results alone that activities do appear to moderate the effect of socio-demographics on cognitive ability. This means that activities appear to have a positive association with cognitive ability even among children who are not currently growing up in circumstances of relatively high affluence and advantage.

5.4.2 Picture similarities

We now look at our second measure of cognitive ability, picture similarities. Table 5.2 follows the same format as Table 5.1 and simply presents indications of the significance levels for each factor. The full results are in the Appendix. It is worth highlighting the figures in the "R squared" row and comparing these with the corresponding figures in the previous table. R squared is a measure of the amount of variation in the variable of interest that has been explained by all the different factors in the analysis. It can be expressed as the percentage of variation explained. The first point to note is that none of the analyses explain a particularly high amount of the variation (19.5% for the naming vocabulary third stage and 12.3% for the picture similarities third stage). This is typical of most social survey data. There will always be a large amount of underlying differences that are either missing from the analysis (i.e. they were measured in the study but have not been selected for consideration in the analysis) or have been omitted from the study completely (e.g. the kinds of genetic and biological information that is known to be associated with cognitive ability, or other aspects of child development that are hard to capture via a survey). The more important point to note, however, is the fact that the percentage of variation explained in each of the picture similarities analyses is lower than it is in each of the corresponding stages of the naming vocabulary. This suggests that the factors being used to explore cognitive ability in this report explain less of the variation in children's ability in the picture similarities assessment than is the case with the naming vocabulary test.

Table 5.2 Picture similarities regression models – summary results

	Regression stages			
Picture similarities	**Stage one**	**Stage two**	**Stage three**	**Stage four**
Independent variables				
Mother's highest qualification	n.s.	n.s.		
Area deprivation	**			
Area deprivation – persistent		**	**	*
Equivalised household income quintile	**			
Household income – persistent		*	*	n.s.
Family and employment type	**			
Family and employment type – persistent		*	*	n.s.
Age of mother at child's birth	*	n.s.	n.s.	n.s.
Developmental concern	**	**	**	*
No. of children in family	**	**	**	**
Gender of child	**	**	**	**
Birth weight	**	**	**	**
At 10 months:				
Reading with parent			n.s.	n.s.
Library visits			n.s.	
At 22 months:				
Daily activities			**	**
Educational games			n.s.	
Number of annual visits/events			**	n.s.
Number of activities rated very important			n.s.	
Importance of educational games			n.s.	
Satisfaction with activities			n.s.	
R squared	9.9	10.0	12.3	11.8
Constant	36.6	37.4	36.0	34.5
Significance	.000	.000	.000	.000
Sample size	*3764*	*3736*	*3687*	*1990*

Notes: **=significant at 99%, *=significant at 95%, n.s.=not significant, blanks cells indicate factors not included in the model.

The stage one analysis of socio-demographic factors shows that only mother's education level is no longer significant once other factors are also considered. This contrasts with the naming vocabulary analysis where education was significant at all stages. Area deprivation and family/employment type are also significant, neither of which was the case in relation to naming vocabulary.

When the three persistence measures are included (at stage two) instead of just the sweep 3 measures, area deprivation retains its significant association, as do the other two factors, albeit with lower levels of significance. While it isn't possible to conclude from this that persistence experiences of disadvantage are more or less influential than shorter-term ones, it does signal that persistent experiences of disadvantage should be an additional matter of concern for policy makers and analysts. Certainly as the children age, and further rounds of GUS are carried out, the role that persistent disadvantage plays in determining outcomes will accrue greater significance.

All of the socio-demographic factors that were significant at stage two retain their significance in the third stage of the analysis. In addition, two of the activities measures found to be important influences of naming vocabulary performance (engaging in lots of activities on a daily basis at 22 months and visiting a wide range of places/events at 22 months) were also significantly associated with picture similarities scores. This reinforces the conclusion drawn above that activities have an effect independent of socio-demographics, though it is clear that the precise dynamics of these relationships differ for the two assessments that were carried out.

As with the naming vocabulary analysis, the final stage then removed children from the most advantaged groups within the population and explored the impact of activities on the group remaining. As before, some of the socio-demographic factors lose their significance at this point: household income, family and employment type, and age of mother at birth. In this analysis only one of the activities measures retains a significant association – the extent of daily activities – while annual visits/events no longer has an independent effect. However, the fact remains that some activities appear to be associated with cognitive ability, once socio-demographic factors have been controlled for and once the analysis is restricted to children who have not experienced high levels of relative advantage.

