Neighbourhood and wellbeing in the early years

Andrew Cullis

Institute of Education

University of London

Submitted for the degree of PhD

I hereby declare that, except where explicit attribution is made, the work presented in this thesis is entirely my own.

Andrew Cullis

Word count (exclusive of appendices and bibliography): 60,963 words

Acknowledgements

I would like to acknowledge and thank Professor Heather Joshi, my supervisor, for her continued advice and support, Professor Ian Plewis for his statistical advice and Dr Ruth Lupton for her helpful comments on an earlier draft of this thesis. Finally, I would like to thank Wendy Wills for her unwavering support throughout the PhD process.

Abstract

The aim of this thesis is to investigate whether compositional and contextual factors relating to neighbourhoods in which children live can explain differences in their wellbeing, over and above factors at the individual and family level. Data collected on young children, sampled from advantaged, disadvantaged and ethnic minority electoral wards within the UK Millennium Cohort Study (MCS) were used to explore the research objectives. 2001 census small area statistics were uniquely utilised to further characterise MCS wards. Multi-level statistical modelling techniques were employed to analyse these data.

Findings suggest that individual and family level factors account for most of the differences in cognitive, behavioural and physical wellbeing. Wards in disadvantaged and ethnic minority areas were shown to be negatively associated with children's readiness to start school and their vocabulary abilities. Behavioural difficulties and the body mass index (BMI) of children were also associated with these wards.

Alongside these factors, several subjective measures of the local area were associated with children's wellbeing. Poor local safety and problems with litter were negatively associated with school readiness and vocabulary skills respectively. Problems with noise, pollution, lack of places to play and poor access to shops were associated with children having behavioural difficulties. Problems with litter in the vicinity were also related to children having a higher BMI.

Furthermore, some 2001 census small area statistics, characterising the demographic composition of each ward were also associated with child wellbeing. Wards with high numbers of children living in them were associated with poor school readiness scores and areas with high numbers of cohabiting childless couples were associated with children having lower vocabulary scores. Wards with high levels of female lone parents who were employed and married couples with children were associated with fewer child difficulties. None of these census factors were associated with BMI.

Table of contents

Acknowledgements....3

Abstract....4

1. CHAPTER ONE – CHILDREN'S WELLBEING AND THE NEIGHBOURHOOD....12

1.1.1. Introduction....12
1.1.2. Aims....14
1.1.3. Objectives....14
1.1.4. Theoretical framework for research....15
1.1.5. Overview of the thesis....17

2. CHAPTER TWO - CHILD WELLBEING....18

2.1.1. Introduction....18
2.1.2. Definitions of wellbeing....18
2.1.3. Wellbeing and development....20
2.1.4. The theory of mind....23

2.2. Cognitive wellbeing....24

2.2.1. Definition....24

2.3. Behavioural wellbeing....26

2.3.1. Definition....26

2.4. Physical wellbeing....28

2.5. Conclusions....29

3. CHAPTER THREE – NEIGHBOURHOOD EFFECTS....31

3.1.1. Introduction....31
3.1.2. Neighbourhood definitions....31
3.1.3. Theoretical neighbourhood models....35
3.1.4. Compositional factors....38
3.1.5. Contextual factors....45
3.1.6. 'Collective' dimension of context....48
3.1.7. Data sources and studies conducted of neighbourhood effects....49
3.1.8. North American neighbourhood studies....51
3.1.9. United Kingdom neighbourhood studies....59
3.1.10. Important neighbourhood studies in other countries....64
3.1.11. Summary of advantages/disadvantages of studies evaluated....65
3.1.12. Conclusions of neighbourhood literature review....67

4. CHAPTER FOUR - METHODOLOGY 68

4.1.1. Introduction 68
4.1.2. Data requirements 68

4.1. The Millennium Cohort Study 70

4.1.1. Background 71
4.1.2. Design of the MCS study 72
4.1.3. Stratification of wards 75
4.1.4. Accessing the MCS data 76
4.1.5. Ethical considerations 77
4.1.6. Subjective neighbourhood factors in the MCS survey 78
4.1.7. Mothers' subjective opinions of the locality 81
4.1.8. Interviewers' subjective opinions of the streets 83

4.2. Stratum 84

4.3. Externally-sourced neighbourhood information 85

4.4. Indicators of child wellbeing 86

4.4.1. Cognitive outcome indicators 86
4.4.2. Behavioural wellbeing outcome indicator 87
4.4.3. Physical wellbeing outcome indicator 87
4.4.4. Child and family explanatory characteristics 88
4.4.5. Structure of MCS data 89

4.5. Methods of analysis 89

4.5.1. Dataset construction 89
4.5.2. Issues in modelling neighbourhoods 90
4.5.3. The neighbourhood boundary issue 92
4.5.4. Temporal measurement bias 93
4.5.5. Multi-level modelling 94
4.5.6. Testing for significance in MLM models 98
4.5.7. Method of model estimation 98
4.5.8. Modelling issues 99
4.5.9. Levels within the multilevel model 99

4.6. Modelling strategy for the wellbeing outcomes 100

4.6.1. Introduction 100
4.6.2. The 'Null' Model 101
4.6.3. The 'Base' model 102
4.6.4. Base and mothers' and interviewers' opinions of the local area 102
4.6.5. Base and child/family explanatory factors model 103
4.6.6. Base, child/family and mothers' and interviewers' opinions of the local area model 104
4.6.7. All child/family, subjective neighbourhood opinions and 2001 census factors model 104

4.7. Conclusion 105

5. CHAPTER FIVE – NEIGHBOURHOODS AND COGNITIVE WELLBEING 106

5.1. Introduction 106

5.2. Results of UK MCS sample School Readiness and Naming Vocabulary Cognitive outcomes 106

5.2.1. Cognitive outcomes: UK sample - Null model 107
5.2.2. Cognitive outcomes: UK sample -Base model 109
5.2.3. Cognitive outcomes: UK sample - Base model plus mothers'/interviewers' opinions of neighbourhood only models 111
5.2.4. Cognitive outcomes: UK sample - All level one child/family related factors model (including mothers' and interviewers' opinions of neighbourhood) . 115

5.3. Cognitive modelling using 2001 electoral ward level census small area statistics: England and Wales. 130

5.3.1. Cognitive outcomes: England and Wales sample – Null model 130
5.3.2. Cognitive outcomes: England and Wales sample – Base model 131
5.3.3. Cognitive outcomes: England and Wales sample - Base and mothers'/interviewers' opinions of the neighbourhood and 2001 electoral ward census variables only model 133
5.3.4. Cognitive outcomes: England and Wales sample - Child/family/interviewers' opinions of neighbourhood and 2001 electoral ward small area census factors model 139
5.3.5. School Readiness full model results 140
5.3.6. Naming Vocabulary full model results 142

5.4. Summary and conclusions 156

6. CHAPTER SIX – NEIGHBOURHOODS AND BEHAVIOURAL/PHYSICAL WELLBEING 160

6.1. Introduction 160

6.2. The behavioural and physical wellbeing sample 161

6.3. Results of the UK sample analysis for the Difficulties score and BMI outcomes 162

6.3.1. Behavioural/physical outcomes: UK sample - Null model 162
6.3.2. Behavioural/physical outcomes: UK sample - Base models 163

6.3.3. Behavioural/physical outcomes: UK sample – Base, mothers'/interviewers' opinions of neighbourhood model 166
6.3.4. Behavioural/physical outcomes: UK sample - Child/family, mothers' and interviewers' opinions of neighbourhood behavioural/physical models 169

6.4. Behavioural/Physical outcomes: England and Wales sample modelling 181

6.4.1. Behavioural/Physical outcomes: England and Wales sample – Null model 181
6.4.1. Behavioural/Physical outcomes: England and Wales sample – Base model 182
6.4.2. Behavioural/Physical outcomes: England and Wales sample - Base and mothers'/interviewers' opinions of the neighbourhood and 2001 electoral ward census small area statistics factors only models 185
6.4.3. Behavioural/Physical outcomes: England and Wales sample - Child/family factors and mothers'/interviewers' opinions of neighbourhood and 2001 electoral ward census small area factors model 191

6.5. Summary and conclusions 207

7. CHAPTER SEVEN–DISCUSSION AND CONCLUSIONS 210

7.1. Introduction 210

7.2. Summary of findings 210

7.3. Discussion of child and family related findings 211

7.4. The importance of neighbourhood factors in explaining child wellbeing 212

7.4.1. Mothers' and interviewers' subjective opinions' of the neighbourhood 212
7.4.2. The Stratum factor 215
7.4.3. 2001 census small area statistics 217
7.4.4. Policy implications 220

7.5. Strengths and weaknesses of the investigation 221

7.5.1. Strengths 221
7.5.2. Weaknesses 222

7.6. Future research 223

8. APPENDIX 1 – MCS SAMPLE INFORMATION 225

9. APPENDIX 2 – RESIDUAL NORMALITY PLOTS 235

10. BIBLIOGRAPHY 239

Tables

Table 4.1 - Sample points and children by country (unweighted) at MCS1 74

Table 5. 1 - Cognitive outcomes: UK sample descriptive analysis 107
Table 5. 2 - Cognitive outcomes: UK sample - Null model estimates 108
Table 5. 3 - Cognitive outcomes: UK sample - Null model - Ward and child level 108
Table 5. 4 - Cognitive outcomes: UK sample - Base model variances 110
Table 5. 5 - Cognitive outcomes: UK sample - Base model estimates 110
Table 5. 6 - Cognitive outcomes: UK sample - Mothers' opinions of neighbourhood estimates 113
Table 5. 7 - Cognitive outcomes: UK sample - Interviewers' opinions of neighbourhood estimates 114
Table 5. 8 - Cognitive outcomes: UK sample – Child/family and interviewers' opinions of the neighbourhood variances 123
Table 5. 9 - Cognitive outcomes: UK sample – Child/family and interviewers' opinions of the neighbourhood 124
Table 5. 10 - Table 5.9 - School Readiness outcome: UK sample analysis - reductions/increases in stratum factor variation 128
Table 5. 11 - Naming Vocabulary outcome: UK sample analysis - reductions/increases in stratum factor variation 129
Table 5. 12 – Cognitive outcomes: England and Wales sample - Null model variances 131
Table 5. 13 - England and Wales cognitive sample - Null model estimates 131
Table 5. 14 - Cognitive outcomes: England and Wales sample - School Readiness/Naming Vocabulary Base model variances 132
Table 5. 15 - Cognitive outcomes: England and Wales sample - School Readiness/Naming Vocabulary Base model estimates 133
Table 5. 16 - Cognitive outcomes: England and Wales sample - School Readiness and Naming Vocabulary - Mothers' opinions of neighbourhood estimates 135
Table 5. 17 - Cognitive outcomes: England and Wales sample - School Readiness and Naming Vocabulary - Interviewers' opinions of neighbourhood estimates 136
Table 5. 18 - Cognitive outcomes: England and Wales sample - School Readiness and Naming Vocabulary – 2001 Census small area statistics for electoral ward estimates. 137
Table 5. 19 - Cognitive outcomes: England and Wales sample – Child/family and interviewers opinions of the neighbourhood together with 2001 ward level census statistics model – changes in ward and child variances 143
Table 5. 20 - Cognitive outcomes: England and Wales sample – Child/family and interviewers' opinions of the neighbourhood together with 2001 ward level census statistics model estimates. 144
Table 5. 21 - Non significant Census variables when included in full model together 148
Table 5. 22 – School Readiness outcome: England and Wales sample - reductions/increases in coefficients of stratum variables 149
Table 5. 23 – Naming Vocabulary outcome: England and Wales sample reductions/increases in stratum variation. 150
Table 5. 24 - Ward level correlations: School Readiness: England and Wales sample 151

Table 5. 25 - Ward level correlations: Naming Vocabulary outcomes: England and Wales sample 154
Table 5. 26 - Summary of changes in ward/child variance estimates for England and Wales cognitive scores 159

Table 6. 1 - Behavioural and physical dependent outcomes - Descriptives 162
Table 6. 2 - Behavioural/physical outcomes: UK sample - Null model – Ward and child variances 163
Table 6. 3 - Behavioural/physical outcomes: UK sample - Null model estimates 163
Table 6. 4 - Behavioural/physical outcomes: UK sample - Base model estimates 165
Table 6. 5 - Behavioural/physical outcomes: UK sample - Base model variances 165
Table 6. 6 - Behavioural/physical outcomes: UK sample – Mothers' opinions of neighbourhood estimates 167
Table 6. 7 - Behavioural/physical outcomes: UK sample - Interviewers' opinions of neighbourhood estimates 168
Table 6. 8 – Behavioural/Physical outcomes: UK sample – Child/family and mothers'/interviewers' opinions of the neighbourhood model variances 174
Table 6. 9 - Behavioural/Physical outcomes: UK sample - Child/family factors and mothers'/interviewers' opinions of the neighbourhood model 175
Table 6. 10 – Behavioural Difficulties outcome: UK sample - reductions/increases in stratum factor variation. 179
Table 6. 11 - BMI outcome: UK sample - reductions/increases in stratum factor variation. 180
Table 6. 12 - Behavioural/Physical outcomes: England and Wales sample - Null model variances. 182
Table 6. 13 - Behavioural/Physical outcomes: England and Wales sample - Null model estimates. 182
Table 6. 14 - Behavioural/Physical outcomes: England and Wales sample - Difficulties and BMI Base models variances. 183
Table 6. 15 - Behavioural/Physical outcomes: England and Wales sample – Estimates for Difficulties and BMI Base model 184
Table 6. 16 - Behavioural/Physical outcomes: England and Wales sample – Difficulties and BMI models - Mothers' opinions of neighbourhood estimates. 186
Table 6. 17 - Behavioural/Physical outcomes: England and Wales sample – Difficulties and BMI models - Interviewers' opinions of neighbourhood estimates. 187
Table 6. 18 - Behavioural/Physical outcomes: England and Wales sample - Difficulties and BMI models - 2001 Census statistics for electoral wards estimates. 188
Table 6. 19 - Behavioural/physical outcomes: England and Wales sample – Ward and child variances. 195
Table 6. 20 - Behavioural/physical outcomes: England and Wales sample - Child/family and interviewers opinions of the neighbourhood together with 2001 ward level census statistics model estimates 196
Table 6. 21 - 2001 census factors that are significant before being entered into full Behavioural Difficulties model together 201
Table 6. 22 - Behavioural Difficulties outcome England and Wales sample - reductions/increases in stratum variation. 202
Table 6. 23 – BMI outcome: England and Wales sample - reductions/increases in stratum variation. 203

Table 6. 24 - 2001 Census factors correlations for the Behavioural Difficulties outcome: England and Wales sample 204
Table 6. 25 - Changes in ward/child variance estimates for England and Wales behavioural and physical outcomes scores 209

Table 8.1- Child and family level variables 225
Table 8 2- Mothers' subjective opinions of neighbourhood sample descriptive information 231
Table 8.3- Interviewers' subjective opinions of the neighbourhood sample descriptive information 233

Table of figures

Figure 1- Research Framework (adapted from Bronfenbrenner (1979) 16
Figure 2 - Bio-ecological model of child development 23
Figure 3 - Example of multilevel model equation 97
Figure 4 –School Readiness level one residual normality plot for England and Wales' final model 235
Figure 5 - School Readiness level two residual normality plot for England and Wales' final model 235
Figure 6 - Naming Vocabulary level one residual normality plot for England and Wales' final model 236
Figure 7 - Naming Vocabulary level two residual normality plot for England and Wales' final model 236
Figure 8 – Behavioural Difficulties level one residual normality plot for England and Wales' final model residual normality plot 237
Figure 9 - Behavioural Difficulties level two residual normality plot for England and Wales' final model residual normality plot 237
Figure 10 - BMI level one residual normality plot for England and Wales' final model residual normality plot 238
Figure 11 - BMI level two residual normality plot for England and Wales' final model residual normality plot 238

1. Chapter One – Children's wellbeing and the neighbourhood

1.1.1. Introduction

Inequalities and risks to child wellbeing in the United Kingdom were highlighted in the United Kingdom government's 'Every Child Matters' consultation Green Paper of September 2003. This was in response to, in part, the Victoria Climbié affair, where a young child had died after a catalogue of abuse but also to a wider feeling that more had to be done to improve the general wellbeing of children. This included addressing the inequalities in all aspects of child wellbeing due to disadvantage and poverty. One in five children in the UK were still reported as being in poverty in the 21st Century, a fact highlighted in the report by Harker (2006) 'Delivering on Child Poverty: what would it take?'. To reinforce the point, the United Kingdom has also been placed twelfth and twentieth in terms of educational wellbeing and behaviours and risk respectively and in the lowest third in all measures of wellbeing in a comparison of children in rich countries by UNICEF (2007).

But the plight of those living in poverty and in particular, disadvantaged areas, had been highlighted many years earlier in the United States by Wilson (1987) who stated that poor neighbourhoods were systematically disadvantaging and segregating those who lived in them from structures and networks in society. This was reiterated in a report by the U.K government's Neighbourhood Renewal Unit (2002) where they stated that part of the explanation for health and socio-economic inequalities was a result of deprivation in parts of Britain where educational underperformance, unemployment and criminal disorder were common. Although these types of adverse neighbourhood circumstances were said to affect adults and their families directly, they can also impact on the children who live in them which may have lifelong implications for health and wellbeing related outcomes.

Further evidence over the past twenty years has supported this link between the child's neighbourhood environment and their wellbeing with the most prominent studies being conducted in the United States, United Kingdom, Canada and the Netherlands (Ellen

and Turner, 1997; Jencks and Mayer, 1990). In general terms, living in disadvantaged neighbourhoods has been associated with lower child wellbeing and people from more affluent ones tend to do better. Neighbourhood disadvantage and affluence, in this context, has been measured in terms of income, employment and social support.

Since 2001, child wellbeing in the United Kingdom has become an important part of the current government's policy. The Child Poverty Review of 2004 suggested that although improvements had been made since 1997 after years of under investment, additional policy was required. Foundations were laid in the 'Every Child Matters' proposals which resulted in the 'Children Act 2004' (2004) that formally recognised the authorities duty in England (Part 1, section 10) and Wales (Part 2, section 25) to enhance the 'physical and mental health and emotional well-being' and the 'social and economic well-being' of children. Furthermore, the Children's Plan (2007) published by the Department of Children, Schools and Families stated that one of the aims of the UK government was to reduce the obstacles to child 'learning, health and happiness of every child' (p2).

Several barriers to improving these dimensions of child wellbeing have been linked to the decision making processes which regulate interactions between the child, their families and their immediate environment. The Children's Plan stated that a sequence of decisions made by the parent was creating barriers to improvement. These included not allowing children to play alone outside the home because of concerns for safety. One knock-on effect of these types of decisions is the reduction in the amount of exercise children undertake. Fear for the child's safety has also been linked to the rise in child obesity. The report also stated that children from more disadvantaged areas are also performing less well in education. Reasons for poor performance include not only those relating the families' socio-economic circumstances that have been shown to be associated with poor child outcomes but also the educational and support resources from an early age in the community. Programmes designed to ameliorate these issues have included 'Sure Start' whose programme started in 1999 and the Children's Fund.

As a result of this discussion, the main motivation of this thesis is to contribute to the body of research concerning the influence of neighbourhoods on the wellbeing and in particular that of young children in the United Kingdom.

1.1.2. Aims

1. The main aim of this thesis is to investigate whether compositional and contextual factors relating to neighbourhoods in which children live can explain differences in their wellbeing, over and above factors at the individual child and family level.