CHAPTER 5

The Relative Importance of Children's Activities and Socio-Demographic Factors

chapter
CONCLUSION

6

A number of conclusions can be drawn from this report. At the purely descriptive level the following are uncontroversial:

- The range and extent of activities that children experience, and the importance that parents attach to those activities, are strongly associated with socio-demographic factors. Children living in low income households, in the 15% most deprived areas of Scotland, in families where no-one has a full time job (or any job), whose mothers have few or no qualifications or were young when they were born all experience a smaller range of activities than their more advantaged counterparts.
- Children who regularly take part in a wide range of activities and whose parents rate activities as very important have higher cognitive ability scores at the age of 34 months than children who experience fewer activities and whose parents attach less importance to them.
- Children from more disadvantaged backgrounds in terms of their household income, employment status, area deprivation and maternal education and age have lower ability scores than children from more advantaged backgrounds. Low birth weight and signs of developmental delay at 22 months are also associated with low scores.

Trying to untangle the dynamics of these underlying relationships is somewhat more complex. Analysis exploring how all these factors interrelate suggests the following:

- Most of the socio-demographic factors explored in relation to cognitive ability have a significant independent association, though the specific factors that are important differ depending on the assessment.
- The overall variation in ability scores explained by either socio-demographic factors or activity levels is relatively small, though it is comparable to other similar analyses (for example the multivariate analysis of MCS presented in Dex, 2008). This means that other factors must therefore help explain cognitive ability than have been considered here or that are available within the study. These would include other associated cognitive skills not measured due to space constraints in the interview, genetic differences of a kind that a social survey would struggle to measure, as well as wider measures of children's early experiences such as maternal mental health (see for example Kiernan and Huerta, 2008).
- The range and extent of activities that children experience also have a significant independent association with their cognitive ability levels once socio-demographic factors have been controlled for. This association is evident even when the relatively more advantaged, and consequently relatively more active, children are excluded from the analysis.

It is clear that parents from the most disadvantaged backgrounds are the most likely to be dissatisfied with the range of activities available to their child so any attempts to encourage parents to do more activities with their children needs to be mindful of this pre-existing demand. Perhaps the most critical policy implication resulting from this analysis is that many of the kinds of activities that appear to be associated with positive outcomes for children can have few or no monetary implications for parents, for example singing songs or looking at books (as long as parents have access to libraries). It is therefore important to avoid any impression that children need to participate in numerous expensive classes and hobbies in order to benefit from the advantages conferred by activities.

There are, of course, limits to the interpretations that can be placed on any analysis of this kind, as noted at the start of Chapter 4. It would therefore be rash to infer that activities alone could close the gap between the outcomes of children from the most and least advantaged backgrounds without steps also being taken to address the wider socio-economic context. Further, only an experiment that exposed one group of disadvantaged children to lots more activities than they would otherwise have experienced while leaving a second control group unexposed would be able to quantify the impact and likely costs relative to the benefits achieved via such an initiative. Though there is nothing in the evidence here to suggest that enriching children's lives with a range of different activities from an early age can do harm.

References

Dex, S. (ed) (2008). *Millennium Cohort Study Exploration of Some Distinctive Results for Scotland*, Edinburgh: Scottish Government.

Elliott, C. D. (1996). *The British Ability Scales II*. Windsor, Berkshire: NFER-NELSON Publishing Company.

Feinstein, L. (2003). 'Inequality in the Early Cognitive Development of British Children in the 1970 Cohort'. *Economica*, 70, 73-97.

Fenson, L., Dale, P., Reznick, S., Bates, E., Thal, D., Pethick, S., Tomasello, M., Mervis, C., Stiles, J. (1994). 'Variability in Early Communicative Development', *Monographs of the Society for Research in Child Development*, 59:5, i-185.

Hill, V. (2005). 'Through the past darkly: A review of the British Ability Scales Second Edition'. *Child and Adolescent Mental Health*, 10, 87-98.