1.1.3. Objectives

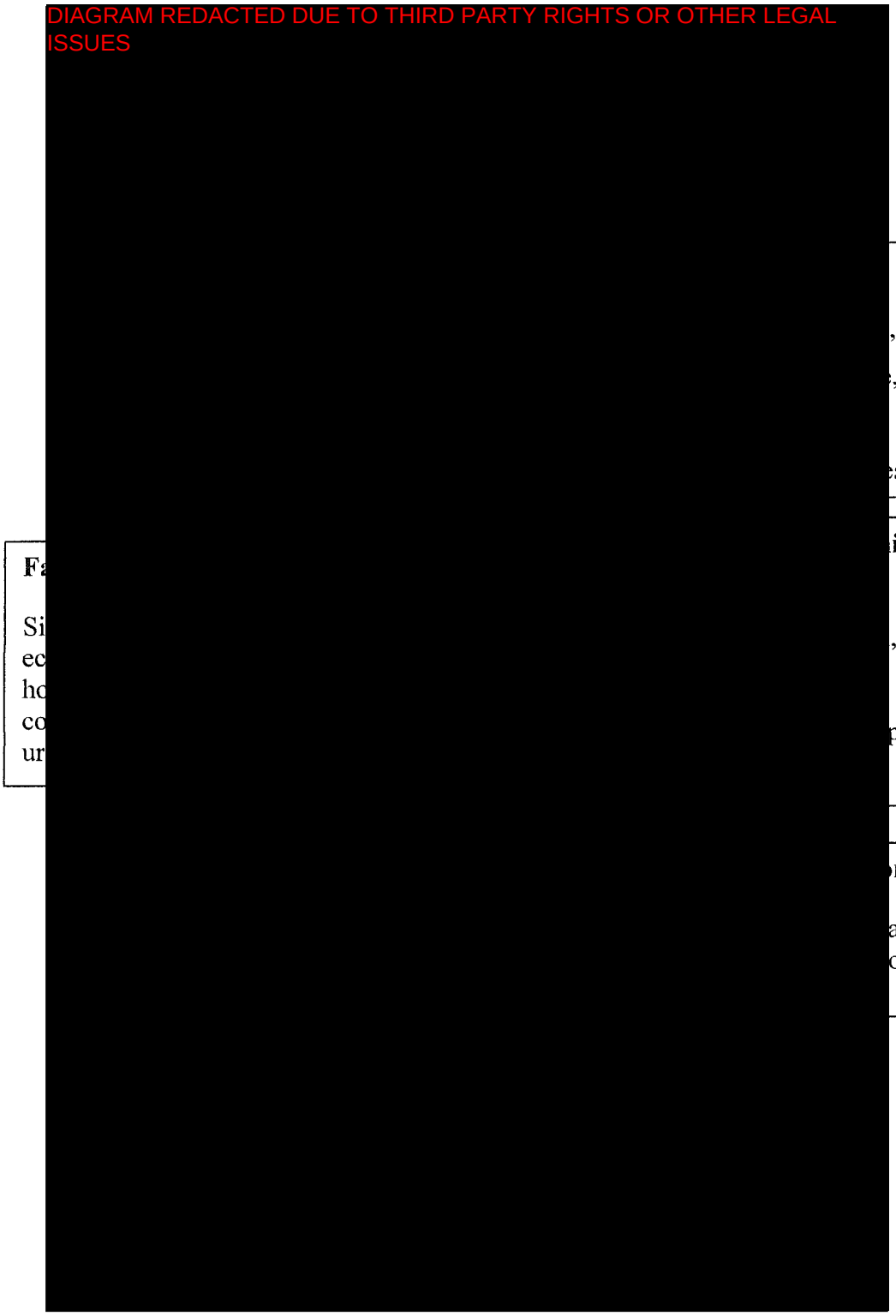
1. To use data on children aged around three years old from the first and second sweeps of the UK Millennium Cohort Study (MCS) whose child wellbeing was assessed using a number of cognitive, behavioural and physical wellbeing measurement indicators.
2. To use subjective opinions from two sets of informants, the MCS child's mother and the interviewers, as measures to describe the locality in which the MCS families live and account for neighbourhood differences in child wellbeing.
3. Using the stratification of the MCS electoral wards (neighbourhoods) into what is described as being either one of three types of wards: economically Advantaged or Disadvantaged or with a high proportion of ethnic minority families to see whether they can explain neighbourhood differences in child wellbeing.
4. To collate and link to the MCS dataset information developed from UK neighbourhood small area statistics derived from the England and Wales' 2001 census that characterise the socio-economic structure of the wards to see whether they are able to explain variations in child wellbeing.
5. To help in identifying relationships, the objective will be to use appropriate quantitative statistical methods including multi-level statistical modelling. The objective in using these modelling techniques will be to aid investigation as to the extent to which the individual level predictors of well-being in MCS children

and their families are concentrated and dispersed across geographical areas. It will also exploit the hierarchical, stratified nature of its sampling design.

1.1.4. Theoretical framework for research

Figure 1 outlines the theoretical framework in which the analysis of neighbourhood influences and child wellbeing will be explored. This has been adapted from that suggested by Bronfenbrenner (1979).

Figure 1- Research Framework (adapted from Bronfenbrenner (1979)



1.1.5. Overview of the thesis

Chapters' Two and Three review the literature concerning child wellbeing and neighbourhood influences. Chapter Four provides a detailed discussion of the methodology employed in the investigation including the sources of data to be used and methods of analysis. The next two chapters report the results and findings of the neighbourhood influences and individual factors as predictors of wellbeing – cognitive development in Chapter Five and behavioural and physical outcomes in Chapter Six. Finally, Chapter Seven provides a discussion of these findings, outlines the strengths and weaknesses of the methods employed and recommendations for further research.

2. Chapter Two - Child Wellbeing

2.1.1. Introduction

This chapter starts with a review of the definitions of wellbeing and discuss some of the important aspects of the concept including domains and components which encompass wellbeing.

Discussion of the literature on wellbeing includes a review of theoretical perspectives put forward by a number of prominent researchers whose views resonate with the ecological perspective in a number of related fields such as sociology, health and psychology. The discussion will help to illuminate some of the important ways in which ecological or environmental effects have been purported to impact on the wellbeing of children, both positively and negatively. Many of the studies of wellbeing and neighbourhoods have concentrated on particular aspects of wellbeing rather than evaluating wellbeing more comprehensively.

2.1.2. Definitions of wellbeing

The World Health Organisation (WHO) (1978) suggests that health can be defined as 'a state of complete, physical, mental and social wellbeing and not merely the absence of disease or infirmity'(p1). Perhaps important to mention in the WHO definition is the use of the terms physical, mental and social wellbeing which are important individual components. Hird (2003), in a review of literature concerning wellbeing highlighted important definitions, concepts and issues. These include:

> 'Wellbeing is about what people will recognise...as a shared life well lived and worth living...[it] is achieved as much by the ways in which people ...make sense of their lives and their social world, as it is by the accumulation of institutions for security of income, wealth, health, environment, or against any crime or any other risk' (Perri, cited in Hird 2003, p5).

Pollard and Davidson (2001) were specifically referring to child wellbeing in the following definition:

> 'Well-being is a state of successful performance throughout the life course integrating physical, cognitive, and social-emotional functions that result in productive activities deemed significant by one's cultural community, fulfilling social relationships, and the ability to transcend moderate psychosocial and environmental problems. Wellbeing also has a subjective dimension in the sense of satisfaction associated with fulfilling one's potential' (Pollard and Davidson, 2001, p8)

Apart from Perri (2002), all the definitions highlighted previously could be said to have been couched in terms applicable to both adults and children. Pollard and Davidson state (2001) child wellbeing can be thought of as 'not merely an absence of problems'(p12).

As the definitions suggest, wellbeing can defined by a number of characteristics and summarised the main themes into 5 domains:

- 'Physical'
- 'Material'
- 'Social'
- 'Development and activity'
- 'Emotional' (Felce and Perry cited in Hird 2003, p7).

For a child to experience a satisfactory level of wellbeing they would have to be happy in all the dimensions being measured (Child Trends, 2000).

Hird (2003) provides a useful checklist to assist in describing the components or domains of wellbeing which encompass most of the terms mentioned in Felce and Perry's (1995) research. Pollard and Davidson's (2001) preferred to summarise the elements of child wellbeing as:

- 'Physical health'
- 'Cognitive growth'
- 'Social and emotional development' (p8)

In accordance with this last summarisation of wellbeing, this investigation concentrates on three of the domains of wellbeing, those of cognition, behaviour (social and

emotional) and physical wellbeing. Some aspects of the material and general social wellbeing will be considered during the exploration of factors used to characterise the child and their family living conditions. However, at this stage a number of general points can be made. As Felce and Perry (1995) suggest in their definition, quality of life and wellbeing is associated with a person's development. If an individual's life span contains a number of developmental stages, Keenan (2002) suggests, it is likely wellbeing may mean something different at each stage. Depending on which phase of development an individual is experiencing, certain domains may experience more change compared to others. For instance, in terms of adulthood, physical changes are more marked at certain developmental stages compared to others. Responsibility for wellbeing at the different stages of development changes from the main carers of the individual to that of the individual themselves. For instance, as Pollard and Davidson (2001) suggest, in childhood the responsibility lies with the primary caregiver, as the child is not only unable to care for him/herself but has, for instance, little immunity to disease. This may have important implications in the argument as to the role environmental factors have to play in the wellbeing of young children. The importance of the environment and culture in which an individual lives appear to be significant determinants in terms of wellbeing.

2.1.3. Wellbeing and development

The terms child development and wellbeing are associated and inter-changeable concepts in this study. Keenan (2002) defines development as 'patterns of change over time which begin at conception and continue throughout the life span' (p2). Development has also been characterised as containing a number of domains which are very similar to those of wellbeing. These domains, like wellbeing, also include biological, social, emotional and cognitive (op cit). Child development is important because this study is investigating the wellbeing of individuals at a specific stage of their development. In terms of theory concerning wellbeing, development and the impact of environmental factors, the arguments put forward by Bronfenbrenner (1979) have particular resonance. In the 'Bio-ecological model of human development' (Bronfenbrenner, 1979) as shown in Figure 2 it was suggested the child could be conceptualised as inhabiting space at the centre of a series of concentric circles or a

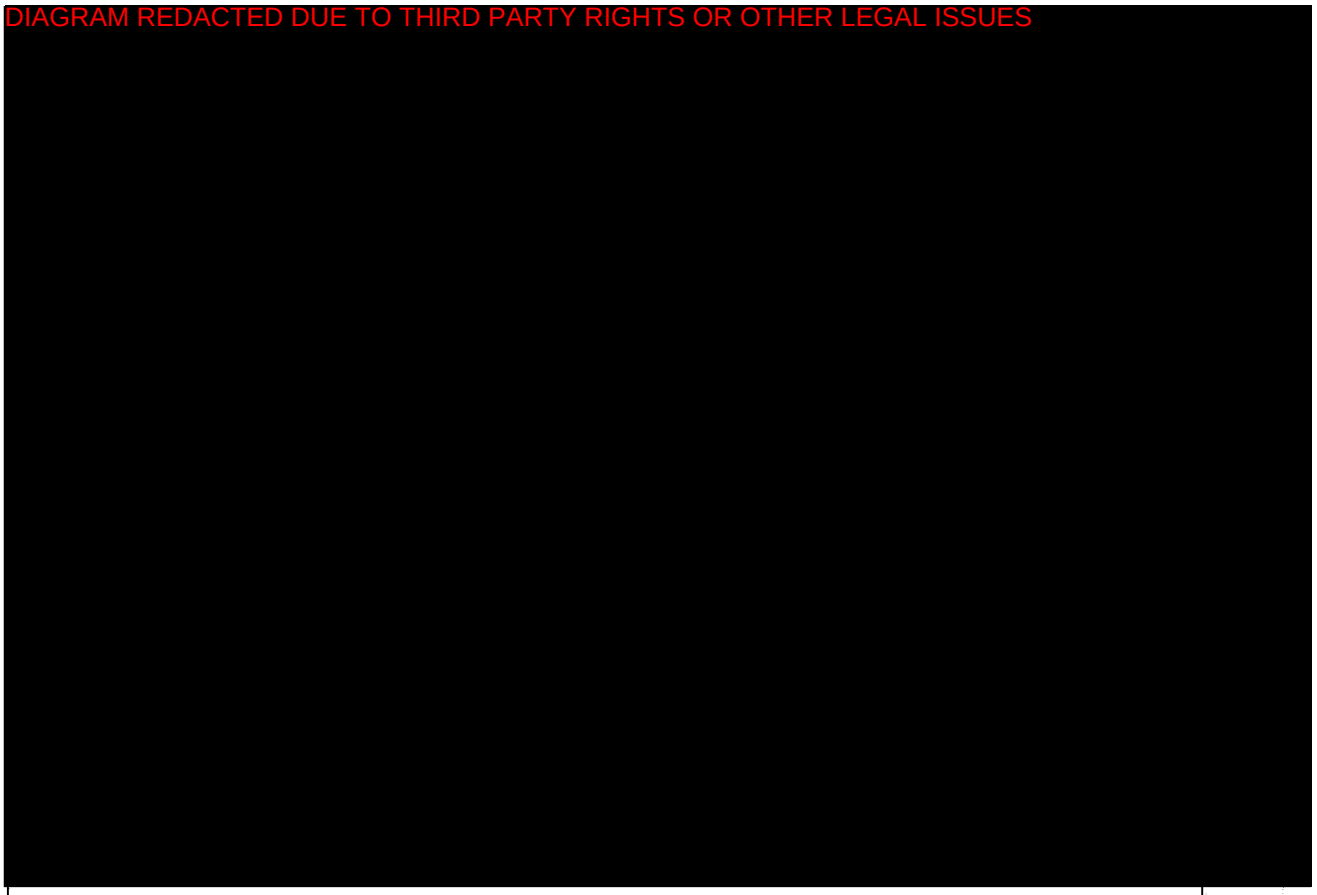
'nested structure' which emanated outwards. The environment in each circle is characterised by actors, resources and processes which can influence the development and wellbeing of the child but overlap in many ways. The immediate environment or set of relationships surrounding the child is described by Bronfenbrenner (1998) as the 'Microsystem'. Keenan (2002) suggests that within this dimension lie interactions between the child and the immediate family members. The child may not only be influenced by parents and siblings on a daily basis but can also influence the process of interaction through a number of factors (Bronfenbrenner, 1979). The child factors may include biological or genetic characteristics (Bouchard and McGue, 1981) and those of a psychological nature such as force of personality. For children aged three, it is thought the child's ability to interact may have an important role compared to children of a younger age. In many ways, if the interactions between the child and another individual is seen as a 'microsystem', then there may be many 'microsystems' operating at any one time. As such, factors relating directly to the child will likely necessitate inclusion as mediating factors in any modelling to identify neighbourhood influences.

The next environmental system in the nested structure is referred to as the 'mesosystem' (Bronfenbrenner, 1979). This is where many 'microsystems' are likely to operate and interact. Again the actors include other family members, siblings, peers and other external actors' such as teachers and care staff. The environment of the 'mesosystem' can include the child's residence, schools, nursery, and other child care units (Keenan, 2002) for children of this age. What is noticeable about these systems and the processes that occur within them is the overlapping and inter-related nature of the structure. As such, untangling the web of influence into its constituent parts is likely to be a complex process.

Both of these systems are placed within the 'exosystem' which can be described as the wider context in which children develop. This is likely to include aspects of the built environment with which the child may interact. For instance, health care centres, hospitals and leisure areas are likely to have an indirect influence on child wellbeing. It also includes more intangible aspects such as the social networks and services, in offering aid through a series of resource settings (op cit).

Overarching all of these systems if what Bronfenbrenner (1979) terms the 'macrosystem'. This really refers to all encompassing government regulatory systems,

laws, cultural and community values. As for most individuals, many of these, such as regulation and law will be the same for all children. However, cultural and community values may differ greatly. To some extent differences in these factors may be identified in proxy measures used to operationalise culture and community such as ethnicity and levels of area deprivation. Finally, as an aside, Bronfenbrenner (1979) suggests the 'chronosystem'. This refers to how the context of time can influence child outcomes (Keenan, 2002). In terms of this investigation, the children to be sampled are not likely to be exactly the same age at the time of their wellbeing assessment. Children aged around three are likely to experience jumps in stages of development far greater than in other stages of the life course. As such age may prove to be an important explanatory factor in determining wellbeing and need to be accounted for in any investigation of neighbourhood influences. Therefore, when discussing each domain of wellbeing, relevant aspects from the child development literature may also be of importance.



Adapted from Bronfenbrenner (1979)

Figure 2 - Bio-ecological model of child development

2.1.4. The theory of mind

Central to this investigation is measuring the wellbeing of children aged around three. It will be important to understand some of the main characteristics of children of this age. It would be useful at this stage to begin by outlining some of the aspects which characterise the developmental phase young children aged around 3 years are experiencing. Children go through an important phase of cognitive, behavioural and physical development between the ages of two and seven. Perhaps one of the most useful models to describe and characterise the phase of development for children around the age of three is the 'theory of mind' (Piaget, cited in Keenan 2002). In this model, children around this age are experiencing the 'preoperational' stage (op cit). A number of characteristics typically describe this phase and are very much related to the

development of various abilities linked to cognition including amongst others, the development of language ability, numeracy, and playing skills (Keenan, 2002). These abilities are important in cognition, behaviour and physical development.

2.2. Cognitive wellbeing

2.2.1. Definition

The processes involved in cognition can include 'perceiving, remembering, conceiving, judging and reasoning in order to obtain and use knowledge' (Zaff et al, 2003, p 26).

A number of fundamental aspects have been suggested that characterise cognitive wellbeing and are provided in Bornstein, Davidson, Keyes and Moore (2003) and include:

- 'Information processing and memory'
- 'Curiosity, exploration and novelty seeking'
- 'Mastery, motivation and goal persistence'
- 'Thinking and intelligence'
- 'Problem solving'
- 'Language and literacy'
- 'Moral development'
- 'Educational achievement'
- 'Creativity and talent' (p 269-371)

Although it is acknowledged that there may be a genetic component to cognition, the aspects mentioned above can be shaped by various other agents and processes operating in the child's environment and most notably that of 'cultural context'(Vygotsky, cited in Keenan 2002). One of the concepts central to Vygotsky's (1978) theory was that of the 'zone of proximal development' (ZPD). He argued that interactions with those in the child's environment such as parents and caregivers could significantly increase the child's rate of cognitive development in comparison to the child working independently.

The process in which parental or other figures help the child to learn through carefully modifying their support depending on the child's improving ability has been termed and developed into what is called 'scaffolding' (Bruner, cited in Keenan 2002). A supportive home environment is likely to play a key role in providing this positive context for improving child cognition and has been found to be associated with higher IQ in children (Bradley, cited in Keenan 2002).

Cognitive wellbeing for young children can be measured using a number of validated tools. However, although these types of assessments are widely used, some researchers have suggested cautionary notes concerning assessment in general, for example, White (1999). Some measure a number of factors mentioned by Bornstein, Davidson, Keyes and Moore (2003) and others tend to concentrate on specific aspects. They are usually designed to take account of the different ages of those being assessed and can include a number of sub-scales to measure various dimensions of cognition.

Examples of assessments include the Stanford-Binet Intelligence Scale, the Peabody Picture Vocabulary test, the British Ability Scales (BAS) and the Revised Bracken Basic Concept Scale. The Stanford-Binet Intelligence Scale (form L-M) (Terman and Merrill, 1973) adjusted for prematurity, is used to measure thinking, intelligence and creativity and has been used in studies of young children and neighbourhood associations (Chase-Lansdale et al., 1997; Duncan, Brooks-Gunn and Klebanov, 1994). It is also commonly used for testing more gifted children. The Peabody Picture Vocabulary test (PPVT) (Dunn and Dunn, 1981) has been used by a number of neighbourhood researchers (Chase-Lansdale et al., 1997; Kohen et al., 2002; McCulloch and Joshi, 2001). This test specifically measures the child's verbal ability and receptive English vocabulary.

The British Ability Scales are designed to measure a variety of dimensions of mental ability including verbal, visual and general intelligence (Elliott, Smith and McCulloch, 1996). Another associated measure is the motor and social development (MSD) scale (Mott et al., 1998). Part of this scale measures cognitive wellbeing and was used by To et al (2001) in their investigation of environmental factors and preschool development. The sub scales measure many of the factors mentioned by Bornstein and Smith (2002). However, the subtests can be used as standalone assessments when cognition is being measured, for instance, the Naming Vocabulary assessment (MCS Development Team,

2006). Another scale used is the Revised Bracken Basic Concept Scale which is used to measure communication skills found in early development and a child's readiness for schooling. More discussion of this assessment will be provided in Chapter Four as it is used in this investigation.