Jones, E. M. and Schoon, I. (2008). 'Child Cognition and Behaviour' in Hansen, K. and Joshi, H. (eds.) *Millennium Cohort Study Third Survey: A User's Guide to Initial Findings*, London: Centre for Longitudinal Studies.

Kiernan, K. and Huerta, C. (2008). 'Economic deprivation, maternal depression, parenting and children's cognitive and emotional development in early childhood', *British Journal of Sociology*, 59:4, 783-805.

Lugo-Gill, J. and Tamis-LeMonda, C. (2008). 'Family Resources and Parenting Quality: Links to Children's Cognitive Development Across the First 3 years'. *Child Development*, 79, 1065-1085.

Scottish Government and COSLA (2008). *Early Years and Early Intervention*, Edinburgh: Scottish Government.

Scottish Government (2007). *Scottish Budget Spending Review 2007*, Edinburgh: Scottish Government.

Shenkin, S. D., Starr, J. M., & Deary, I. J. (2004). 'Birth weight and cognitive ability in childhood: A systematic review'. *Psychological Bulletin*, 130, 989–1013.

Silva, A., Metha, Z., and O'Callaghan, F. (2006). 'The Relative Effect of Size at Birth, Postnatal Growth and Social Factors on Cognitive Function in Late Childhood', *Annals of Epidemiology*, 16, 469-476.

Appendix A Regression Tables

Regression analysis compares a reference category within each variable with the rest of the categories in that variable and produces an estimate of the size of the contribution that category makes to the overall variation in cognitive ability. These estimates are called coefficients.

Table A.1 presents the significance levels of the variables for each of the stages in the naming vocabulary analysis. Table A.2 shows the coefficients for the stage three analysis and Table A.3 shows the coefficients for stage four. Tables A.4-A.6 follow the same format for the picture similarities analysis.

Full results of the first and second stages are available on request from ScotCen.

Table A.1 Naming vocabulary multiple linear regression – significance levels for individual variables

	Regression stages			
Naming	Stage one	Stage two	Stage three	Stage four
Independent variables				
Mother's highest qualification (standard grade or below)	**.000**	**.000**	**.001**	.925
Area deprivation (15% most deprived areas)	.340			
Area deprivation – persistent (3 years 15% most deprived areas)		**.003**	.084	.069
Equivalised household income quintile (5th quintile – lowest income)	**.001**			
Household income – persistent (3 years 5th quintile – lowest income)		**.001**	**.000**	**.000**
Family and employment type (all adults unemployed/working <16 hours)	.207			
Family and employment type – persistent (3 years all adults unemployed/working <16 hours)		.254		
Age of mother at child's birth (below 25)	**.000**	**.004**	**.034**	.093
Developmental concern (some concern at 22 months)	**.000**	**.000**	**.000**	**.003**
No. of children in family (4 or more)	**.000**	**.000**	**.000**	**.000**
Gender of child (boy)	**.000**	**.000**	**.000**	**.000**
Birth weight (low birth weight)	**.003**	**.001**	**.005**	**.013**
At 10 months:				
Reading with parent (never)			**.044**	.084
Library visits (never been)			.646	
At 22 months:				
Daily activities (25% least active)			**.000**	**.000**
Educational games			.910	
Number of annual visits/events (one/none)			**.001**	**.020**
Number of activities rated very important (one/none)			.711	
Importance of educational games			.475	
Satisfaction with activities (would like much wider range)			.822	
R squared	15.6	15.7	19.5	18.2
Constant	35.7	36.5	32.5	31.2
Significance	.000	.000	.000	.000
Sample size	*3560*	*3534*	*3484*	*1985*

Note: reference categories are shown in brackets, significant values are shown in bold, blank cells indicate factors not in the model.