2.3. Behavioural wellbeing

2.3.1. Definition

Bornstein, Davidson, Keyes and Moore (2003) suggest a number of social and emotional elements that encompass behavioural wellbeing:

- 'Emotional development'
- 'Emotional regulation'
- 'Coping'
- 'Autonomy'
- 'Trust and attachments'
- 'Parent-child, sibling-child and peer-child relationships'
- 'Positive development of self'
- 'Pro-social behaviour, empathy and sympathy' (p 125-253)

Emotions are an important part of behavioural wellbeing. Factors that characterise emotions include 'disgust, happiness, fear, anger, sadness, interest and surprise' (Campos et al, cited in Keenan 2002, p174). After early emotional development in infancy, positive emotions developed around the age of three can include laughter which they engage in as a result being able to perceive differences from normal behaviour due to their increased cognitive abilities (Keenan, 2002). At this stage the laughter also becomes more public and displayed in front of others (op cit). Socialisation by adults and other siblings begins to play a role in the emotional and behavioural development at around this time (Maletesta and Haviland, cited in Keenan 2002). For example, this might include parents responding positively to good behaviours or emotional child expressions. This is perhaps an important aspect of

wellbeing in terms of interaction with the environment including within the family and neighbourhood. This stage of socialisation is when children begin to learn from their parents, important rules and pick up on emotional traits displayed.

At this point, children are also learning to control their emotions and are prompted by rules set by parents (Keenan, 2002). However, significantly, in displays of behaviour, children of around three years old are unable to distinguish between their own feelings and rules of behaviour they might be displaying (op cit). At around the age of around two to three years, children are able to express more 'self conscious' emotions of envy, guilt and embarrassment (Campos et al, cited in Keenan 2002). From between three to five years, they are beginning to show emotional understanding. For example, they would not be able to understand that when another child is displaying a smile, he or she might actually be feeling lonely. Children at the age of around three also begin to understand other emotions such as pride, for example, when solving a complicated undertaking rather than a more simple one (op cit).

In terms of social development, children learn how to be social and interact with parents' and peers' during the early years (Bandura and Walters, cited in Keenan 2002). This can include finding different ways to play with other children, for instance. Keenan (2002) explains that at around the age of three years, children are able to develop role playing abilities and how to construct from building blocks. Children also begin to display power or authority over their peers through being assertive. Imitation of behaviour in others and sharing begins to occur (op cit).

Many of the behavioural traits displayed by the child are learnt within the environment of the home and sometimes in the local environment. Where ever they take place, the parents or carers are likely to carefully regulate the environment and actors within that environment.

In terms of behavioural wellbeing, this thesis will explore children's behavioural difficulties. Behavioural difficulties have been found to be associated with family level factors and are considered less difficult to measure in children of around preschool age (Brooks-Gunn et al., 1993). Assessment tools used to measure behavioural functioning in studies of neighbourhood influences have included the Child Behaviour Checklist for Ages 2-3 (Achenbach, Edelbrock and Howell, 1987) and the Revised Child Behaviour

Profile for Ages 4-5 (Achenbach and Edelbrock, 1884) which were used by Brooks-Gunn et al (1993) for two year olds, Chase-Lansdale et al (1997) for 3 year olds, Caughy et al (2003) for 3 ½ and 4 year olds (externalising behaviours) and Duncan et al (1994) for five year olds. The first of these authors used scales rated by the parents relating to the child internalising and externalising behaviour. Examples of internalising behaviour include feelings of fearfulness, depression, sadness or unhappiness and externalising included a tendency to destroy belongings and the displaying of tantrums (Chase-Lansdale et al., 1997).

2.4. Physical wellbeing

The important aspects of child physical wellbeing can include 'good nutrition, preventative healthcare, physical activity, safety and security' (Zaff et al, 2003, p 24). In this thesis, one particular aspect of child physical health, the size of body mass, will be considered. Body mass can be affected by all of the aspects considered by Zaff et al. For instance, good nutrition means a balance of vitamins, proteins and carbohydrates. Saturated fats should also be kept to recommended levels (Department of Health, 1994). High levels of body mass, classified as overweight and obesity, have been linked to chronic heart problems and other diseases in childhood and through to adulthood (Cole et al., 2000) and the problem has become worse over several decades in most developed countries (Ebbeling, Pawlak and Ludwig, 2002). One reason for exploring this measure of physical health is the potential risk the neighbourhood environment may have for this aspect including physical resources such playing areas and issues relating to unsafe environments (Lake and Townsend, 2006) . Another reason for studying this dimension is the excellent data available concerning both neighbourhoods and body mass in the MCS and the previous limited research in this area for children aged around three.

The measure to be explored will be the Body Mass Index (BMI) of the MCS children. BMI for an individual is defined by using an index calculated from weight and height measurements together with sex and age. Measurements at each end of the BMI spectrum are commonly used in analysis such as those that indicate under and overweight or obesity (Cole et al., 2000). However, analysing the actual BMI measurements of individuals rather than allocating individuals to risk groups using BMI

cut-offs can also be an effective way to discover whether variations exist in the population by socio-economic background or geography. Using overweight and obesity thresholds in the analysis of children is also considered by some to be controversial (Evans, Evans and Rich, 2003). Attempting to identify area differences using small geographical units in overweight or obese children may be difficult as the numbers of children in these risk groups by area are likely to be very small (Hawkins et al., 2008).

Evidence shows that differences in overweight young children can be explained partly by individual factors such a diet and physical activity (Hawkins and Law, 2006) and those related to behavioural variables associated with the child's mother such as smoking and other socio-economic factors (Hawkins and Law, 2006; Lobstein, Baur and Uauy, 2004). Although it is accepted that a great deal of individual variation in child BMI can be explained by inherited genetic influences (Wardle et al., 2008), behaviour is also considered to be an important mechanism in determining BMI and especially in recent times. This may be operating indirectly through the parents or could be directly attributable to the child.

The impact of area deprivation has also been linked to child obesity (Parsons et al., 1999). In adults, obesity was found to be associated with fewer leisure facilities, the perception that there were few shops that could be reached by walking, residing in an area with no paths (or perceiving there were none) (Giles-Corti et al., 2003). Some significant differences by country and by region have been found in overweight young children in the UK (Hawkins et al., 2008). Differences between neighbourhoods in levels of obesity have been found in the UK with those in more deprived having more problems (Ellaway and Macintyre, 1996; Ellaway and Macintyre, 1997).

2.5. Conclusions

Wellbeing is a complex and multi-faceted concept. Genetic and personality characteristics can play a major role in determining positive and negative wellbeing. It is also evident that dependent on the stage of development an individual is experiencing, different aspects (such as resources) or actors (such as parents, siblings) will have a

greater or lesser role to play. The evidence discussed also suggests that the environment in which an individual lives can also have a major impact.

The main focus of this dissertation is to explore the associations between environmental factors, especially the neighbourhood in relation to child wellbeing in the United Kingdom.

The next chapter provides a review of the literature on how neighbourhood may affect young children and their cognitive, behavioural and physical wellbeing.

3. Chapter Three – Neighbourhood effects

3.1.1. Introduction

This chapter aims to review the concept of neighbourhood, or ecological, effects that may impinge on the cognitive, behavioural and physical wellbeing of preschool children in the United Kingdom. First, the chapter outlines some of the key elements of neighbourhood effects. This includes defining what is meant by the term neighbourhood and how it has been operationalised, discusses some of the concepts, theories, explanations, mechanisms and processes in the neighbourhood literature relevant to child wellbeing providing and provides a brief review of the historical background of neighbourhood research, major information sources used and research findings.

3.1.2. Neighbourhood definitions

A number of definitions have been proposed by writers. These include Warren (1981) who defined neighbourhoods as social networks which is useful as it not only describes the size of the area a neighbourhood might occupy but also alludes to the importance of the concentration of people who live in this space.

> '...a limited territory within a larger urban area, where people inhabit dwellings and interact socially' (Warren, 1981, p 62).

This definition also suggests that the neighbourhood is not only a place that can be measured physically but also has a social dimension (Berkman and Clarke, 2003). Tienda (1991) uses White's (1987) definition of neighbourhood as places which are:

> '...physically bounded areas characterised by some degree of relative homogeneity and/or social cohesion' (White, 1987, p 3).

Another aspect of neighbourhood boundaries is that they are not always easy to identify as they are shaped by the social environment (Galster, 2001). He provides another definition of neighbourhood as a:

> '...bundle of spatially based attributes associated with residences, sometimes in conjunction with other land uses' (Galster 2001, p 2113).

The characteristics or attributes of neighbourhoods can include those relating to the physical and social space (Lupton, 2003). Physical aspects include environmental features, infrastructure and proximity characteristics. Social space attributes include demographic features of the area including social class status, social interaction and networks of the inhabitant's political involvement (op cit).

Glennerster et al (1999) suggested that neighbourhoods could be conceptualised as being similar to an onion with its various layers, with the overlapping layers representing the social interactions and networks (Massey, Gross and Shibuya, 1994) which take place between individuals within neighbourhoods.

How neighbourhoods have evolved may provide further insight into their characteristics and how this might impact on wellbeing related outcomes.

The following commentary illustrates one trajectory which neighbourhoods may have taken in human development. Although hypothetical, the development takes a number of aspects from Maslow's hierarchy of needs (1968) and Macintyre's et al (2002) discussion of functions that need to be satisfied for inhabited localities. In earlier times, humans tended to live within close proximity to one another for social and economic reasons such as food sharing (Hawkes et al., 1998). Social bonds between families were also important. Foraging for food was more efficiently undertaken by groups rather than by individuals. Groups of related families lived close to one another for purposes of security from predators, be they human or animal. In these times, neighbourhoods may have been easier to define. For instance, in very small communities, where agriculture and hunting practises sustained life, the edge of the physical boundary of the neighbourhood could easily be defined as a wall or fence that surrounded the encampment of families. The space within the encampment contained all the shelters within the area with all shelters in walking distance of one another. An assumption is made that individuals within the confines of this area probably knew each other and could communicate on a regular basis (if they had wanted to). Therefore the neighbourhood in this example could to some extent be defined physically, socially, spatially and in time. These dimensions are, therefore, important factors in defining a neighbourhood. As time passed and communities grew, the dimensions that defined the

neighbourhood became more difficult to define themselves. For instance, the physical boundary of the original settlement mentioned may have become more difficult to distinguish for someone new to the area. The fence or wall may have become a road or pathway. For individuals living in the centre of the original neighbourhood area, the limits of social boundary may not have changed greatly. However, for those living on the edge of the original settlement, the social, spatial and time boundaries may now include a whole new collection of individuals. Economic and social links between individuals in the neighbourhood are no longer exclusively mutual and therefore the original precepts of neighbourhood such as closeness to other individuals become less important to the concept of neighbourhood.

Complexity in defining a neighbourhood has certainly increased in more modern times (Galster, 2001). Neighbourhoods were conceptualised by Forrest and Kearns (1999) as areas where the perceived problems of urbanisation could be controlled through providing identity, friendliness with those living close by and a place where individuals could create community. Other drivers have begun to shape the definition of neighbourhoods (Berkman and Clarke, 2003) such as busy roads or industrial development splitting original communities in two by creating barriers. The nature of neighbourhood housing boundaries in urban areas is that they may have become less contiguous with other neighbourhoods with the development and expansion of industry in these areas. Patterns of social communication between the original community members may have been damaged by these barriers and the boundaries of the original neighbourhood changed. In more urban areas, the type of employment available in an area may have changed dramatically over time. For instance, former industrial areas in towns may have been demolished to make way for new forms of employment such as high tech businesses. Families of former employees from the industrial era may still live in the neighbourhood. However, new housing in the same area may be developed to house the new highly skilled workers. Divisions may be created in the neighbourhood due to the differing socio-economic backgrounds of residents. New/old residents might have a subjective view of what is now 'their' neighbourhood, changing the boundary in doing so. The new inhabitants of these areas may have different perceptions of the communities to which they belong and what they consider to be their neighbourhood and it's their geographical boundary.

These are also just some of the issues that are present in attempting to conceptualise operationalise neighbourhoods.

Neighbourhoods have been operationalised in the research literature in a number of different ways. For instance, a number of neighbourhood studies in the UK, not only of child wellbeing but also of other health related outcomes have used geographically defined areas developed for administrative purposes rather than for neighbourhood research specifically, such as the electoral ward (Buck, 2001; Ellaway, Macintyre and Kearns, 2001; McCulloch, 2006; McCulloch and Joshi, 2001). Although, it has been acknowledged that these units may suffer from a number of technical issues when used as proxies for neighbourhood, they have the advantage that many sources of information that could be used to characterise neighbourhoods are available at this unit of geography, for example from the UK decennial census. Wards have a population average of around 5,500 people but the geographical area covered can vary, among other reasons, on whether they are in rural or urban areas. Enumeration district (ED), a smaller unit of geography with fewer households (around 150), has also been used especially in studies using information derived from the census, for instance, Garner and Raudenbush (1991). Stafford et al (2007) in their analysis of obesity in the England and Scotland used postcode sectors (around 5000 persons) to represent neighbourhood areas. This unit of administrative boundary is used in the UK post delivery system. One problem highlighted by the authors of this study was the lack of information at this level specifically associated with the boundary size. In fact, all postcode sectors within the same local authority (125,000 persons) were provided with the local authority level statistics such as crime rates which may have introduced created a certain amount of error measurement in the analysis.

In US, many studies have used the census tract (3,000 to 8,000 inhabitants) including Brooks-Gunn et al (1993), and Chase-Lansdale et al (1997), Raudenbush and Sampson (1999b), Ginther et al (2000) and Leventhal et al (2003b) which is an approximate unit of size to the UK ED. Around four census blocks are found within a census tract each with around 1,500 persons.

Caughy et al's (2003) study of Baltimore city used the lowest geographical unit in U.S census geography, that of the Census Block, containing around 1,500 households These

can be aggregated to Census tract but the smaller units (census block) are considered these researchers to be more homogeneous.

In Canada, studies have used the Enumeration Areas (EA) census unit level of geography which is has around 300 households. The Canadian census also uses census tracts each with around 2000 families and both units of geography are comparable to the US census tract and block (Kohen et al., 2002).

Neighbourhoods have also been operationalised using boundaries of neighbourhood based upon specific temporal definitions such as the area within 20 minutes walking distance of the respondent's home (c.f. the MCS study) or less well defined areas such as the general 'local' environment (Curtis, Dooley and Phipps, 2004).

3.1.3. Theoretical neighbourhood models

A number of interesting theoretical models have been suggested to explain some of the mechanisms that may be operating in the local environment which impact on an individual's health and wellbeing. Jencks and Mayer (1990) suggested four models that could help explain aspects of neighbourhood influence. These included 'social isolation', 'contagion', 'competition' and 'relative deprivation'.

In the social isolation model, being cut off from support structures can have a negative impact. For instance, a lack of neighbourhood employment and limited support resources such as child care and in the neighbourhood can have a negative influence on young children. Census variables which have been used to operationalise this type of model have included levels of neighbourhood income, poor education and joblessness (Jencks and Mayer, 1990). However, Brooks-Gunn et al (1993) found little support for this model for young children, as deprived individuals did not appear to benefit from living in advantaged areas whereas they did for children in more affluent ones who did benefit. In a related model, which Jencks and Mayer termed 'collective socialisation', they suggested problems in poor neighbourhoods could be improved by the monitoring and role modelling. They thought these activities would be mediated through adults in the household. Wilson (1991a) had proposed that the mixing of advantaged and disadvantaged groups would be of benefit to the latter group with resources such as

access to job opportunities being provided through socialisation by the advantaged residents through networking. In support of this theory Brooks-Gunn et al (1993) found that parental educational inputs were important factors in the cognitive wellbeing of young children.

Jencks and Mayer (1990) also suggested that neighbourhood influences could operate through peers who provide examples of poor or good behaviour which would be copied. This 'contagion' model was perhaps posited in the context of adolescents from deprived backgrounds' who might provide a bad example for more affluent peers by displaying behaviours such as delinquency, smoking or drinking in the neighbourhood. Both deprived and affluent groups could encourage both negative and positive behaviour. These may be 'pull up or pull down' influences (Graham et al., 2000). However, the evidence for this model (Brooks-Gunn et al., 1993) is weak for preschool children. It might be argued that for children of around 3 years old, this type of peer pressure is not likely to occur. Social mixing of children may occur at this age in a variety of situations but it likely to be controlled by parents or other adults. However, it may be envisaged that peer 'contagion' in smoking, drinking or unhealthy eating habits, for example, may occur amongst adults responsible for children, indirectly affecting the wellbeing of the child.

In the 'competition' model, Jencks and Mayer (1990) suggest that a struggle for resources such as for care places or employment between parents in the neighbourhood may indirectly result in adverse child outcomes. For young children, this model of transmission of risk is plausible. This might be especially so in poor neighbourhoods although these areas often receive more support. If it is assumed higher ratios of children per head of population are more likely to be found in disadvantaged compared to advantaged neighbourhoods (Plewis, 2004), competition for resources directly affecting the child such as child care, nurseries and health clinic facilities may be greater. Indirectly, a child's wellbeing may also be influenced by high competition for limited employment opportunities in these types of areas. Heavy competition for jobs may result in high unemployment and lower wages. Low family income is a powerful child predictor of wellbeing (Brooks-Gunn et al., 1993).

Finally, in the 'relative deprivation' model (Jencks and Mayer, 1990) it is suggested that individuals judge their situation against those of their peers in the neighbourhood. In

terms of relative poverty, for example, this model is likely to be affected by the proportion of disadvantaged and advantaged individuals living in a particular area. For instance, large numbers of deprived individuals in an area may result in underestimates of negative neighbourhood influences. They may have few affluent neighbours upon which to judge their own relative poverty. On the other hand, the opposite might also be true.

Macintyre et al (2002) provide an interesting historical account of research into associations between health and locality. In the last 20 years or so, research has focused on contextual and compositional explanations as opposed to those related to individual behaviour in a range of outcomes in the health, wellbeing and socio-economic dimensions. This contextual argument reflects the return to structural explanations championed in the Victorian era when local facilities were constructed to encourage good health through improved sanitation (Macintyre, Ellaway and Cummins, 2002). Much of this research has been driven by changes in the population of many areas during this period (Brooks-Gunn et al., 1993). In the US, for example, Wilson (1991a) suggested that inner city areas had experienced a dramatic change in the composition of their internal populations with unemployment being an important driver. Macintyre et al (2002) suggest that from the mid 1980's, the few studies that have been conducted are mostly of particular communities in the United States. They go on to suggest that before this much of the research was shaped by the idea that health was connected to locality and related to people's behaviours. Other factors believed to account for adverse health have included the non random selection process of people into areas, conditions in the past, culture, behaviour and physical resources.

Mechanisms underlying explanations for neighbourhood effects can be summarised by the following dimensions (Kawachi and Berkman, 2003). These include:

- 'Compositional' and contextual' influences (Duncan, Jones and Moon, 1998; Ellen, Majanovich and Dillman, 2001; Kawachi and Berkman, 2003; Macintyre, Ellaway and Cummins, 2002)
- 'Material' and 'psycho-social' factors (Kawachi and Berkman, 2003; Macintyre, 2000; Macintyre, Ellaway and Cummins, 2002)

3.1.4. Compositional factors

The distinction between context and composition has become a framework commonly used in neighbourhood research. To some extent, this has been driven by attempting to aid policy makers in deciding where and how best to allocate resources to improve various individual outcomes. Should resources be allocated to individuals to improve their health-related outcomes or are area-based initiatives a more appropriate way to approach the problem? Evidence has shown geographical differences in these types of outcomes do exist, including those considered to be proxies for neighbourhoods such as wards or even for larger geographical units of scale such as the district or region. The argument has been that area differences are due to the context in which people live their lives. The problem is how context is defined. Duncan et al (1998) and others have suggested that context cannot ignore the potential role of the individual in determining health status. For instance, individual behaviours and socio-economic characteristics, also termed compositional factors (or what has been termed the 'structural-composition' (Aber et al., 1997) dimensions of ecological variation) may be important factors in explaining poor health outcomes in areas. For example, some studies of limiting long-term illness (Shouls, Congdon and Curtis, 1996) and psychotic symptoms (Os et al., 2000) have shown that individual socio-economic factors had negative associations with these outcomes, even after controlling for other individual level factors. Reijneveld and Schene (1998) found that differences in mental status were due to those with low socio-economic status (SES) living in the area rather than neighbourhood deprivation. Differences in health status in localities might be explained by people with similar individual characteristics, who all have adverse health outcomes, living in the same locations, i.e. the composition of the population.

A closely related topic is that of 'social selection' which has been considered an important argument in explaining neighbourhood influences (Kawachi and Berkman, 2003). This suggests that people are not always able to make individual choices as to where they live as the social environment drives these choices. For instance, these non-random processes include the notion that more advantaged families would prefer and are able to reside in more attractive urban areas (Atkins et al., 1996), or individuals, such as lone parents families, may have to live in deprived areas as they lack the

resources to move into more affluent areas (Crowder and Teachman, 2004). To illustrate, a lack of resources may have been shaped by poor standards of education in a deprived area, which in turn prevents an individual being employed in a well paid job where they can save up to move into a better location. The problem in these types of models is that associations at the neighbourhood level might be mirroring the types of families who live in those particular neighbourhoods (Duncan, Connell and Klebanov, 1997; Tienda, 1991). For instance, this might occur in the testing of these models if similar types of variables are used at both the individual and neighbourhood but do not control for other unmeasured family differences in analysis. An important strategy in attempting to understand variations in health related outcomes might not only be to consider the characteristics of those who live in a particular area but also those who are absent. For instance, children of movers were more likely to be associated with lower cognitive development (Kohen, Hertzman and Wiens, 1998). Residential stability in the local area can help children's outcomes (Kohen et al., 2002; Sampson and Raudenbush, 1999). Young people who tend to move are more healthy than those young people who do not (Norman, Boyle and Rees, 2005). They suggest in their study of migration and deprivation that moving populations can sometimes account for variations in outcomes rather than poverty in these areas. Although it may not always be possible to account for these sorts of variables, 'selection' should be at least considered in any explanation of variations in wellbeing.

Operationalising and finding evidence that combines individual, family and neighbourhood level data has been difficult in the past (Brooks-Gunn et al., 1993). Large scale studies in the UK and US, in particular, have made use of measures of population composition to characterise neighbourhoods such as census data to investigate area differences in the samples of people selected in those areas rather than other characteristics of the neighbourhood, for example, Sloggett and Joshi (1998), Duncan et al (1994) and Brooks-Gunn et al (1993). However, the data used to characterise areas have usually aggregated socio-economic information on all those living in the area (Diez-Roux, 2007). This information in many of these studies included such factors as proportions by area of ethnic minorities, employment status, educational qualifications, indices of deprivation, population density, socioeconomic classification and various measures of levels of health in the locality. The characteristics used to identify marginalised areas have included high and low levels of household income in

the area; the predominance of ethnic minority families, female headed lone parent families, families in receipt of government subsidies or benefits, male unemployment and housing. Classifying areas into either being deprived or disadvantaged, affluent or advantaged or largely ethnic minority areas are some of the most commonly used summaries of the neighbourhood. They have been used to investigate the wellbeing of young children with concentrated levels of deprivation being found to be associated with low cognitive functioning (Brooks-Gunn et al., 1993) and behavioural problems (Boyle and Lipman, 2002; Kalff et al., 2001) in young children. For example, in analysis of a sample of electoral wards in the MCS, Cullis (2007) found that childhood mortality was higher in wards with a high proportion of Ethnic Minority by population compared to those wards characterised as being economically 'Advantaged'. On the other hand, those wards considered to have a high proportion of families who were economically disadvantaged had mortality rates that were not significantly different to the 'Advantaged' wards. Several summary factors have been used to characterise deprivation including the proportion of poor to affluent individuals in a particular area. Brooks-Gunn et al (1993) explored threshold effects (or the influence of various sizes of these proportions), for instance, in attempting to explore Crane's (1991) 'epidemic' theory whereby the worst neighbourhoods have a particularly large impact on child and adolescent outcomes. Indeed combining factors into indices or summaries of various factors can reduce the problems of multi-collinearity (Small and Newman, 2001). (McCulloch and Joshi, 2001) used combined summary or indices of indicators of deprivation, for instance, the Townsend Index of Deprivation for wards (Townsend, Phillimore and Beattie, 1989) which combines levels of unemployment, no access to a car, overcrowding and housing tenure and was found to be related to young children's cognitive outcomes. McCulloch (2006) in his study of children in the UK, classified administrative areas (proxies for neighbourhoods) using a system of socio-economic and demographic factors (Wallace, Charlton and Denham, 1995) which could be characterised into 10 groups or descriptors such as 'Deprived City Areas', 'Prosperous Areas', 'Industrial and Manufacturing Towns' and 'Rural Areas'. He found 'Deprived Areas' were associated with high levels of behavioural problems and poor cognitive outcomes in young children.

However, this strategy can lead to difficulties in interpreting the division between individual and aggregated compositional factors in analysis of area effects (Diez-Roux,

2007). Macintyre et al (2002) have highlighted the need to recognise that people are shaped by their environment and therefore this interaction should be acknowledged.

Not recognising individual socio-economic characteristics when using aggregated structural factors to describe the locality can lead to committing an ecological fallacy (Macintyre, 2000; Macintyre, Ellaway and Cummins, 2002; Pearce, 2000; Robinson, 1950; Schwartz, 1994). This can occur when aggregated higher level compositional factors are inferred to be responsible for an individual's outcome. This labels all individuals in the area with the same explanation for poor health when in reality not all the people in the sample area may have the same compositional characteristics but still have similar levels of poor health. The people who have the poor outcome may not be the same individuals as those who have the characteristic identified at the ecological level.

It has already been noted that compositional factors relating to individuals living in the area might in some way interact with other compositional factors measured at the higher neighbourhood level. Although individual factors may operate in specific ways in producing certain health or wellbeing outcomes, they could be described as having an over-ruling or superseding role when attempting to identify neighbourhood level explanations for variations in health (Ellen, Majanovich and Dillman, 2001). As explained earlier, a typical procedure in acknowledging the presence of the interplay between 'composition' at various levels is to statistically control for, say, individual child, adult or family factors not representative of the neighbourhood. Not only might early childhood factors be important as mediating factors but they have also been implicated as an influence in outcomes in later life (Furstenburg, 1993). Although not an exhaustive list, these factors, in terms of importance in influencing young children's wellbeing can be summarised as those relating to the child individual factors, parental and family characteristics, behaviours, and economic/educational resources (Boyle and Lipman, 2002; Brooks-Gunn et al., 1993; Hansen and Joshi, 2007; Kalff et al., 2001). Factors relating to the child that have been found to be important in child health have included age, ethnicity and health related factors such as low birth weight and the length of gestation (Schoon et al., 2005). General health from birth is an important factor which might include a short or long term health episode. One issue that arises when using wellbeing related factors which themselves can be considered as outcome factors,

is whether they have also been shaped by the environment which the child inhabits (Yen and Kaplan, 1999). This may be another issue to consider when attempting to disentangle compositional and contextual influences.

Parents and other family members can influence the child's wellbeing. Factors related to the mother or father that have been shown to be associated with child wellbeing have included being an immigrant (To, Caderette and Liu, 2001) or from a certain ethnic minority background (George, Hansen and Schoon, 2007) which has been associated with lower cognitive scores; low levels of maternal education (Brooks-Gunn et al., 1993; Curtis, Dooley and Phipps, 2004; Dearden, Machin and Reed, 1997; George, Hansen and Schoon, 2007; To, Caderette and Liu, 2001); low levels of individual or family income (Brooks-Gunn et al., 1993; Curtis, Dooley and Phipps, 2004; George, Hansen and Schoon, 2007; To, Caderette and Liu, 2001) including social benefits or government support (Curtis, Dooley and Phipps, 2004); advantaged or disadvantaged backgrounds (George, Hansen and Schoon, 2007) with children from affluent backgrounds doing better; low employment or socio-economic status (To, Caderette and Liu, 2001); social or local authority housing (Brooks-Gunn et al., 1993); poor maternal mental health (O'Campo, Salmon and Burke, 2008) such as depression (To, Caderette and Liu, 2001); and marital status (George, Hansen and Schoon, 2007) (although in children aged one, lone parenthood (Dooley et al., 1998); a good child/parent relationship improved development outcomes (To, Caderette and Liu, 2001)) and parenting behaviour (George, Hansen and Schoon, 2007).

Behavioural factors found to be negatively associated with child wellbeing include parental smoking and the drinking of alcohol. External decision making factors relating to parents might include moving home. Other family members have been shown to play a role whether they live with child's family on a regular basis or not. For example, grandparents can also have an influence on child outcomes and could be said to have also shaped the child's parental outcomes (Hawkes and Joshi, 2007). Factors such as whether the child sees the grandparents have been found to be significant in studies of child development at earlier ages such as at 9 months (Schoon et al., 2005). Household factors such as family size are important with larger family sizes being associated with higher levels of wellbeing (Curtis, Dooley and Phipps, 2004). The home environment factors found to be important for some forms of child wellbeing relate to physical safety

such as whether dampness exists as a result of condensation and central heating (McCulloch and Joshi, 2001; Schoon et al., 2005), although some studies have found these types of factors are not associated with cognitive outcomes (Brooks-Gunn et al., 1993). Other household issues can include the existence of old and commonly banned paint products and insect or animal infestations which have been related to breathing problems (Ellen and Turner, 1997). Home learning factors and parenting practises such as strict discipline (To, Caderette and Liu, 2001) were associated with poor development outcomes and interactions (Brooks-Gunn et al., 1993; Ellen and Turner, 1997; To, Caderette and Liu, 2001). For young children these are likely to be basic skills such as counting, reading and letter recognition which have been found to be important in cognitive wellbeing (Brooks-Gunn et al., 1993; Schoon et al., 2005). External sources of support such as social support and capital (Coleman, 1988) are considered to be important in the health of individuals and for children and include maternal social support and general support (Curtis, Dooley and Phipps, 2004; To, Caderette and Liu, 2001).

In an attempt to solve this problem of accounting for individual characteristics when using compositional area factors, researchers have developed statistical methods. One common strategy employed to identify contextual differences includes adjusting for a number of individual characteristics with any remaining differences in the outcome between neighbourhoods (wards and local authority) being seen as the area or contextual effect (Wiggins et al., 1998; Wiggins et al., 2002). However, Macintyre et al (2002) have suggested these types of studies could use more integral (or more material) types of variables, such as levels of physical resources, to describe the context in which individuals live. These should help to identify the specific contextual explanations.

In terms of modelling strategies and tools, many researchers have employed multivariate ordinary least squares regression (Brooks-Gunn et al., 1993; Caughy, Brodsky and Muntaner, 2003; Duncan, Brooks-Gunn and Klebanov, 1994). Related to this method, Curtis et al (2004) for example, used a logit conditional regression model. Analysis of variance techniques (ANOVA) could also be used to investigate area differences as they are able to separate out within and between neighbourhood variations.

However, each of these suffers from several methodological problems. Goldstein (1995), Rasbash et al (2004) and Rajatnam et al (2006) argue that social organisations are hierarchically structured and OLS regression models can underestimate neighbourhood associations. The following commentary illustrates ideas from Rasbash et al (2004). For instance, children live in families and families within neighbourhoods. As such, children in one family are more likely to be alike in terms of, for instance, behaviour than children in another family. The same goes for families within neighbourhoods. This is termed 'clustering'. Another example might be that the social class of adults in a family is likely to be the same. In any regression analysis of both individuals and context, the error terms of individuals within a particular context would be correlated and thus violating the assumption of error term independence required in regression analysis (Lewis-Beck, 1980). To account for this phenomenon, many researchers, (as reviewed by Picket and Pearl (2001)), have employed the use of multilevel (MLM) analysis techniques (Goldstein, 1995; Raudenbush and Bryk, 2002) in health related neighbourhood studies (Subramanian, 2004). As an extension to normal regression techniques, this allows for the clustering of individual within areas. Similar to Analysis of Variance (ANOVA) techniques, it can identify 'within' and 'between' neighbourhood differences using such statistics as the Intra Correlation Coefficient (ICC) (Goldstein, 2003). This identifies the proportion of variation accounted for by a particular level in the hierarchical structure. In relation to compositional and contextual analyses, this might be the variation existing between children and that found between neighbourhoods. However, MLM has the advantage over ANOVA techniques in that the sample of areas chosen are considered to be from a random population of areas and therefore has greater applicability for generalisation to a wider population of areas (Rasbash et al., 2004).

These modelling techniques do not, however, help untangle complex underlying mechanisms when using only compositional type variables. Most research tends, especially in younger children's outcomes, to find few neighbourhood influences and the estimates are also particularly small. As mentioned earlier, Macintyre et al (2002) suggest using other types of contextual variables might be more useful and these are the subject of the next section.

3.1.5. Contextual factors

At this stage, it would be useful to allude to the second of the explanations for neighbourhood associations as described by Macintyre et al (2002), that of contextual factors. This term can be divided into two dimensions, 'material' and 'psychosocial' explanatory factors. It is argued here that rather than this being an argument between using one or other of two types of contextual factor, examples of each could be important influences for health and child wellbeing. As mentioned earlier, these explanations focus on 'integral' factors (Macintyre, Maciver and Sooman, 1993) to characterise contextual aspects of the environment rather than those of the composition of individuals. Integral factors are based upon physical resources or conditions within an area (Diez-Roux, 2007; Macintyre, Ellaway and Cummins, 2002). It is argued that to adequately apportion contextual influences as the explanation of difference between individuals in their outcomes, factors should include material and therefore more tangible aspects of the local environment rather than inherently socio-economic structural features characterised as compositional factors (Cummins et al., 2005; Macintyre and Ellaway, 2000a; Macintyre, Maciver and Sooman, 1993). This strategy may also have the advantage of ameliorating some of the problems outlined in the compositional factors argument. Separating out at which level (individual or area) the compositional factors may truly belong can be complex as explained. Material and psychosocial characteristics can provide appropriate ways to define the most common resources in the neighbourhood that may improve or damage an individual's life chances. These sources of variation may also help in identifying the mechanisms that may be operating to produce such effects (Kaplan, 1996; Macintyre, Maciver and Sooman, 1993).

In terms of aspects of the material environment that might directly be important to children's wellbeing, these can perhaps be classified as being particularly dangerous through to the more benign. For instance, living near physical dangers such as industrial or environmental waste sites can put the child in immediate danger and could result in hospitalisation if exposed to contaminants even at a very young age. These sites are more likely to be near deprived areas (Vrijheid, 2000). Heavy pollution, could over a prolonged period of time have a detrimental impact on child wellbeing and even

endanger life (Ellen, Majanovich and Dillman, 2001). Less dramatic but perhaps equally problematic are issues relating to the material condition of pavements, buildings and play areas where children can become injured (Haynes et al., 2007b; Kendrick et al., 2005; Reading et al., 2007). The quality and size of housing developments can be important as poor quality can be dangerous and poor design lead to 'blind' areas which attracts anti-social behaviour and are considered unsafe (Lupton, 2003). Physical resources such as play areas, child care and nursery facilities, health care surgeries (Ellen, Majanovich and Dillman, 2001) or what Aber et al (1997) term the 'institutional and organisation' factors can also be considered material contextual factors. Play areas are likely to provide an opportunity for children to exercise and burn off energy and calories which may be important factors in limiting problems of obesity (Carver, Timperio and Crawford, 2008). As such play areas can be important to child wellbeing (Miles, 2008). They are also places where children can interact with other children and perhaps learn important behavioural and emotional lessons such as how to communicate effectively and play fairly. They also provide opportunities for children to improve motor skills such as balancing and coordination by using climbing and other forms of equipment. Nurseries, other child care facilities and libraries are where children can develop cognitive, behavioural and emotional wellbeing. Religious centres and community halls (or centres) may provide opportunities for children to interact with their peers and older children. Many of these physical resources in the neighbourhood can also provide benefit for parents and other adults related to the child. For instance, social capital can be developed through networking opportunities provided at these venues (Subramanian, Lochner and Kawachi, 2003). Indirectly, these can be of benefit to the child as parents may be less likely to feel isolated and less likely to become depressed (House, Landis and Umberson, 1988). Good quality and good levels of interconnectedness in the neighbourhoods were associated with improved child wellbeing (Curtis, Dooley and Phipps, 2004). Attempting to receive medical help for these ailments might be more difficult for the poor due to cost and are less likely to be found in poor areas (House, Landis and Umberson, 1988). Maternal depression has been linked to a number of adverse child outcomes such as emotional wellbeing (O'Campo, Salmon and Burke, 2008). These centres can also be unofficial places for identifying employment opportunities through networking with either important stakeholders in the community or gatekeepers to other opportunities.

Other material aspects of the neighbourhood that can influence health can include such integral factors as levels of rubbish or litter, vandalism, graffiti, noise (Evans, 1997), pollution on the streets or in the neighbourhoods (Diez-Roux, 2007). These material aspects can be measured in objective ways such as visiting and recording levels of litter on the streets. Raudenbush and Sampson (1999b) in their study of Chicago neighbourhoods used video cameras to film graffiti on walls on the streets of certain neighbourhoods to show these types of factors had a role to play in adverse child outcomes. However, a more subjective way to measure levels of these types of neighbourhood factors might be to ask respondents in a survey to provide their opinions about these aspects of the area. Subjectivity in measurement can, however, create problems.

One individual's perceptions of a neighbourhood may differ from another's for several reasons. Sources of variation in perception may not only be dependent on objective and subjective measurements of the neighbourhood but also inherent factors related to the data sources themselves, for instance, the respondent's thoughts. For instance, Sampson and Raudenbush (2005), in their study of perceived disorder in Chicago found that as the proportion of ethnic minority inhabitants increased in an area, the perception of disorder also increased. In this case people's prejudices or preconceived ideas may be resulting in the reports of neighbourhood variation. Context and historical neighbourhood factors such as these are likely to determine which structural factors are important, as Franzini et al (2008) found in their study of disorder problems. Differing perceptions of the neighbourhood might give rise to problems of reliability where more than one data source is used (Fagg et al., 2008). However, 'triangulation' (Singleton, Straits and Straits, 1993) of results through the use of more than one source of neighbourhood data can be an advantage.

Psycho-social aspects of context can be characterised as those that indirectly reflect material aspects of the neighbourhood. These can be measured objectively, subjectively or from multiple points of view and are associated with health related outcomes (Weden, Carpiano and Robert, 2008). One common way to derive measures of psycho-social factors is to aggregate survey respondent's opinions of the local area. For example, safe, friendly and cohesive neighbourhoods have been associated with high levels of child wellbeing (Curtis, Dooley and Phipps, 2004). Poor neighbourhood safety

has been found to be associated with negative child cognitive outcomes with safety being measured using an amended version of the Simcha-Fagan Neighbourhood Questionnaire. This is a subjective report by the parents of how safe the local area is and if there were any problems experienced within their local neighbourhood (To, Caderette and Liu, 2001). Again, perception may also be a source of measurement bias of objective risks. For instance, for many individuals, lots of graffiti and vandalism can be perceived as characterising an unsafe and threatening environment. For others, graffiti may, for young people, for example, be considered a sign of self-expression and make them report feeling perfectly comfortable in that environment. A mother perceiving the neighbourhood to be unsafe or unwelcoming because of signs of graffiti or vandalism may result in her rarely venturing into the neighbourhood. From the point of view of the child, not experiencing cognitively stimulating aspects of the local neighbourhood on a regular basis such as new sights and sounds or other forms of social interaction may limit the child's cognitive or behavioural development and wellbeing. However, on the other hand, it could also protect the child from more damaging aspects of the neighbourhood.

3.1.6. 'Collective' dimension of context

Another aspect of the contextual explanation has been suggested, that of the collective dimension (Macintyre, 1997). This differs from the physical resources and facilities that may encourage networking mentioned in the previous section. Aber et al (1997) provide examples of these process factors such as social networks, friendship, social capital (Subramanian, Lochner and Kawachi, 2003), shared cultural and religious values (Macintyre, 1997). Macintyre (2002) has described these as 'collective psycho-social' factors. This extra dimension of context has become more popular in research since the early 1990's (Macintyre, Ellaway and Cummins, 2002) with the emergence of social capital theory (Coleman, 1988; Putnam, 2000).

Social networks can influence children's health and wellbeing in a number of ways (Ellen, Majanovich and Dillman, 2001). They possess both contextual and composition aspects. They can provide a forum for the exchange of information and a setting where

shared social norms are developed. Supportive local area and institutional networks (Coulton, 1996; Furstenburg, 1993) can be formal or informal paths for the circulation of information which adults can act upon. These networking opportunities can range from organised events or meetings in the local area or just talking with neighbours. These situations can provide information on important issues such as the availability and quality of local health related services, child care and educational opportunities. Neighbourhood based programmes/classes organised by local services may help, indirectly, to regulate, for instance, the physical wellbeing of children by providing best practice for healthy eating or methods of control/disciplining young children. The levels and types of networking by socio-economic grouping are likely to differ as evidence has shown, for example that deprived families have smaller networking areas compared to more advantaged families (Altshuler, 1970).