Table A.2 Naming vocabulary multiple linear regression – full results of stage three model of socio-demographic factors and activities/parental attitudes measures

	Coefficient	P value	95% CI	
Mother's highest qualification (standard grade or below)				
Degree	1.523	0.022	0.225	2.820
Vocational below degree	-0.586	0.224	-1.540	0.367
Higher grade	-0.581	0.596	-2.758	1.596
Area deprivation – persistent (3 years 15% most deprived areas)				
Never in 15% most deprived area	0.163	0.843	-1.478	1.804
1 year	-0.936	0.413	-3.206	1.334
2 years	-1.851	0.073	-3.881	0.178
Household income – persistent (3 years 5th quintile – lowest income)				
Never in bottom quintile	4.393	0.000	2.581	6.204
1 year	2.380	0.006	0.721	4.039
2 years	0.845	0.387	-1.091	2.781
Age of mother at child's birth (below 25)				
25 to 34	1.437	0.010	0.351	2.523
35+	1.585	0.027	0.187	2.984
Developmental concern (some concern at 22 months)				
No concerns	4.662	0.000	2.766	6.559
No. of children in family (1)				
2	-1.954	0.000	-2.773	-1.136
3	-3.423	0.000	-4.543	-2.304
4	-4.639	0.000	-6.410	-2.867
Gender of child (boy)				
Girl	3.731	0.000	2.978	4.484
Birth weight (low birth weight)				
Not low	2.529	0.005	0.780	4.279

Note: reference categories are shown in brackets

Table A.2 Naming vocabulary multiple linear regression – full results of stage three model of socio-demographic factors and activities/parental attitudes measures – continued

	Coefficient	P value	95% CI	
At 10 months:				
Reading with parent (never)				
Every day	2.589	0.010	0.646	4.532
Once or twice a week	2.591	0.004	0.841	4.341
Once every 1 or 2 months or less	1.938	0.075	-0.202	4.079
Library visits (never been)				
Has ever been to a library	0.219	0.646	-0.728	1.166
At 22 months:				
Daily activities (25% least active)				
2nd most active	2.783	0.000	1.666	3.900
3rd most active	3.751	0.000	2.098	5.405
Most active 25%	5.521	0.000	3.587	7.456
Educational games				
1-3 days	-0.134	0.796	-1.163	0.896
4-6 days	0.301	0.670	-1.102	1.703
7 days	0.288	0.678	-1.093	1.670
Number of annual visits/events (one/none)				
2	1.318	0.086	-.190	2.827
3	1.570	0.057	-.045	3.185
4	2.755	0.002	1.090	4.420
5+	3.300	0.001	1.487	5.112
Number of activities rated very important (one/none)				
2	-0.235	0.832	-2.441	1.972
3	0.439	0.714	-1.942	2.820
4-5	0.480	0.637	-1.541	2.500
Importance of educational games (Quite/neither/not important)				
Very important	-0.518	0.475	-1.958	0.922
Satisfaction with activities (would like much wider range)				
Very happy	-0.102	0.885	-1.499	1.296
Quite happy	0.325	0.612	-0.952	1.603
Would like slightly wider range	-0.161	0.800	-1.425	1.103

Note: reference categories are shown in brackets

Table A.3 Naming vocabulary multiple linear regression – full results of stage four model of socio-demographic factors and activities/parental attitudes measures (advantaged children removed)

	Coefficient	P value	95% CI	
Mother's highest qualification (standard grade or below)				
Degree	(dropped)			
Vocational below degree	-0.053	0.926	-1.202	1.095
Higher grade	-0.521	0.694	-3.153	2.112
Area deprivation – persistent (3 years 15% most deprived areas)				
Never in 15% most deprived area	-0.161	0.844	-1.792	1.469
1 year	-0.804	0.506	-3.204	1.595
2 years	-2.347	0.030	-4.462	-0.232
Household income – persistent (3 years 5th quintile – lowest income)				
Never in bottom quintile	4.778	0.000	2.784	6.773
1 year	3.184	0.001	1.340	5.029
2 years	1.492	0.155	-0.579	3.564
Age of mother at child's birth (below 25)				
25 to 34	1.315	0.042	0.046	2.585
35+	1.227	0.109	-0.280	2.734
Developmental concern (some concern at 22 months)				
No concerns	3.773	0.003	1.322	6.224
No. of children in family (1)				
2	-1.364	0.030	-2.594	-0.134
3	-3.138	0.000	-4.821	-1.454
4	-4.319	0.000	-6.301	-2.337
Gender of child (boy)				
Girl	3.775	0.000	2.805	4.744
Birth weight (low birth weight)				
Not low	3.243	0.013	0.706	5.779

Note: reference categories are shown in brackets

Table A.3 Naming vocabulary multiple linear regression – full results of stage four model of socio-demographic factors and activities/parental attitudes measures (advantaged children removed) – continued