Other associated psycho-social constructs which may be important include shared social norms (such as smoking behaviour), ethnic identity or religion (Ellen and Turner, 1997). A number of studies, of older children, have found associations between various collective socialisation indicators as measured at the neighbourhood level and behavioural outcomes (Simons et al., 2004). For instance, they found no link with levels of crime and concentrated deprivation. In a similar earlier study by Simons et al (2002), they found deviant behaviour in older children in more deprived neighbourhoods was not ameliorated by more disciplined parental control.

3.1.7. Data sources and studies conducted of neighbourhood effects

Many of the investigations in neighbourhood research have been conducted by investigators interested in the geographical and medical related sub-branches within sociology, geography and epidemiology. Many of these studies have helped to develop the theoretical and conceptual aspects relating to influences of neighbourhood or locality on health-related outcomes across the life course (Bernard et al., 2007) discussed in the previously.

General examples of studies of neighbourhood effects relating to health outcomes over the life course have included general health (Curtis et al., 2004); mortality (Barker and Osmond, 1987; Sloggett and Joshi, 1994; Waitzman and Smith, 1998; West and Lowe,

1976); childhood mortality (Cullis, 2007); limiting long-term illness (Mitchell et al., 2000; Shouls, Congdon and Curtis, 1996; Wiggins et al., 1998; Wiggins et al., 2002); self rated health (Collins, Hayes and Oliver, 2008), mental health (Os et al., 2000; Reijneveld and Schene, 1998) and deprivation (Dezateux et al., 2004; McCulloch, 2001). However, in terms of young children, few studies have been undertaken, mainly because children at this age have limited exposure to neighbourhood environments (Bronfenbrenner and Morris, 1998). The problems of finding sources of data are compounded by the fact that for statistical analysis substantial numbers of neighbourhoods and appropriate numbers of children in each neighbourhood are required. Comparisons of neighbourhood effects on different age groups will also help to identify which mechanisms are likely to be important (Ellen and Turner, 1997).

Various researchers have reviewed studies of the neighbourhood and child/youth wellbeing/health literature, perhaps the most notable being Ellen and Turner (1997), Ginther et al (Ginther, Haveman and Wolfe, 2000), Leventhal and Brooks-Gunn (2000), Pickett and Pearl (2001), Sellstrom and Bremberg (2006) and Rajaratnam, Burke and O'Campo (2006). These reviews appear to indicate a large number of studies have explored neighbourhood and child outcomes (not all concerning only cognition, behaviour and physical outcomes for young children). The child and youth outcomes discussed in these studies include cognitive and behavioural outcomes, birth weight, injury, general health, substance abuse, disciple, maltreatment and aggression. The number of studies has increased significantly since the start of this decade with Rajaratnam et al (2006) suggesting that since Pickett and Pearl's review in 2001, there have been many more studies of cognitive, verbal, child behavioural and conduct problems. Some of the reviews tend to highlight particular aspects of the studies conducted, for instance, Sellstrom and Bremberg (Sellstrom and Bremberg, 2006) concentrated on identifying studies that have used multilevel models in the analysis of neighbourhoods and wellbeing.

For young children up to the age of around six, researchers have identified links between various wellbeing outcomes and neighbourhood characteristics. Most of the main or seminal studies of neighbourhoods in relation to very young children have taken place in the past 16 years in the US, Canada or the UK and the Netherlands. Outcomes have included cognition (Brooks-Gunn et al., 1993; Chase-Lansdale and

Gordon, 1996; Chase-Lansdale et al., 1997; Duncan, Brooks-Gunn and Klebanov, 1994; Klebanov et al., 1998; McCulloch, 2006; McCulloch and Joshi, 2001) and behavioural/emotional outcomes (Brooks-Gunn et al., 1993; Chase-Lansdale and Gordon, 1996; Chase-Lansdale et al., 1997; Duncan, Brooks-Gunn and Klebanov, 1994; Kalff et al., 2001; Kohen et al., 2002; McCulloch, 2006).

In relation to comments made in the previous paragraph, it is perhaps significant that many of these main studies have used large quantitative datasets, although there have been a small number of qualitative ones. The following commentary identifies, summarises and evaluates some of the key data sources and findings' from studies conducted and goes on to discuss methodological issues that arise which may impact on this project.

3.1.8. North American neighbourhood studies

In the US, a number of important surveys, some of which have been conducted in the last thirty years have spurred a significant body of research of neighbourhoods and their associations with child wellbeing related outcomes.

These large quantitative sources of data on the lives of young children and their families and their circumstances include the Infant Health and Development Program (IHDP), the US National Longitudinal Survey of Youth (NLSY), the Gautreaux Assisted Housing Program (GAHP), the Yonkers (New York) study, the Moving to Opportunity demonstration project (MTO), the Project on Human Development in Chicago (PHDCN) and the Panel Study of Income Dynamic (PSID). Many of these programmes were begun as a result of policy attempts to improve the lives of families living in poor conditions. As such they were not always set up directly to study neighbourhood effects or wellbeing but more as interventions which were later evaluated by researchers. As a result, there may be issues concerning limitations of their ability to generalise to population groups. The most significant advantages to research of these programmes was that they contained relatively large numbers of respondents from the major US ethnic groups (White, African-American and Hispanic) and some were longitudinal and assessed various child wellbeing and development outcomes at a number of child ages.

In the context of this thesis, one of the most significant issues was that ecological data at the local level could be and was linked into the surveys.

One of the early major studies where the effects of neighbourhoods are explored was the Infant Health and Development Program (IHDP) which was started in 1985 with the objective of improving the wellbeing and development of low birth weight young children (IHDP, 1990). The families were selected from eight large US cities. 985 families were included if the child was less than 2500 grams at birth. The children and families were randomly allocated to either an intervention or follow-up group with the intervention group provided with a cognitive and social development intervention programme in the first three years of the children's lives. The children were the subject of various social and developmental assessments at the age of three, five and eight years (IHDP, 1990). Although there may be issues surrounding the use of various measurement tools (White, 1999), a number of researchers have used assessments of IQ in this study. Brooks-Gunn (1993) found that having a high proportion of affluent neighbours and two parent families in the neighbourhood was associated with better IQ and behavioural outcomes for children aged three with the latter outcome mediated by parental behaviour. One of the main contributions was that they found the preponderance of high levels of low income families in the neighbourhood to be inconsistently important to child wellbeing outcomes for young children whereas affluent neighbours had a far more convincing effect. Another important finding was that racial differences in outcomes were associated with neighbourhood affluence. More advantaged neighbours were more important for white children than they were for African Americans (Chase-Lansdale et al., 1997). Affluence (above $30,000) was associated with better cognitive scores whereas deprivation (below $10,000) was related to worse externalising behaviour for five year olds (Duncan, Brooks-Gunn and Klebanov, 1994). A few years later, Duncan et al (1997) found that using neighbourhood factors such as more extensive measures of neighbourhood such as levels of socio-economic status, male unemployment, ethnic diversity and density of families in the area were important. They also tested for what they suggest were usually unmeasured family factors and found that neighbourhoods with higher concentrations of high socio-economic families were associated with better IQ scores. However, this was not true for African-American males unless there were other African-Americans with high socio-economic status in the neighbourhood. Leventhal (1999) also found that

neighbourhood characteristics were associated with child cognitive outcomes, most prominently at five years old. Having affluent neighbours was associated with better outcomes over time and being in a low income family and being separated from the parent also important family level negative factors in cognitive attainment.

The US National Longitudinal Survey of Youth survey was designed to identify the reasons and costs of unemployment in the US and was started in 1974. Although the study contained around 12,000 youths aged between 14 and 21, a number of researchers have used a subsample of the young children born to the female respondents of the original sample who numbered around 1,500 in total. Researchers have explored the cognitive and behavioural wellbeing of children aged between 3 and 6 years old (Chase-Lansdale and Gordon, 1996; Chase-Lansdale et al., 1997) using this data. Similar to Duncan et al (1997) these investigators examined high socio-economic neighbourhood circumstances, male joblessness, population density and neighbourhood ethnicity and child outcomes. They found similar results with neighbourhoods containing more families with higher socio-economic status being associated with better cognitive scores. However, they also but there were also regional differences. A higher concentration of adults in the neighbourhood was also associated with fewer child behavioural issues.

The Moving to Opportunity (MTO) demonstration project (Leventhal and Brooks-Gunn, 2003b) began in 1994 as a social experiment conducted in five US cities. This experimental study design offered the chance for randomly chosen poor families living in poor neighbourhoods to move to more affluent ones using a voucher system. Evidence had suggested that this type of action could improve the educational, health and employment chances of these types of families who had moved. The families that moved were examined after two years in an evaluation of the programme. The families were included in a three group randomised control design with groups differing in the type of restriction as to where they could move. This design method addressed a common problem in neighbourhood research, that of selection bias (Tienda, 1991). The MTO families were associated with receiving subsides and headed by out of work female lone parents. Most respondents wanted to move because of the drugs and gangs culture in their neighbourhoods. There were around 3 families per neighbourhood (in this instance defined by census tract). Interviews with the families were conducted

between 1994 and 1999. The parents were on average around thirty years old. Around half of the sample were described as being Latino with the remainder being African American and most were female headed lone parent families. Research that evaluated the project concentrating on 550 families and 806 children who were aged between 8 and 18 years at the New York City site with more in-depth interviews conducted of some of the caregivers and children found that moving to a more affluent neighbourhood with fewer reported neighbourhood problems not only reduced mental health issues of the parents but also anxiety/reliance issues for boys (Leventhal and Brooks-Gunn, 2003b). 1990 census information for census tracts, parental subjective opinions of the physical and social local environmental and interviewer ratings of the local area were used as neighbourhood indicators. Living in neighbourhoods with good and poor resources were associated with better and poorer outcomes respectively (Leventhal and Brooks-Gunn, 2000; Leventhal and Brooks-Gunn, 2003a). In a later analysis four to seven years after the experiment began, Sanbonmatsu et al (2006) found little evidence that movement to better neighbourhood had further improved the educational based assessment scores of the 5000 children aged between 6 and 20 in 2002. Some of the explanations put forward of this apparent lack of improvement were mainly due to the types of neighbourhood the experimental groups actually moved to. Many of those that did move sent their children to the schools in their original neighbourhoods, or they had moved to neighbourhoods that still suffered from discriminatory issues. Also, the assumption that more affluent neighbourhoods might have better schools was also challenged. The conclusion was that neighbourhood based experimental intervention programmes such as these may also require policies targeted at the schools and children themselves rather than the families and neighbourhoods (Sanbonmatsu et al., 2006). This supports other evidence as to the mechanisms operating to produce poor outcomes. The likelihood that an array of hardships rather than one particular problem were responsible for poor outcomes such as behaviour were considered to be slim (Rutter, Giller and Hagell, 1998).

The Project on Human Development in Chicago (PHDCN) was designed to help identify how neighbourhoods helped in the development of social, cognitive and adverse social behaviour of around 6,500 children whose ages were from birth to 18 years (Raudenbush and Sampson, 1999b). This study had an important pioneering role in the development of observation based assessments of neighbourhoods which would

help to illuminate the mechanisms operating to produce neighbourhood effects. The 1995 study chose families from many ethnic and socioeconomic backgrounds and represented a variety of neighbourhoods in the City of Chicago. The survey used census tracts to derive over 300 neighbourhood clusters each with around 8000 residents (assumed this was due to being an urban area). The families were interviewed three times in a six year period. An important part of the survey was the inclusion of neighbourhood level systematic observations by interviewers of the neighbourhood and a resident's survey about the neighbourhoods in which the families resided. Researchers have used this data source to explore the relationships between neighbourhoods and violent crime (Morenoff and Sampson, 1997), child development (Duncan and Raudenbush, 1998) and child behavioural problems (Cheong and Raudenbush, 2000). Various methodological issues relating to child outcomes and neighbourhood research have also been generated using this data source (Raudenbush and Sampson, 1999a; Raudenbush and Sampson, 1999b). Subramanian et al (2003) used this data source and in particular, the Community survey to conduct a multi-level investigation to identify whether compositional or contextual differences could account for differences between neighbourhoods in levels of social capital. In this case social capital was measured by an individual respondent's perceptions of whether they trusted their neighbours. They found that social capital could be considered an important contextual factor after controlling for other individual level factors.

The notion that fragile parental links with neighbours are associated with can benefit children has been explored. Not knowing neighbours (neighbourhood cohesion) but living in a less deprived area was related to increased behavioural problems amongst African- American young children aged between 3 and 4 ½ years old (Caughy, Brodsky and Muntaner, 2003; Caughy, Hayslett-McCall and O'Campo, 2007). Results also showed that sense of community was not associated with behavioural problems after accounting for family and child factors. Interestingly, however, not knowing your neighbours (related to concept of social capital) and living in a deprived area was associated with fewer behavioural problems. However, not knowing neighbours but living in a less deprived area was related to raised behavioural problems. They were particularly interested in the effect of immediate neighbourhoods and those neighbourhoods surrounding them. U.S. 2000 census data was used to define neighbourhood disadvantage, specifically identifying rates where government subsidies

were being received, joblessness and female lone parent families were high. Factors analysis was used in common with Sampson et al (1997) methods in summarising census variables into more manageable factors. They found that focused levels of economic deprivation in the very local and surrounding area were related to lower cognitive scores as was population volatility. Contrary to their original hypothesis, they found that for children residing in deprived neighbourhoods surrounded by other deprived neighbourhoods created a buffering affect and reduced the risk of lower scores.

The Family and Community Health Study (FACHS) was developed to aid in the study of nearly US 900 families specifically in small cities and towns. Information was collected in 1997 from two sites in Iowa and Georgia representing a wide range of families from all economic classes. It has also been used to explore child behavioural outcomes in older African American children (aged 10-12) and associations with neighbourhood deprivation and collective socialisation. One such study by Simons et al (2002) used this data to identify whether two aspects of neighbourhood parenting behaviour, those of corporal disciple and control, varied by neighbourhood characteristics. Neighbourhood characteristics were measured by aggregating census blocks (as too few respondents in each) into community areas. 1990 US census variables including average income, proportions of female lone parenthood, deprived households, people on benefits and male joblessness were used. Cluster analysis identified 46 clusters in both sites with between 15 and 30 survey families in each. Respondent's opinions of community deviance was also measured using an instrument similar to one used in the PHDCN. Respondents were asked to provide their opinion of the problems in the area concerning drugs, violence and gangs. They also looked at safety for adults and in play areas for children and the prevalence of corporal discipline within community. Census neighbourhood information was used to identify the proportion of African Americans in the Block group area (proxy for community) and a summary measure of deprivation. The findings of a multi-level regression analysis showed that more physical parental discipline strategies were effective in reducing behavioural problems in communities where these types of strategies were uncommon. However, these strategies were not effective in communities where corporal punishment was common. The study was cross-sectional and therefore of limited potential for causal

explanations, as it used mainly black children in cities and towns and therefore was not nationally representative.

In another study, Rauh et al (2003) explored the reading test outcome of slightly older third grade children including 3,693 African American and Hispanic Head Start participating children. The Head Start intervention program was a government initiative targeting 3 to 5 year old children in poor families in 250 neighbourhoods in the New York area and aimed at improving educational outcomes (NYC, 2008). Census information was used to characterise neighbourhoods as deprived and these areas were shown to be associated with lower scores having controlled for child and family related factors. Communities with high proportions of immigrant families were associated with higher scores with boys doing better than girls in these communities.

The Gautreaux project was begun 1976 as a project to restore some of the racial inequalities in housing allocation in Chicago. Researchers began to use information on around 7000 Black families who were provided with vouchers to allow them to move from the inner city public housing areas to mainly White or Mixed neighbourhoods in the suburbs from 1982 with a follow up in the mid 1980's. Although it was acknowledged the program improved the family outcomes, there were issues concerning selection bias and therefore reduced opportunity for generalisability to other public housing families (Gagne and Ferrer, 2006). In a study that compared those who moved within the city and those who had to the suburbs, children in the latter group aged around seven years old achieved high educational results and more generally, moving to more middle class areas could improve children's educational outcomes (Kaufman and Rosenbaum, 1992). The Yonkers study was another migration study following the movement of poor neighbourhood families to more clustered accommodation in middle class locations.

Studies in Canada include the Canadian National Longitudinal Study of Children and Youth (CNLSCY) (Statistics Canada and Human Resources Development Canada, 1995) and a study set in Vancouver City. The study was started in 1994 and around 13,000 families were followed up every two years. Those in remote regions and First Nations' People's Reserves were excluded. Curtis, Dooley and Phipps (2004) used the CNLSCY to explore associations between conduct, emotional disorder and hyperactivity for 11,037 children aged between four and eleven years old and the

quality of the neighbourhoods in which they resided. Better quality neighbourhoods, in the opinion of the interviewer were found to be associated better child outcomes. Both neighbourhood cohesion and safety as reported by the respondent were negatively associated but the former more so. As in many other studies the size of the estimates was larger for the individual and family control factors. One interesting finding was that neighbourhood factors were significant after controlling for mediating factors which is not always the case. Other studies using this survey found that children with poor behavioural outcomes were more likely to reside in neighbourhoods with a greater proportion of lone parents. However, this was not so here. Other findings using this study have included fewer child behavioural problems being associated with affluent families residing in more deprived areas with the opposite also being found (Boyle and Lipman, 2002; Kohen, Hertzman and Brooks-Gunn, 1998). Analysis of children in specific age groups has shown that for those 4 to 5 years (Kohen, Hertzman and Brooks-Gunn, 1998; Kohen et al., 2002) and 2 to 3 years (To, Cadarett and Liu, 2000; To, Caderette and Liu, 2001), local area safety and neighbourliness respectively were associated with better child outcomes.

In more detail, Kohen et al (2002), examining children aged 4 to 5 years old, were able to show that advantaged neighbourhoods, in terms of income, were related to better verbal scores in children. Deprived neighbourhoods, high rates of female lone parent in the neighbourhood and local disorganisation (rubbish, people waiting around, any hostile behaviour, drunkenness and conditions of housing) were associated with worse verbal scores. Neighbourhood cohesion did not appear to be important when individual/family controls were included. More advantaged neighbourhoods were associated with fewer behavioural issues whilst high levels of local joblessness had the opposite association. Physical disorder was not important whereas cohesion was. These results were very similar to those found in the U.S studies. In interactions, less advantaged children living in more advantaged areas fared the best. In terms of size of effects, neighbourhood factors were able to account for around 3% of variation.

To, Cadarette and Liu (2001) used a sample of 1,233 children from birth to age three. They found that the neighbourhood played a more convincing role in the social and cognitive wellbeing outcomes as children aged. Although they only used neighbourhood

safety as an ecological measure they found this to be important for child wellbeing controlling for biological and family factors.

Oliver and Hayes (Oliver and Hayes, 2008) studied the effects of neighbourhood on the BMI of children between the ages 2/3 and 10/11. Using a neighbourhood low income indicator to characterise disadvantaged areas derived from 1996 census, they found that after controlling for other individual factors, children from these area had higher BMIs'.

Using data from the City of Vancouver to assess ethnic minority groups who included migrants from Asian countries and many unable to speak English (which affects economic chances), Oliver, Dunn, Kohen and Hertzman (2007) used a sample of 3,736 young children aged five (first year in school) to explore their readiness to learn and neighbourhood factors. They looked at five dimensions of this outcome including physical wellbeing, social competence, emotional wellbeing, cognition, and social skills. Neighbourhood measures included 1996 Canadian census variables including proportions of average family income, low educational achievement, joblessness, lone parenthood, non-movers and English speaking. Interestingly, non standard geographical areas were examined with 68 geographical clustered units with around a total population of 4000 in each and on average 25 respondent children. Those units with less than 25 respondents were grouped with larger ones using cluster analysis of various census variables. After controlling for individual factors and using hierarchical linear modelling techniques they found that neighbourhood variables were able to account for as much as 25% of variance in educational related outcome. One limitation was that the census data was four years out of date as the study was conducted in 2000. Also joining of the neighbourhoods may have provided a less effective measure of the neighbourhood. The multiple scale of contextual effects were not explored here and may be a problem as these effects may also be more effective at other geographical aggregations (Mitchell, Dorling and Shaw, 2002).

3.1.9. United Kingdom neighbourhood studies

In the UK, few sources of neighbourhood data exist that satisfy the requirements for this topic of research. The main ones are the National Child Development Study (NCDS), the West of Scotland Twenty-07 study, the England Sure Start Programme, the Twins

Developmental Study, the Health Survey for England (HSE) and the Millennium Cohort Study (MCS). This thesis is one of the first studies to use MCS data for the purpose of neighbourhood research.

The British Cohort studies such as the 1958 NCDS has a substantial sample of over 17,000 children, following their lives at regular intervals from birth in England, Scotland and Wales. This particular survey contains a wealth of data on young children's cognitive and behaviour wellbeing outcomes and has been used by researchers such as McCulloch and Joshi (McCulloch, 2006; McCulloch and Joshi, 2001) to explore neighbourhood effects. McCulloch and Joshi (2001) used a sample from the NCDS which sampled the children of 1/3rd of the original cohort members in 1991, around 2,290 children of differing ages. Although the study sample included children from the three countries in Britain, the sample used in their study used only children from England and Wales. They used the Townsend (Townsend, Phillimore and Beattie, 1989) multiple index of deprivation measure to characterise the electoral wards (proxy for neighbourhoods) which were of variable size but an average population of 5,500 persons. They found that children aged 4/5 years in less deprived neighbourhoods were associated with worse cognitive outcomes. McCulloch (2006) used the same survey. However, he used a sample of children who were aged around seven years. The measure of behavioural wellbeing was the parent completed Children's Behaviour Questionnaire and cognitive ability was measured by the PPVT. The Office of National Statistics (ONS) socio-economic classification of wards (Wallace, Charlton and Denham, 1995) was used to characterise neighbourhoods, a classification derived using factor analysis of census socio-economic information. A multi level binomial regression model was used in the analysis phase of the cohort child's external behaviour (912 children) (but not internalising behaviour as no ward associations were found) and the linear form for the assessment of cognition (1629 children). Using the ONS area classification of neighbourhoods, children classified as living in 'Deprived City Areas' were associated with more problems. In terms of cognition using the PPVT scores, those residing in 'Deprived City Areas', those in 'Lower Status Owner Occupier Areas' and 'Middling Britain' had lower scores and those in 'Prosperous Areas' had higher scores. All these results were after controlling for child and family characteristics. McCulloch suggested that these better defined neighbourhood findings, compared to their 2001 (McCulloch and Joshi, 2001) analysis especially for behavioural outcomes,

were a result of using the ONS classification which is perhaps a more multi-dimensional indicator than the original 'Townend' indices used.

Another source of data that has been used by researchers, not necessarily to explore the effects of neighbourhoods on child wellbeing but on more adult outcomes has been the West of Scotland Twenty-07 longitudinal study based at the University of Glasgow in Scotland. The participants were aged between 15 and 55 years old in around 1987 when the study started and data collection finished in 2007. The study contrasted four neighbourhoods (wards) in Glasgow (West End, Garscadden, Mosspark and Pollock) which were considered either affluent or disadvantaged. Indicators of the neighbourhood characteristics included physical resources; area problems (such as vandalism, litter and traffic); environmental issues such as pollution; anxiety about crime; feeling of neighbour cohesion; neighbourhood reputation and satisfaction. Analysis of this study has helped in the methodological development of neighbourhood research especially in the area of neighbourhood indicators (Macintyre and Ellaway, 2003; Macintyre et al., 2003) and theory in relation to neighbourhood effects on health outcomes in general (Macintyre, Ellaway and Cummins, 2002). In terms of how people perceived the place where they lived and health related outcomes, those who lived in more affluent neighbourhoods and liked the area were healthier than those who did not (Ellaway, Macintyre and Kearns, 2001; Sooman and Macintyre, 1995). Issues relating to perceptions of neighbourhood are important results from these studies. For example, those who lived in social housing were more likely to experience negative issues with the local area. Women were also significantly more likely to provide a worse evaluation of their neighbourhood compared to men, with the worst being from unemployed mothers (Ellaway and Macintyre, 2001). Males with poor mental health were also more likely to provide negative assessments of their neighbourhoods (Ellaway and Macintyre, 2001). Older people who resided in owner occupied homes in more advantaged areas and worked at home had more affinity with their neighbourhood than those who did not (Macintyre and Ellaway, 2000b). Conversely, those who felt excluded from their neighbourhoods were more likely to report mental health issues. Those from lower social groups are no more likely to report poor general health than those from higher social groupings. It had been suggested that there may have been bias in the reporting by certain social groups who might be more enduring of their suffering (Macintyre, Der and Norrie, 2005).

This data is also an important source of findings in relation to neighbourhoods and the effects on physical wellbeing, specifically body weight. In terms of factors relating to physical health and specifically weight related issues, poorer neighbourhoods were associated with less availability of more expensive food items considered to be healthy and a lower quality of fruit and vegetables (Ellaway, 2005). Those living in more disadvantaged areas in Scotland were more likely to have larger waist measurements and to weigh more than those living in less disadvantaged areas (Ellaway and Macintyre, 1997). Those living in poorer neighbourhoods in Glasgow were associated with less exercise, have poorer diets and more smoking compared to those in less disadvantaged areas (Ellaway and Macintyre, 1996). Healthier foods in poorer neighbourhoods were more likely to be more expensive and were less likely to be stocked than in more affluent areas (Sooman, Macintyre and Anderson, 1993).

The England based Sure Start programme (DWP, 2007) aimed to improve the health and wellbeing of young children under the age of four years living in poor areas (260 in total) by introducing a set of neighbourhood-based initiatives (not necessarily defined by electoral ward) and was started in 1999. Those areas where initiatives were in place had seen improvement in such child health indicators as perinatal mortality (apart from in areas with high levels of ethnic minorities), hospitalisations due to severe injuries and dependency on government social/financial benefits (Barnes et al., 2006b). Barnes et al (2007) have been able to develop indicators relevant to the neighbourhoods in which the children live in their evaluation of the programme. In a study of three particular Sure Start neighbourhoods, Barnes and Cheng (2006) found that for children aged between five and twelve years, family attachment and non-family networks in the neighbourhood were able to explain some of the variance in behavioural problems. In another study but still using Sure Start data, Barnes et al (2006a) also found more school disorder amongst children aged 5 to 12 in more deprived neighbourhoods but it was noted that disorder was associated with lower educational achievement for those aged 7 to 11 after type of neighbourhood had been accounted for.

The Twins Early Developmental study set in England and Wales in 1994 has been used by Caspi et al (2000). Same sex twins in the study when they were two years old were assessed by their parent to identify emotional, inattention and conduct issues. The authors' intention was to attempt to account for a genetic explanation for behavioural

problems that can be passed from generation to generation. This factor is not usually accounted for in behavioural studies of families. The neighbourhoods were measured using the 1991 U.K census data derived 'A classification of Residential Neighbourhoods' (ACORN) indicator and was based upon enumeration districts (ED), the smallest census geographical unit at the time. Cluster analysis of 79 census variables identified six types of neighbourhood ranging from advantaged to deprived areas. The neighbourhoods appeared to over represent families in affluent areas and under represent poor ones but weighting was used in an attempt to adjust for this. Structural model equations were used in the analysis and they found that deprived neighbourhoods are associated with child behavioural issues after controlling for what they termed genetic additives and environmental child and household effects.

Parkes and Kearns (2006) used the Scottish Household Survey, 2001 to explore the relationships (using logistic regression) between various adult health related outcome and social disorganisation in the neighbourhood indicated by safety, crime, and problems. Although related to adults this information source was important in using neighbourhood indicators other than socio-economic. The main issue with this survey is the lack of clustering of respondents at the neighbourhood level for half of the survey as Scotland is divided in two for this purpose. Even the clustered areas only have around 11 respondents. The physical environment was indicated by appearance and noise and local facilities as being good, poor and quality. Social support and neighbourhood commitment was measured by length of residence and support from others and satisfaction with neighbours. Many neighbourhood factors were related to health. Neighbourhood support and commitment were associated, perceptions of the neighbourhood being unsafe and having problems was associated with poor health outcomes. Liking the neighbourhood was associated with better health but noise (peace and quiet) was not related. Liking facilities was also associated with better health.

Poortinga (2006) used the Health Survey of England (HSE) (2003) in an attempt to identify whether adults' perception of the neighbourhood was associated with BMI in adults. Using 14,836 respondents she was able to identify that problems in the area such as vandalism and other social problems were related to higher BMIs. Although this study did not explore associations with the BMI of children, the findings pertaining to perceptions of the neighbourhood are still instructive for this investigation.

Stafford et al (2007) also used data from the HSE but combined it with data from the Scottish Health Survey to examine neighbourhood factors and their relationship with obesity in around 5,400 participants using structural model equation modelling. To characterise neighbourhoods, postcode sectors were used and information covering over 300 dimensions were linked into the analysis including local infrastructure, services and environmental conditions. Although the age range of those in the study were 16 and over, the comprehensive analysis of neighbourhood factors may help in identifying which are likely to be important in the investigation of child BMI. In general terms, neighbourhoods characterised as having little neighbourhood disorder were associated with people who had lower obesity levels. Access to local financial and health facilities located on high streets was also related to lower obesity.

3.1.10.Important neighbourhood studies in other countries

In the Netherlands, Kalff et al (2001) used a study set in the city of Maastricht of second grade kindergarten children who were aged between five and seven years old and born in 1991. Data from this study was combined with neighbourhood information from a central city health related register. The study mostly comprised white Dutch nationals and few ethnic minority groups. The sample size was around 1,417 children. Behavioural deviance was measured using the parental completion Child Behavioural Checklist (CBCL). Thirty six neighbourhoods were provided with a neighbourhood classification using six socio-economic measures. Principal components analysis (PCA) reduced the following neighbourhood variables of level of employment, welfare dependency, lone parent families, non voters, foreign migrants and movement in and out of the City into 3 factors identifying the level of disadvantage in the neighbourhood. Using a multilevel model design, they found that those residing in the most and intermediate disadvantaged areas were associated with more behavioural problems.

Similar findings were seen in another Dutch study. Although the study by Schneider's et al (2003) concentrated on older children from 10-14 years of age who were assessed twice in this age group, their findings are still instructive. They utilised a sample of children in Rotterdam born in 1978 using the Child Behavioural Checklist as the outcome. 68 neighbourhoods were represented out of 74 with the median number of

respondents in each being 23. Neighbourhood socio-economic disadvantage was found to be negatively associated with both internalising and externalising issues. Again, PCA was used to derive a summary measure of deprivation suing eight neighbourhood variables including the proportion of those in education, receiving benefits, ethnic minorities, joblessness, migration, income, married and age of buildings. Multi-level modelling was used and results reflected similar negative associations between both late childhood and early adolescence and neighbourhood disadvantage. One of the main disadvantages of these studies was their inability to generalise to the population and in particular ethnic minority groups.

3.1.11.Summary of advantages/disadvantages of studies evaluated

The next section attempts to summarise some of the advantages and disadvantages of the studies and data sources outlined in the previous section.

Many of the results of the studies were not easily generalizeable to the general population of children. Although it is recognised that this was not necessarily the intention of some of the studies as they had other aims it is still noted. Although many of the studies used large numbers of respondents, many concentrated on specific ethnic groups. For instance, many of the US studies had high levels of African Americans and few whites and even fewer Hispanics. In the U.K, few ethnic minority respondents are included in any of the studies and yet these groups are of great risk and therefore interest. Many of the studies were concentrated in large urban areas and did not cover rural communities. This is perhaps unsurprising as surveying sufficient numbers in 'neighbourhoods' requires a high density of individuals. Many of the studies were over or under representative of certain social-economic groups.

For example Brooks-Gunn et al (1993), Chase-Lansdale et al (1997) and (Klebanov et al., 1997) used a sample of low birth weight LBW and pre-term babies from the IHDP and poor families in the NLSY. This might be considered problematic. From the perspective of representation of ethnic groups, the studies using the US data sources were mainly of African-American families with few White or Hispanic children included. On the other hand, the UK based NCDS, BHPS and West of Scotland studies contain few ethnic minority children with little clustering by neighbourhood. This

makes it particularly difficult to conduct any analysis by ethnic minority groups who are likely to be at risk of poor child cognitive and behavioural outcomes. The McCulloch and Joshi (2001) study was more representative of younger mothers whereas Curtis, Dooley and Phipps (2004) sample had few parents under the age of 25. The under representation of older and younger born mothers respectively may have biased the results as mother's correlates and the types of neighbourhoods these mothers lived in affected by their stages in the life course.

It should be remembered that the main thrust of this thesis is the investigation of children from birth to the pre-school age of around 3 years old. Two of the studies, Brooks-Gunn et al (1993) and To, Caderette and Liu (2001) studied children at the age 3 or younger whilst McCulloch and Joshi (2001) and Curtis, Dooley and Phipps (2004) examined children from the age of 4 years. The main issue here is whether neighbourhood effects differ in impact on children aged 3 and those aged 4 and therefore whether they are comparable. As To, Caderette and Liu (2001) suggest, the direct effects of neighbourhoods on health and child outcomes change as the child gets older. It is hypothesised that effects for those under age 3 years are likely to be indirect and mediated through the family and home environment. As the child grows older, and as he/she has more interaction with their neighbourhood, the neighbourhood effects are likely to be more direct. Although the age difference is only approximately only 1 year in some cases, this older age group may have had greater interaction with other environments such as school compared to the 3 year olds and therefore the results are more likely to be different. However, although this fact should be taken into account, it is considered worthwhile to review effects on the slightly older age group.

The studies chosen in this review examined developmental outcomes that relate to the health and wellbeing of young children. The main dimensions of child development under investigation were cognitive and behavioural development. In cognitive development, some of the studies examined intelligence quotient (IQ) scores. However, as was noted earlier in this chapter, it has been suggested these types of measurement should be treated with caution (White, 1999). For instance, Brooks-Gunn et al (1993) used the Stanford-Binet Intelligence Scale (form L-M) at 36 months and corrected for prematurity. McCulloch and Joshi (2001) used the Peabody Picture Vocabulary test (PPVT) which has been shown to be associated with IQ scores as well as the Stanford-

Binet Test. The majority of the studies investigated behavioural or health related dimensions. For instance, Brooks-Gunn et al (1993), investigated the extent to which the child showed externalising and internalising behaviours; To, Caderette and Liu (2001) used the Motor and Social Development Score (MSD) which uses items from the Bayley, Geselle and Denver Measurement scale (Poe, 1986). It was designed to elicit physiological and social dimensions of child development (Mott et al., 1998). Curtis, Dooley and Phipps (2004) perhaps used the most comprehensive measures of the dimensions of well being by including indicators of behavioural, emotional and physical well being. It should also be noted that McCulloch and Joshi (2001) also examined behavioural aspects but did not include results or discussion or results as they were not significant.

3.1.12. Conclusions of neighbourhood literature review

In conclusion, few studies of neighbourhood effects and their association with young children have been conducted. However, this area has become an important avenue for investigation when attempting to identify inequalities in health in general and child wellbeing in particular. Neighbourhood elements can play a role in explaining variation but their association tends to be smaller than individual factors such as those directly related to the child and family. This review of the literature has identified a need for further exploration of both contextual and composition at the neighbourhood level with special reference to young children at around the age of three and four years and their wellbeing.

4. Chapter Four - Methodology

4.1.1. Introduction

The aims of this chapter are to detail the data, methods of analysis and modelling strategy to be employed in examining the relationships between ecological factors and the wellbeing of young children. Discussion of the data sources includes all the ecological indicators, the indicators of child wellbeing together with all the child and family related explanatory factors. The methods of analysis are then discussed in more detail including the use of multi level models to account for hierarchically structured data.

4.1.2. Data requirements

The overall question to be explored is whether, over and above child and family related factors, neighbourhood factors are associated with levels of wellbeing in young children. The central topic of investigation here is the influence of neighbourhood factors on child wellbeing. Ideally, a broad range of characteristics relating to the children's environment would be used to provide the opportunity for exploring the ecological relationship in sufficient depth. There also needs to be a sufficient number of children living in a sampled area for associations to be validly deduced and a sufficient number of localities for the same reason. Primary sources of data that are collected specifically for this type of research based on these requirements could be prohibitively expensive. Therefore, a secondary source of data with a sufficient number of children sampled in a sufficient number of localities is required. Another aim of this investigation is to generalise any findings of the analysis to the population of both children in the UK and also the types of areas in which they live. To be able to achieve this, the sample sizes not only need to be of sufficient size in each UK country but also by neighbourhood to be able to generalise to those populations.

As discussed in Chapter Three, the characteristics of the localities in which the children are sampled can be measured in a number of ways. From a quantitative point of view, these can include measurements such as the socio-economic mix, age structure and

housing tenure of those living in the area, all of which have been shown to be related to the wellbeing of older children and adults (Chase-Lansdale and Gordon, 1996). From a more subjective aspect of measurement, conditions within the area could provide a useful insight into the local factors that might influence varying levels of child wellbeing such as local environmental conditions. Another related question is how to define the spatial boundaries of the ecological areas to be explored. If possible, ecological boundaries defined in a number of different ways might help generate a more comprehensive range of explanations for differences in child wellbeing.

To correctly attribute differences in the levels of wellbeing between children to the nature of the neighbourhoods in which they live, one important requirement needs to be satisfied. The method of analysis must be able to separate those associations that can be indirectly attributed to the child (or through other family members) from those of an ecological nature. However, it is acknowledged that even the child and family factors are indirectly associated with the neighbourhood as they geographically clustered. To satisfy this requirement, an appropriate method of analysis will need to be employed. The method to be employed will be discussed in more detail later in this chapter but, in summary, a suitable method is provided by, amongst others, Goldstein et al (1998). They suggest the use of multi-level modelling techniques.

Although the primary purpose of including child related factors is to achieve a certain level of statistical control for factors other than neighbourhood ones, the child related factors will also be of substantive interest in themselves. Characteristics found to be associated with wellbeing relate to prenatal health conditions such as low birth weight and a preterm gestational period. More indirect child related factors include those that are attributable to the mother or father but have a direct association with the child's wellbeing. These can be summarised under a number of themes. For example, themes include socio-economic factors such as educational attainment, income and social class; parental health including physical and mental aspects; and environmental conditions within the child's immediate environment. Decisions made by parents may also have an impact on the child's wellbeing. For instance, whether parents read to the child or are active in helping the child to improve basic educational or behavioural skills.

As Chapter Two has shown, there are a number of dimensions of wellbeing that could be explored. To some extent, the decision as to how broad and to what depth the topic

should be explored may be driven by the availability of data. This is perhaps an appropriate time to introduce the data sources which have been used in the investigation.

4.1. The Millennium Cohort Study

The Millennium Cohort Study (MCS) is a multi faceted data resource that contains most of the data required to sufficiently explore the relationships between neighbourhoods, child characteristics and wellbeing. The study enables a variety of the dimensions of wellbeing to be explored in some depth. The study tracks the lives of a particularly large group of children in the UK from the age of around nine months. When they were around three years old, aspects of their wellbeing were assessed, and in particular, their cognitive, behavioural and physical wellbeing. The assessments were conducted using a number of validated measurement instruments.

A great deal of other information about the children and their families is available. The study contains details about the conditions within the child's local area. In addition to this, the MCS has a mechanism that allows other ecological data from other data sources to be linked directly into the dataset. The link can be made using geographic identifiers common to both sources of data. The main source of data linked into the MCS in this investigation is a dataset containing aggregated small area statistics derived from the England and Wales' 2001 census. These statistics aim to characterise the socio-economic environment of the electoral ward in which the MCS children were sampled. More detail concerning individual characteristics and mechanisms for linkage will be discussed later in this chapter.

Another requirement is for suitable data preparation, statistical analytical strategies and tools. A computerised data preparation tool is necessary for speed and efficiency. Statistical modelling of the data will enable differences between neighbourhoods to be identified having controlled for the characteristics of children and other individuals who live with them. Specifically, the modelling tools will need to take account of the following statistical issues: the clustering of individuals within neighbourhoods and the stratified design of the survey from which the data have been drawn.

4.1.1. Background

The study was initiated in 1999 by the United Kingdom government of the day to celebrate the coming of a new century. More specifically it was designed to enable researchers to gain a better understanding of the lives UK children lead and the conditions in which they live (Dex et al., 2005). Not only was the study to look at the children's current circumstances, but also to follow them into their later lives.