	Coefficient	P value	95% CI	
At 10 months:				
Reading with parent (never)				
Every day	2.578	0.015	0.514	4.642
Once or twice a week	2.545	0.013	0.554	4.536
Once every 1 or 2 months or less	2.349	0.064	-0.144	4.842
At 22 months:				
Daily activities (25% least active)				
2nd most active	3.553	0.000	1.977	5.129
3rd most active	5.064	0.000	3.519	6.610
Most active 25%	6.279	0.000	4.321	8.238
Number of annual visits/events (one/none)				
2	1.627	0.055	-0.036	3.290
3	1.870	0.060	-0.080	3.820
4	3.143	0.002	1.168	5.118
5+	3.304	0.007	0.938	5.670

Note: reference categories are shown in brackets

Table A.4 Picture similarities multiple linear regression – significance levels for individual variables

	Regression stages			
Picture similarities	Stage one	Stage two	Stage three	Stage four
Independent variables				
Mother's highest qualification (standard grade or below)	.085	.070		
Area deprivation (15% most deprived areas)	**.006**			
Area deprivation – persistent (3 years 15% most deprived areas)		**.001**	**.001**	**.014**
Equivalised household income quintile (5th quintile – lowest income)	**.010**			
Household income – persistent (3 years 5th quintile – lowest income)		**.013**	**.023**	.201
Family and employment type (all adults unemployed/working <16 hours)	.000			
Family and employment type – persistent (3 years all adults unemployed/working <16 hours)		**.026**	**.024**	.077
Age of mother at child's birth (below 25)	**.029**	.138	.277	.355
Developmental concern (some concern at 22 months)	**.000**	**.000**	**.006**	**.037**
No. of children in family (4 or more)	**.000**	**.000**	**.002**	**.003**
Gender of child (boy)	**.000**	**.000**	**.000**	**.000**
Birth weight (low birth weight)	**.003**	**.001**	**.006**	**.007**
At 10 months:				
Reading with parent (less often than every day)			.356	.097
Library visits (never been)			.297	
At 22 months:				
Daily activities (25% least active)			**.001**	**.000**
Educational games			.734	
Number of annual visits/events (one/none)			**.006**	.428
Number of activities rated very important (one/none)			.278	
Importance of educational games			.191	
Satisfaction with activities (would like much wider range)			.130	
R squared	9.9	10.0	12.3	11.8
Constant	36.6	37.4	36.0	34.5
Significance	.000	.000	.000	.000
Sample size	*3764*	*3736*	*3687*	*1990*

Note: reference categories are shown in brackets, significant values are shown in bold, blank cells indicate factors not in the model.

Table A.5 Picture similarities multiple linear regression – full results of stage three model of socio-demographic factors and activities/parental attitudes measures

	Coefficient	P value	95% CI	
Area deprivation – persistent (3 years 15% most deprived areas)				
Never in 15% most deprived area	2.084	0.010	0.527	3.642
1 year	-0.355	0.744	-2.512	1.803
2 years	-0.364	0.734	-2.493	1.766
Household income – persistent (3 years 5th quintile – lowest income)				
Never in bottom quintile	1.772	0.045	0.044	3.499
1 year	0.505	0.596	-1.386	2.396
2 years	-0.227	0.829	-2.322	1.868
Family and employment type – persistent (3 years all adults unemployed/working <16 hours)				
Never in hhold with no adult working >16 hrs	3.014	0.003	1.066	4.962
2 years	1.964	0.076	-0.209	4.137
1 year	1.252	0.318	-1.233	3.736
Age of mother at child's birth (below 25)				
25 to 34	0.762	0.141	-0.258	1.781
35+	0.955	0.126	-.276	2.185
Developmental concern (some concern at 22 months)				
No concerns	2.234	0.006	.6777543	3.791156
No. of children in family (1)				
2	-0.632	0.157	-1.515	0.250
3	-2.104	0.000	-3.192	-1.016
4	-1.809	0.058	-3.682	0.064
Gender of child (boy)				
Girl	1.527	0.000	0.763	2.290
Birth weight (low birth weight)				
Not low	2.495	0.006	0.747	4.242

Note: reference categories are shown in brackets

Table A.5 Picture similarities multiple linear regression – full results of stage three model of socio-demographic factors and activities/parental attitudes measures – continued