The multi-disciplinary, longitudinal study was commissioned and initially funded by the UK Economic and Social Research Council (ESRC) and later additional funding was provided through a number of governmental collaborators headed by the Office of National Statistics (Hansen, 2008).

The study of a large cohort of individuals of the same age and their families from birth and through their life course is not a new phenomenon in the UK. The lives of three previous cohorts of children have been recorded in Great Britain in a similar way. The 1946 birth cohort study (known as the MRC National Survey of Health and Development), the 1958 National Child Development Study and the 1970 British Cohort Study are all examples of studies similar in design to the MCS.

One of the aims of the MCS was to illuminate and allow comparison with the other cohort studies already mentioned (Hansen, 2008). More pertinently, another aim of the study was to:

'investigate the wider social ecology of the family, including, social networks, civic engagement and community facilities and services, splicing in geo-coded data when available' (Shepherd et al, 2004, p12)

This last point is important as it perhaps illustrates the suitability of the MCS as a dataset to investigate the main research questions of this thesis. One of the key objectives of the study was to chart the lives from birth of a sample of children from diverse social and economic backgrounds, in particular, children from what have been termed disadvantaged and advantaged areas of society (Plewis, 2007). With the

increasing number and diversity of ethnic minority families living in the UK, another aim was to ensure adequate representation of this group in any analysis conducted by researchers (Hansen, 2008). As might be expected therefore, as a representative sample of children in all countries of the United Kingdom, the sample size of children was over 18,000.

As with the original cohort studies, the nature of the information collected is related to the economic, social and health characteristics of the children and their families. However, the MCS differed in a number of ways from the other Birth Cohorts. The sample of births used in the MCS represented births from all seasons of the year rather than one which takes into account seasonal differences in numbers of births. The sample is representative of the UK rather than just Great Britain. As mentioned earlier, the representation of children from diverse social, economic and ethnic backgrounds in the previous cohort studies were limited especially in the latter aspect. The MCS design deliberately over-represented areas where a number of these characteristics were common. The longitudinal nature of the study is also important. Interviews and assessments of the children and their families have been conducted when the children were aged around 9 months and then when approximately 3 years old. The latest sweep of data collection when the children were 5 years old has very recently been made available (but not used in this study).

The MCS also provides a wealth of information concerning a number of compositional and contextual factors about the child, the parents and the local environment. The longitudinal nature of the MCS has a number of advantages. Information pertaining to the child and their family at each sweep interview has been cross referenced. This means socio-economic and health circumstances in earlier years of the child's life can, if required, be used to help explain any differences in the child development.

4.1.2. Design of the MCS study

In the design of the survey a number of principles were followed. The children included in the study were (for the most part) to be born in one year. In England and Wales this meant all children born alive and living between September 2000 and August 2001 inclusive. For Scotland and Northern Ireland the dates were slightly different for various

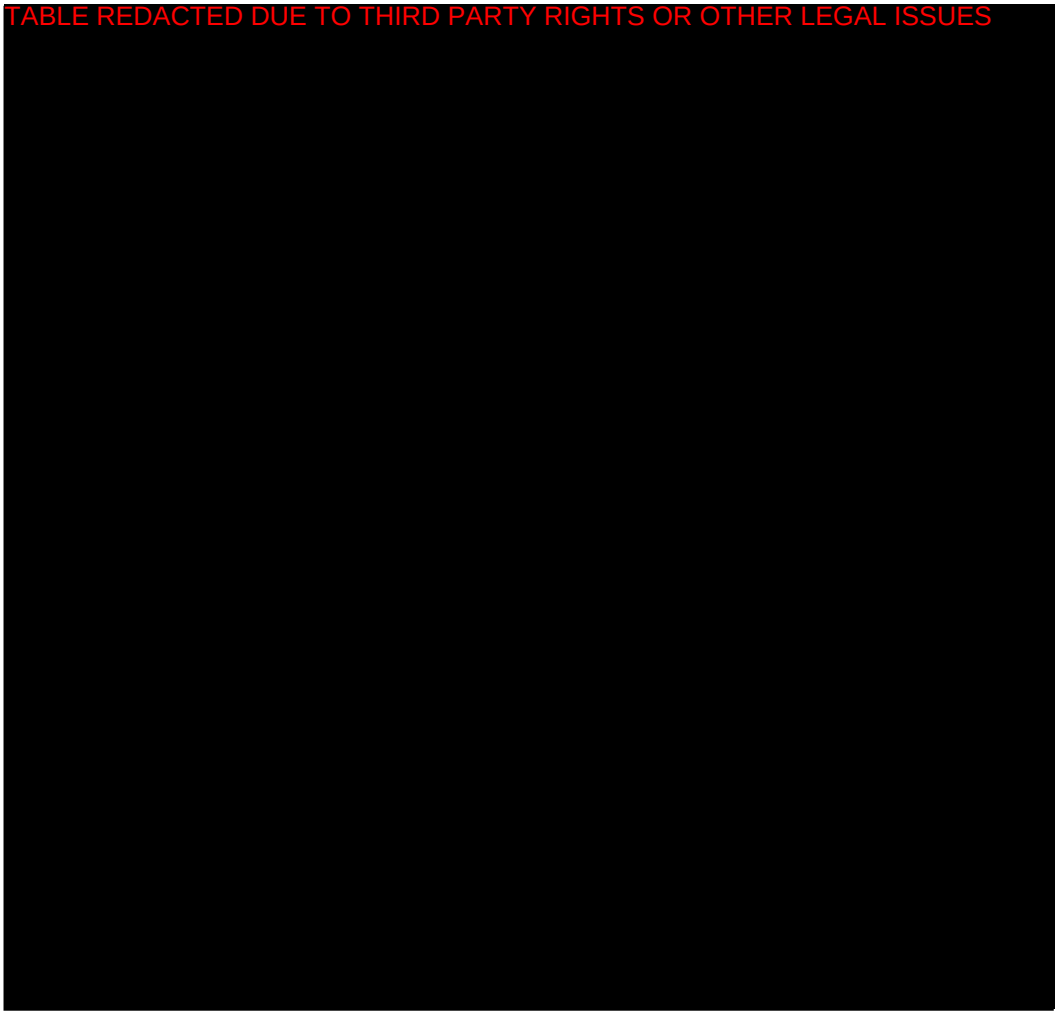
reasons. The dates were from around the end of November 2000 to the early part of January 2002 (Plewis, 2004). Although the study was intended to be representative of all children, the sample was actually drawn from those families eligible to draw child benefit at that age. Although a majority of families are on the UK child benefit register, it should be noted that a very small minority are not. Child benefit is a UK wide monetary provision and typically paid to the mother of the child. The small group ineligible to claim this benefit include those families whose residence in the UK is not permanent and include, for instance, armed forces personnel from abroad and those applying for asylum (Plewis, 2007)

The sample was drawn using a probability random sample method which included geographical stratification by UK country and then by region. A further clustering by electoral ward type within those regions was then undertaken (Plewis, 2004). The MCS was stratified to achieve better representation of the marginal socio-economic and ethnic groups as mentioned earlier in the chapter. The sample has been termed a 'disproportionately stratified cluster sample' (Plewis, 2004). The disproportionate nature of the sample means that children in advantaged, disadvantaged or ethnic minority electoral wards were over sampled. For any analysis to take place, a system of weighting is advised as children born in advantaged wards are less likely to be selected compared to those from disadvantaged areas. The clustering of families' in wards means that observations are not independent and therefore sampling errors need to be calculated. The clustering effect also has implications for the methods of analysis to be employed.

In addition to the geographical stratification by the four home countries and then by region within England, there was stratification by ward to gain a good representation of the social, economic and ethnic diversity of those living in the study area. Unfortunately, in terms of social and economic factors used to identify the stratification, data reflecting individual child/family advantage, disadvantage or ethnicity were not available for the population at the time of the survey design. As a result, factors that allowed an electoral ward to be labelled as either advantaged, disadvantaged or with a high proportion of ethnic minorities was used. This was derived from the electoral ward-based Child Poverty Index (CPI), a sub category of the Index of Deprivation 2000 (Noble et al., 2000). In the MCS datasets the variable identifying which type of ward the

child was sampled in is called the 'Stratum' variable. There are 9 strata in the UK MCS. These are England Advantaged, England Disadvantaged, England Ethnic Minority, Wales Advantaged, Wales Disadvantaged, Scotland Advantaged, Scotland Disadvantaged, Northern Ireland Advantaged and Northern Ireland Disadvantaged. Table 4.1 describes how many sample points (electoral wards and 'super-wards') and children in each at the first sweep of the study (MCS1) and is adapted from Plewis (2007). Superwards in the MCS are a combination of contiguous wards.

Table 4. 1- Sample points and children by country (unweighted) at MCS1



When the sample was drawn many of the 'Advantaged' Stratum wards chosen were considered to have too few births (the minimum requirement was 24 babies per ward) for analytical purposes. Therefore wards contiguous to the original sample ward were included to boost the number of births, as long as they were from the same MCS strata

(Plewis, 2007). The term ward, super-ward and sample point are considered in this investigation to be interchangeable.

By the second sweep of the study (MCS2) the sample had reduced to 15,590 families with 15,808 children. Attrition was due to reasons such as the refusal of respondents to continue in the study and being unable to contact some of the original families. However, new respondents did enter the study at sweep two who could not be found at sweep one but were by MCS2 and numbered 692 families.

4.1.3. Stratification of wards

The CPI 2000 (Noble et al., 2000) was used to determine whether a child lived in an Advantaged or Disadvantaged area or ward for England and Wales (it should be noted that the CPI did not apply to income tested benefit receipts in 1998 and 1999 for Scotland) (Plewis, 2007). The Index of Deprivation in England and Wales used electoral ward boundaries extant on 01 April, 1998 (op cit).

For England and Wales, Disadvantaged electoral wards were those wards which were in the upper quartile (poorest 25%) of all wards in the CPI index in England and Wales. Those wards not in the upper quartile of the CPI index were deemed to be part of the 'Advantaged' stratum (op cit).

A CPI index based on all four home countries was not available at the time of the sampling of wards. Wards in England and Wales had to be chosen for the survey before indices for Scotland and Northern Ireland were available. Wards selected for each Disadvantaged stratum in all countries used the same cut off point of 38.4% which was the upper quartile of disadvantage (op cit). Ward boundaries for Scotland and Northern Ireland were extant as at the end of 1998 and 1984 respectively.

To ensure an adequate representation of children from diverse ethnic backgrounds, a third stratum was identified called the 'Ethnic Minority' stratum. As there were few ethnic minorities in wards in Wales, Scotland and Northern Ireland, this Stratum was defined for England only. Electoral wards in England with at least 30% of its population being either 'Black' or 'Asian' at the 1991 census were designated as being in the 'Ethnic Minority' stratum. From these, nineteen wards were randomly selected. It

should also be noted that almost all of these wards would have fallen into the Disadvantaged ward classification had they not been sampled as Ethnic Minority stratum wards to begin with.

By sweep 2 of the MCS, the children of the original sample were approximately aged 3 years old. A number of sample families had moved since the first survey but where possible, were traced to their new locations and included in the study. The second sweep of the MCS also included some new entrants to the survey, as mentioned earlier. In the data collection phase of the first sweep some eligible families in the ward were not included. When the Department of Work and Pensions (DWP) updated their child benefit records some eligible addresses had not been issued in time for the first MCS survey. This could have been for a number of reasons such as being classified as sensitive cases (op cit).

4.1.4. Accessing the MCS data

The data sources used are available from a number of locations. For MCS data, both sweeps' one and two are available for internet download from the UK Data Archive at the University of Essex. Having signed the relevant confidentiality data agreements, both datasets were downloaded together with the relevant documentation. There are a number of confidentiality requirements put in place by the Millennium Cohort Study Development Team for those wishing to use the data. Of these, one requires that the electoral wards used in the survey are not identified and made public. As mentioned earlier, one aim of the study is to examine the associations between child wellbeing and neighbourhood factors. To achieve this, 2001 census electoral ward small area statistics representing neighbourhood characteristics have been linked to the MCS by the author of this thesis. This data was obtained from the office of National Statistics and is publically available. Permission for linking of this data to the MCS has been granted by the Director of the Study. One of the limitations of this investigation is that only 2001 census data at ward level for England and Wales was available for linkage. Although the ward data (including London wards) are defined in the census in 2002, a look-up table was used to allow linkage on the 1998 ward boundaries. For Scotland, at the time of completing this task, a complex process of re-aggregating census data to fit the

original MCS sampling wards would have been required. This would have had to have been completed by the General Register Office for Scotland's census office. Time and operational constraints of the PhD meant this was not feasible. For Northern Ireland, the process was even more complex due to the nature of the ward boundaries used and for the same reasons mentioned above, not feasible. However, it was felt that using census data for England and Wales aggregated to the original sample point boundaries would provide a unique and interesting examination of how neighbourhood characteristics were associated with MCS children's wellbeing. There was also the added bonus of being able to control for Ethnic Minority wards which were not available for Scotland and Northern Ireland.

Aggregated ward level socio-economic data such as census statistics relating to the original ward geographical boundaries are not presently available in the MCS datasets for public use. As such, one of the unique achievements of this investigation is that data used to examine neighbourhood influences at the ward level of aggregation in the MCS had not been achieved before. Interestingly, the MCS development team have recently included external census data using different boundaries such as census output areas (OA) and super output areas (SOA) but these were not available at the time of this investigation.

The data linkage has been completed in a secure data environment within the CLS at the IOE and under the guidance of the MCS development team. Further details of the externally linked data are discussed later in section 4.3.

4.1.5. Ethical considerations

As part of the investigation, an ethical review of the project was conducted to ensure requirements concerning this process were adhered to. This was reported in the Ethical Research Review Form completed by the author as part of the Institute of Education's Doctoral standard procedures.

As this investigation uses only secondary sources of information many of the ethical issues surrounding data collection that are important in primary research have already been considered in the ethical review process conducted for the approval of the MCS itself. The main issue for concern for this investigation was the confidentiality of the data used and this was maintained as explained earlier.

4.1.6. Subjective neighbourhood factors in the MCS survey

Three definitions of locality are used to characterise the physical and socio-economic environment in which the MCS child were sampled. Two definitions of locality are found within the MCS dataset and the third from the external source mentioned earlier.

The first two sources relate to subjective information concerning the locality in which the MCS family resides collected during the fieldwork phase of sweep one and two of the study. During sweep one, when the cohort child was aged around 9 months, the main respondents (in most cases the child's mother) were asked to give their opinions regarding environmental conditions, availability of services and safety of the area in which they lived. 'Area' was defined as a 20 minute walking radius and is the first of the three definitions of locality. The second definition of locality was based upon the survey interviewer's opinions of the streets on which the cohort children lived at MCS2. With such a large number of cohort families to be interviewed over such a wide geographical area, around 300 interviewers were used in the survey (GfK NOP Social Research, 2006). During their visits to the cohort families, the interviewers were asked to give their opinions concerning the environmental and safety conditions of the streets on which cohort families lived. Interviewers, in some cases, visited the families a number of times and provided opinions for each time. Many of these visits were also at different times of the day.

At this stage it would be useful to discuss the rationale for using these two measures of neighbourhood. The reason for using the mothers' opinion of neighbourhood from sweep one was a methodological one. The MCS children were aged around 9 months old at the time of the first sweep of the MCS. The second sweep interviews were undertaken within a month or two either side of the cohort child's third birthday. If the cohort family had not moved away from the area between surveys, the child would have had at least two years of exposure to the neighbourhood in which the family had been twice interviewed. In this analysis around 60% of the sample had not moved ward (neighbourhood) between sweep one and two. This meant 38% of MCS families had moved address from the first sweep but most moves were of a short distance (Hansen and Joshi, 2007). Moves were most common in lower income and renting families with

most stating they wanted a larger house as the reason for moving (Hansen and Joshi, 2007). For those who had not moved, one of the assumptions of the ecological association hypothesis was that this provided enough time for the localities' characteristics to have had an influence (or not) on the cohort child's wellbeing. Of course, it was acknowledged that for those families who had moved in the intervening years, the mechanisms operating at the ecological level may not have had time to have an influence on the child's wellbeing. It could be that the move was made just after the first sweep interview and therefore the impact of the new neighbourhood would have had time to have an impact but it is unclear in the data when these families would have moved. An indicator of migration was added to adjust for moving residence. Information concerning when the move was made was not available.

The second subjective report on the locality, those made by the interviewer's, to some extent allows triangulation of neighbourhood influences as more than one type of assessment of the area is being made and is therefore also used.

Each mother and interviewer provides a set of subjective and individual opinions of their localities. The mothers and interviewers are each asked around eleven questions (not the same) relating to the area and street respectively. They are required to choose one response from a set of Likert scale based responses. However, another issue arises of how to use these questions and responses in any analysis. One strategy might be to use Principle Components Analysis (Pagano, 1998) to derive a smaller number of ecological factors that summarise the eleven original neighbourhood indicators. One reason for using this method might be that many of the indicators are correlated with one another. Although this point is acknowledged here, by reducing the number of factors used, details of the influence of specific individual factors will not be uncovered. For this reason, in this analysis, each subjective neighbourhood factor will be analysed separately. Any issues of correlation between factors will be identified and discussed when the need arises in the context of the other findings.

A fundamental issue that arises relates to what is actually being measured by these subjective perceptions or reports of the locality. For instance, are the mother and interviewer reports, of say, litter being common, saying that there is actually litter in the area? Or should these opinions be taken only as opinions. These subjective reports have not been verified using other methods and to some extent are treated with caution. This

is especially so with the mother's report as the geographical area being reported upon could be fairly large (20 minute walk of home) with perhaps not all parts of this area actually having litter. It could be that these measures are identifying more general negative concerns about litter. This issue has implications for how this data is used. The individual responses could be aggregated to form an area score. The problem here is what boundary of aggregations is appropriate? The mother's score is based upon an area that may differ quite considerably from other respondents 'area' and from the ward boundary (a logical boundary for aggregation), especially for those who live near the edges. Her 20 minute walk may overlap into another ward. In terms of the interviewer's reports, the amount of litter on streets may vary widely in the ward. Some preliminary analysis of these scores had shown that responses within many of the ward areas did differ. As a result the decision was taken to treat this as individual level rather than not to aggregate the data.

Another issue relates to 'adaptive preference' theory (Burchardt, 2004). Burchardt showed that subjective responses to how a person feels about their financial wellbeing may be biased by having been in that state for a protracted period of time compared to someone who has not. It may be that the same process operates when people give subjective opinions of the area in which they live. People who have lived in an unsatisfactory area for sometime may provide a different opinion of the conditions in that area compared to a persons who has not been there for long. This issue is discussed to some extent in the context of neighbourhood inequality, relative deprivation and health status. Wilkinson suggested

> '...as we move from higher to lower units of aggregation the relevant social comparisons that generate anxiety, stress and a sense of relative deprivation are weakened since the salient heterogeneity is mostly between rather than within smaller geographic units' (Wilkinson, cited in Hou and Myles 2004, p6).

The argument proposed here is that mothers living in deprived neighbourhoods for a long time may tend to under-report the poor aspect of the neighbourhood creating measurement bias. This may be due to low expectations from having never lived in an affluent neighbourhood or had affluent neighbours or have become 'used' to the deprivation. The situation might be compounded if the neighbourhood in close

proximity is also deprived. However, this has not been examined in this investigation and a cautious approach will be taken.

4.1.7. Mothers' subjective opinions of the locality

Firstly, of the eleven questions asked concerning her locality, eight are used in this analysis. The questions can be summarised in groups of one or more questions with headings as follows: general satisfaction with area, specific environmental problems in the area, child safe play areas and friendliness of neighbours. By area, it was meant within a mile or 20 minutes walk of the place of interview (their residence). Two further questions were asked concerning 'how common insults or attacks to do with someone's religion' were and the how common 'poor public transport' was. They were excluded when the data was being explored (and were also found to be insignificant when tested in further checks) as few respondents answered these questions. Table 8.2 provides descriptive information concerning the responses for each of these questions within the context of the analysis conducted in this investigation.

In more detail, the respondents were asked how 'satisfied or dissatisfied' they were with the area they lived in. In relation to specific problems in their area, they were asked how common the following issues were.