	Coefficient	P value	95% CI	
At 10 months:				
Reading with parent (never)				
Every day	1.558	0.136	-0.505	3.621
Once or twice a week	1.030	0.327	-1.051	3.110
Once every 1 or 2 months or less	1.563	0.202	-0.861	3.987
Library visits (never been)				
Has ever been to a library	-0.405	0.297	-1.174	0.364
At 22 months:				
Daily activities (25% least active)				
2nd most active	1.590	0.011	0.381	2.797
3rd most active	2.585	0.000	1.264	3.906
Most active 25%	3.261	0.000	1.768	4.755
Educational games				
1-3 days	-0.436	0.457	-1.603	0.730
4-6 days	0.044	0.944	-1.201	1.288
7 days	-0.496	0.418	-1.710	0.718
Number of annual visits/events (one/none)				
2	-0.085	0.904	-1.495	1.324
3	0.519	0.486	-0.962	2.001
4	1.438	0.032	0.129	2.747
5+	1.690	0.014	0.349	3.031
Number of activities rated very important (one/none)				
2	1.489	0.088	-0.227	3.204
3	0.501	0.521	-1.049	2.050
4-5	0.586	0.457	-.980	2.152
Importance of educational games (Quite/neither/not important)				
Very important	-0.714	0.191	-1.791	0.364
Satisfaction with activities (would like much wider range)				
Very happy	-0.553	0.454	-2.019	0.913
Quite happy	-1.370	0.036	-2.647	-0.093
Would like slightly wider range	-0.652	0.239	-1.746	0.443

Note: reference categories are shown in brackets

Table A.6 Picture similarities multiple linear regression – full results of stage four model of socio-demographic factors and activities/parental attitudes measures (advantaged children removed)

	Coefficient	P value	95% CI	
Area deprivation – persistent (3 years 15% most deprived areas)				
Never in 15% most deprived area	1.259	0.134	-0.400	2.917
1 year	-0.712	0.543	-3.036	1.612
2 years	-1.104	0.326	-3.334	1.126
Household income – persistent (3 years 5th quintile – lowest income)				
Never in bottom quintile	-1.747	0.058	-0.062	3.556
1 year	0.982	0.305	-0.914	2.878
2 years	0.458	0.675	-1.714	2.629
Family/employment type – persistent Never in hold with no adult working >16 hrs	2.467	0.020	0.399	4.534
2 years	1.417	0.227	-0.903	3.738
1 year	0.372	0.774	-2.204	2.948
Age of mother at child's birth (below 25)				
25 to 34	0.862	0.166	-.366	2.090
35+	1.012	0.225	-.638	2.661
Developmental concern (some concern at 22 months)				
No concerns	1.978	0.037	0.123	3.832
No. of children in family (1)				
2	-0.708	0.201	-1.802	0.386
3	-2.774	0.000	-4.186	-1.362
4	-1.860	0.082	-3.962	0.242
Gender of child (boy)				
Girl	1.661	0.000	0.771	2.551
Birth weight (low birth weight)				
Not low	3.336	0.007	0.940	5.732

Note: reference categories are shown in brackets

Table A.6 Picture similarities multiple linear regression – full results of stage four model of socio-demographic factors and activities/parental attitudes measures (advantaged children removed) – continued

	Coefficient	P value	95% CI	
At 10 months:				
Reading with parent (never)				
Every day	2.393	0.025	0.306	4.480
Once or twice a week	1.374	0.180	-0.652	3.401
Once every 1 or 2 months or less	2.105	0.107	-0.471	4.680
At 22 months:				
Daily activities (25% least active)				
2nd most active	2.200	0.004	0.730	3.671
3rd most active	2.921	0.000	1.442	4.401
Most active 25%	3.368	0.000	1.828	4.909
Number of annual visits/events (one/none)				
2	-0.024	0.978	-1.735	1.687
3	0.386	0.671	-1.420	2.192
4	1.047	0.269	-0.830	2.924
5+	1.324	0.163	-0.551	3.200

Note: reference categories are shown in brackets

This document is also available on the Scottish Government website:
www.scotland.gov.uk

ISBN (web only): 978-0-7559-1968-0

RR Donnelley B59787 3/08