- Noisy neighbours or loud parties
- Rubbish or litter lying around
- Vandalism and deliberate damage to property
- Racial insults
- Food shops and supermarkets that are easy to get to
- Pollution, grime or other environmental problems
- Places where children could play safely

The answer to each of the questions was measured using a four category Likert scale (apart from the first question concerning satisfaction with the area which had five

categories). The choice of responses ranged from 'very common' to 'not at all common'. The question relating to places in which children could play safely required a 'yes' or 'no' response. This was entered as a dichotomous factor in the analysis.

From a substantive point of view, discussion of the mechanisms that may be operating to influence child wellbeing provides the reasoning for the choice of these neighbourhood factors. Firstly, these neighbourhood characteristics may have both direct and indirect associations with cognitive, behavioural and physical wellbeing. Although it is not clear what the mothers' satisfaction with the area reveals what they are satisfied with, it is assumed a general overall satisfaction is likely. It might also be assumed at this stage that a locality considered to be satisfactory may have a positive association with a child's wellbeing. Ellaway, Macintyre and Kearns (2001) and Sooman and Macintyre (1995) found for adults, that those who liked the area in which they lived were associated with being more healthy.

A noisy environment may have a direct negative impact on the child (Evans and Lapore, 1993) (although this was not found to be related for adults and health (Parkes and Kearns, 2006)). The child may be kept awake and is prevented from getting sufficient sleep. Loud noise may also be considered stressful for a child (Evans and Lapore, 1993). From a cognitive and behavioural point of view, these negative distractions may operate by reducing the child's ability to concentrate, take in new information or become frustrated, thereby reducing the child's scores on the measures of wellbeing. The impact may be more indirect as a noisy neighbourhood may impact on the family. In this case the main caregivers may also become stressed and sleep deprived, reducing the inclination to stimulate the child's cognitive and behavioural wellbeing.

Over time, high levels of pollution may also have a physical impact on the child's brain function and reduce cognitive ability. The lack of play areas may influence child wellbeing (Carver, Timperio and Crawford, 2008). This may reduce the child's chances of experiencing new objects, interesting shapes, colours and new vocabulary and therefore result in lower cognitive scores. In terms of behavioural difficulties, having no place in which to play may make the child frustrated with nowhere to release excess energy. This may also impact on the child's weight, as fewer opportunities for exercise may mean the child has less chance to use up excess calories.

High levels of rubbish may have an indirect impact. It is assumed that children at the age of three are unlikely to venture out of the home environment without the mother or at least another care provider. Lots of rubbish in the area may only discourage the mother from venturing out into the locality as it can be perceived as being associated with an unsafe or undesirable environment. Unsafe rubbish items might range from simple paper and plastic bags to the more dangerous used injection needles discarded by drug users. This may reduce the child's likelihood of experiencing new cognitive and behavioural stimulation which contact with the outside world brings. Not going into the local environment may also reduce the opportunity to play with other children.

High levels of vandalism may discourage families from venturing from their homes and reduce the child's opportunity of greater positive cognitive and behavioural stimulation.

The lack of food shops or supermarkets within easy reach has been shown to have an impact on the family and the child in a number of ways. If the shops are far away then shopping may happen less frequently. The child may therefore have less opportunity to experience or assimilate those indicators of cognition used in the cognitive assessments. Disadvantaged areas were also shown to be associated with poor stocks of healthy foods (Sooman, Macintyre and Anderson, 1993) which can affect the levels of nutrition in children.

4.1.8. Interviewers' subjective opinions of the streets

The second group of neighbourhood factors relate to the subjective opinions of conditions on the streets on which the cohort families lived at sweep 2 of the MCS. They recorded opinions concerning 11 criteria. One question asked whether there were burnt out cars on the street but this was not included as the response rate to this was particularly low. Most of the questions and statements used a Likert scale of measurement. The number of responses available ranged from between three and six. The questions and statements asked how common the following were:

- Good general conditions of buildings in the street?
- Security blinds etc?

- Traffic calming?
- Volume of traffic?
- Is there any litter etc in the street or on the pavement?
- Is there dog mess on the pavement?
- Is there any graffiti on walls or on public spaces?
- Is there any evidence of vandalism?
- Is there any arguing or fighting on street?
- How do you feel in the street? (...in relation to safe and comfortable).

As mentioned earlier, the same interviewer (or a different one) may have visited the street on more than one occasion. They were asked to provide an assessment on each occasion and there were up to five visits for some. Although the assessments remained very similar for each visit, the decision for this investigation was to use the information from all the visits to achieve a more rounded view of the interviewers' opinions. This was achieved by giving each question's Likert scale response a score ranging from one for the least problems and successively higher scores for answers higher up the scale. A sum was derived of all the visits to a family made by the interviewers and the sum then divided by the number of visits. Each score was then mapped back to the original Likert scale response labels.

4.2. Stratum

Another very important source of variation within the survey is the information about the type of neighbourhood the children and their families lived as used in the disproportionate stratification. As mentioned earlier, children were sampled in what were described as Advantaged, Disadvantaged or predominantly Ethnic Minority wards. Many studies mentioned in Chapter Three use measures of neighbourhood poverty as factors in trying to explain variations in wellbeing with disadvantaged areas having been linked to negative cognitive and behavioural outcomes (Brooks-Gunn et al., 1993) and also childhood obesity (Kinra, Nelder and Lewendon, 2000).

Not only can the stratum be used as a measure of poverty but also the Ethnic Minority wards can also provide additional neighbourhood characteristics to the explanation.

4.3. Externally-sourced neighbourhood information

The next section describes the ward definition of neighbourhood factors used in the investigation. 2001 census small area statistics for electoral wards in England and Wales were utilized to objectively characterize the locality in which the children and their families lived. As will be explained later, a separate strategy was used in the analysis phase for the England and Wales data. The Census information provides a snapshot and backdrop to the circumstances into which the MCS children were born and their families were living. These data were collected during the England and Wales 2001 decennial census. The information from all individuals in the census has been aggregated to ward level based on the 1998 geographical boundaries. Wards have been constructed for local government administrative purposes. As such, there may be difficulties in their use as proxies for neighbourhoods. For instance, rural wards may be far larger in geographic area than urban ones although the total number of persons in each ward is likely to be smaller (around 5,500). It is not clear whether rural wards in terms of the MCS are more homogenous than urban ones concerning socio-economic factors. However, although not necessarily ideal, this definition of neighbourhood has been used in a number of studies of neighbourhood, for instance McCulloch (2006), discussed in the literature review. The census information concentrates on the proportions of aggregated social and economic characteristics of people in the ward. In summary, these include such factors as neighbourhood level of qualifications, age structure, employment, housing tenure, general health, lone parenthood and country of birth. Each variable has been derived as a univariate continuous neighbourhood factor for the purposes of this investigation. As such it provides another dimension which may characterise the area in which the cohort children were sampled.

Over 45 census statistics for each of the MCS sample points (wards or super-wards) in England and Wales were extracted. This was a time consuming process for the author as some of the linking of census data to the MCS process could not be computerised. For super-wards, an average of the census factor's statistical proportions for each ward was

calculated. This was weighted by the relevant denominators for the individual wards within the super-ward. This dataset can be used by other researchers observing the same confidentiality safeguards.

4.4. Indicators of child wellbeing

The next section of this chapter concentrates on the indicators of child wellbeing that are investigated in relation to neighbourhood factors. Three dimensions of wellbeing are examined, cognitive, behavioural and physical. Cognitive wellbeing is examined using two measures, the Bracken School Readiness Assessment (Bracken, 2002b) and a sub set of the British Ability Scales, the Naming Vocabulary Assessment (Hansen and Joshi, 2007). The behavioural wellbeing dimension is examined using the Difficulties assessment from the Strength and Difficulties Questionnaire (SDQ) (Goodman, 1997). Physical wellbeing was measured using the child's Body Mass Index (BMI) (Cole et al, 2000). Each wellbeing assessment will now be discussed.

4.4.1. Cognitive outcome indicators

In the second sweep of the MCS, when the cohort children are aged approximately three years, a set of assessments are administered by the interviewers. The Bracken School Readiness Assessment evaluates the MCS children's appreciation of key basic concepts (Bracken, 2002b). Up to six interviewer administered tests are used to measure the understanding of basic concepts which are relevant to the child's educational development. The child is asked to identify various shapes, colours, counting numbers, sizes, comparisons and letters (Bracken, 2002a; MCS Development Team, 2006). For the purposes of this investigation the Bracken School Readiness Assessment will be referred to as the School Readiness Assessment.

Within the MCS age 3 assessment dataset, a number of variables have been derived by the MCS development team relating to this indicator. These include a standardised percentile rank variable and a raw score variable. The raw score variable has been used in this case rather than the former. The School Readiness Assessment tool was developed in the United States primarily for the assessment of pre-school children. In

the US, an age standardised score is derived to control for the age of the child when they were assessed (Bracken, 2002b). However, to ensure an age appropriate control for the UK children is used, the raw score variable has been used in this analysis and a separate regressor used to control for the child's age. Each sub test within the Assessment contains around 20 question items and the child is asked to attempt as many as they can in the allotted time. The raw score variable is the total score from the addition of the individual scores.

The children were also assessed using the Naming Vocabulary Assessment from the British Ability Scales (BAS) (Elliott, Smith and McCulloch, 1996). This has been used to measure the cognitive functioning of the MCS children in terms of their expressive language abilities. This is a more specific assessment of the child's vocabulary knowledge and the raw score is again utilised.

4.4.2. Behavioural wellbeing outcome indicator

The behavioural domain of well-being is being assessed using the Behavioural Difficulties Assessment of the Strengths and Difficulties Questionnaire (Goodman and Scott, 1999) (SDQ) and is again measured at the second sweep of the survey. In the self completion section of the survey the main respondent is asked to complete the SDQ in relation to their cohort child. It contains a battery of 25 question items which measure a number of psychological attributes including emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship behaviour and pro-social behaviour (the latter is not included in this analysis so only 20 question items are used). Each item is individually scored. The scores are summed to provide an overall total for each child.

4.4.3. Physical wellbeing outcome indicator

Physical wellbeing is measured using the child's Body Mass Index (BMI). A physical assessment by the interviewer was conducted of the child at the second sweep which included the measurement of height and weight when fully clothed. The interviewers were specially trained to use the measuring scales. The BMI is dividing the child's weight in kilogrammes by the height (metres) squared (Cole et al, 2000). In the analysis phase of this investigation, a number of issues concerning the reliability of this measurement for a small number of children were identified. In brief, these relate to a

small number of child BMI scores at the extremes of the distribution. Further details of how these were overcome and the implications for the analysis are discussed in more detail in Chapter Six.

4.4.4. Child and family explanatory characteristics

To disentangle neighbourhood influences from those of geographically clustered individual terms, it is necessary to consider what factors may also be related to the child's wellbeing at the individual level. The review of literature has identified various child and family health, socio-economic and physical factors that have been found to have a significant association with various dimensions of child wellbeing and childhood development. However, in this investigation, the main reason for including these types of characteristics is a methodological rather than substantive one. Although child and family characteristics affecting wellbeing are, of course, of great interest, the main thrust of this investigation is the identification of additional neighbourhood influences. For these to be correctly and separately identified from other characteristics, child and family factors need to be included in the analysis as control factors.

The following provides an overview of the child and family related factors which will be controlled for in the analysis. Details of the distribution of these factors in the sample are found in Table 8.1 in the Appendix. The age, gender, and ethnicity of the child have been included. Pre-natal birth related factors such as whether the child was a low birth weight or preterm baby together with any previous hospitalisations or ongoing long-term illnesses and how many siblings the child have also been included. Factors that may indirectly have an influence on the child's wellbeing are related to the mother, father and household factors. In particular, those relating to the mother will include her age, mental health status and educational attainment. Household factors, including the family structure, the highest socio-economic class (using the NS-SEC, 2000) of the mother/father, family income, housing tenure, and whether the family live in an urban or rural area (although Meltzer et al (2000) did not find any differences between these areas for children aged three in behavioural problems). The physical conditions within the home have been taken into account including whether anyone smokes in the child's presence at home, damp conditions and central heating. Life events affecting the family

such as having moved home since the first sweep will be included. Finally, indicators have been included that identify whether the child receives a variety of educational inputs that may be important in improving wellbeing. These include whether English is spoken at home, whether the child is read to, given help with the alphabet and counting at home.

Details of how each of these factors is defined for the purposes of the analysis will be discussed to some extent in the following section but mainly in the individual results chapters.

4.4.5. Structure of MCS data

The MCS is divided into data files related to each of the sweeps. Each sweep has a main respondents' interview file, household level information file and where appropriate additional files such as child assessment or neighbourhood assessment files. Each can be linked using unique family and child within family identifier variables, within and between sweeps.

4.5. Methods of analysis

4.5.1. Dataset construction

Files containing all the data for sweep one and two of the MCS were downloaded from the UK Data Archive at the University of Essex. It was imported into the 'Statistical Package for the Social Sciences (SPSS) version 14'. The School Readiness, Naming Vocabulary, BMI and neighbourhood assessment data for the children at age 9 months and 3 years are contained in separate SPSS data files to the main parent's interview file. The latter file contains the main child and family explanatory variables (and the Behavioural Difficulties Assessment data) required for analysis. After a large amount of variable manipulation, each of the derived SPSS data files was then linked together using various child and sample point identifiers. As explained earlier in the chapter, 2001 census small area statistics were also matched into the main SPSS data files. A separate data file was derived for each of the four wellbeing outcomes and contained all

the necessary child, family and ecological variables. The data files contain information on all the cohort children. However, not all children were selected into the sample for analysis. The sample selected for each wellbeing outcome analysis contained the same children, for the most part. However, depending on the availability of non-missing values for the wellbeing dimensions being investigated, some children were dropped from the analysis.

The SPSS data files were then used to construct tables for descriptive analysis of the data (as seen in Tables 8.1 to 8.3). Having manipulated the data into the correct format for analysis, the next section of the chapter discusses how this was undertaken.

4.5.2. Issues in modelling neighbourhoods

In deciding which statistical method to use, the one chosen had to fulfil a number of tasks. Firstly, the main requirement is the need to measure and attribute differences in child wellbeing to a number of explanatory factors. One of the recognised methods of accomplishing this is through the use of statistical regression techniques (Pagano, 1998). This method has been used in a number of studies relating to the measurement of neighbourhood effects as reviewed in Chapter Three.

However, there are a number of issues relating to the structure of most social data including that in the MCS. Goldstein (1995) argues that it is important to recognise the hierarchical nature of the structure of individuals in society. The MCS can also be viewed as hierarchical in nature. The MCS children are grouped within families and the families within defined wards. In the context of this investigation, children are nested within families and families within areas. There are a number of characteristics associated with this nested structure. For instance, people clustered in a family may share similar characteristics such as social class. Goldstein (1995) also suggests that people living in one context are more alike, on average, than people from another context. For various reasons discussed in Chapter Three, individuals in a household will tend to share similar attitudes. The assumption then, in relation to this study, is that children and family members living in households are likely to have a similar socio-economic status, educational background and unobserved characteristics related to levels of wellbeing. However, the level of wellbeing or other social or health related

factors will vary from family to family. To extend this assumption, it might be expected that children in a neighbourhood will have similar levels of wellbeing, compared to those in another area.

Goldstein (1995) also discusses what can happen if clustering in the data structure is ignored in analysis. To estimate relationships between factors such as wellbeing and the characteristics of wards, the researcher might typically employ ordinary regression techniques (Pagano, 1998) as mentioned earlier. However, Goldstein suggests that the standard errors of regression coefficients will be underestimated if the hierarchy is ignored. As a result, inferences at the neighbourhood level may be made, when, in fact, they could be attributable to chance.

Rasbash et al (2004) also describe why ordinary regression methods may be problematic. Using the example of the MCS data to be analysed in this investigation, I will attempt to illustrate the two methods they suggest that could be employed to analyse this sort of data and the associated problems.

Child scores, for a particular wellbeing indicator in individual electoral wards could be aggregated and a mean wellbeing score derived that summarises the level of wellbeing for each electoral ward. The same could be done for any child, family or ecological explanatory variables. Any relationships between the mean ward wellbeing scores and the ward level explanatory variables could be estimated using ordinary regression methods. However, this type of strategy may create problems in interpretation of results (Diez-Roux, 2001). As Rasbash et al (2004) suggest, any significant relationships found between wards cannot then be assumed to be ones that are present between the children in those wards. For causal interpretations of these results to be made, information about each individual child is required. However, in the aggregation process this information has been lost and therefore any causal interpretation is unreliable and an ecological fallacy may be committed.

Rasbash et al (2004) also discuss another method using ordinary regression. This method would suggest that rather than aggregating the child information to the ward level, one mean wellbeing value for all the MCS children would be used to estimate the model. A dummy variable for each ward would also be estimated separately and variations between wards examined. However, with a large number of wards this would

make the comparison between each ward estimate time consuming and an inefficient method of estimation. Related to this latter method is the need of this investigation to be able to make generalisations from these results to the population as a whole. The MCS is a stratified random sample of children from the whole of the UK and lends itself ideally to generalisation. Therefore, it would be an advantage to use statistical modelling methods that made good use of this advantage and allow the generalisation of finding to the respective population. According to Rasbash et al (2004) estimating each ward dummy individually means each ward would not be viewed as being from a random sample of wards. This also implies that generalising the results to all wards in the population is not appropriate using this method. They suggest Analysis of Variance (ANOVA) techniques also suffer from this problem.

4.5.3. The neighbourhood boundary issue

An important factor in the analysis of ecological effects is how to define the geographical boundaries which aim to reflect the neighbourhood or locality which highlights a number of issues (Mitchell, Dorling and Shaw, 2002). Defining the locality using different geographical boundaries has been found to produce different results in modelling and has been called the modifiable areal unit problem (MAUP) (Flowerdew, Manley and Sabel, 2008; Haynes et al., 2007a; Openshaw, 1984). Methods to define boundaries in studies can range from measurement of time taken to walk a certain distance (MCS Team, 2006) to those which have been developed for administrative purposes such as UK Census geographical units, for example, census output areas (OA) or for UK electoral geographical areas (electoral ward or divisions) (McCulloch, 2006; Wiggins et al., 2002). Deciding which boundaries are appropriate can be a difficult issue (Lupton, 2003). There is some evidence that ward boundaries have been found to be around the size that children identify as appropriate for their neighbourhood (Matthews, 1987). In the US and Canada census tract has been accepted as a way to operationalise neighbourhoods (Brooks-Gunn et al., 1993; Kalff et al., 2001; Ross, Tremblay and Graham, 2004; Sampson, Raudenbush and Earls, 1997). Many of these definitions have been used as proxies for neighbourhoods and it is usual to acknowledge that these may not be the best way to characterise the neighbourhoods in which people live. To re-iterate some earlier discussion, for instance, in rural areas, wards are likely to be large

and therefore questions may arise as to how appropriate they are to describe a person's neighbourhood. Also, living close to the boundary of an administratively defined neighbourhood may mean the respondent is likely to use resources and facilities in an adjacent area. Therefore, for this person, the neighbourhood has not been appropriately defined and may result in measurement bias.

4.5.4. Temporal measurement bias

A number of methodological issues can arise when attempting to design neighbourhood studies. Some of these issues are now considered. One considers the temporal nature of neighbourhood data collection. If a mismatch between time of outcome assessment and when the neighbourhood attributes used to explain variances in the outcome were measured occurs then this can result in measurement bias (Ellen and Turner, 1997; Jackson and Mare, 2007). To some extent this may have implications for analysis in the MCS and has been acknowledged here. A good example might be the use of aggregated UK census data to characterise areas. For instance, information used to derive the MCS Ethnic Minority strata was based upon 1991 UK census information (Plewis, 2007). This meant the information on ethnicity for these wards was out of date compared to when the sample was selected (around 1998). Wards which would not have been considered Ethnic Minority wards in 1991 using the MCS definition, may have been by the time the MCS sample was selected due to population changes in these areas. This may have affected the sampling design. Although some preliminary analysis was conducted concerning this issue for this investigation, further analysis would be required to ascertain the impact of these changes to the study.

Another issue relating to temporal measurement concerns the clustering structure when the children's outcome variables were measured. The ward structure which was used in the modelling of the children when aged three is, in fact, that defined when the child was aged nine months (MCS1 interviews). As such those who had moved may no longer be associated with their original ward.

4.5.5. Multi-level modelling

Goldstein (1995) and Rasbash et al (2004) propose the technique of multi-level modelling for analysing hierarchical data. These models have a number of advantages over those discussed earlier. Firstly, they can account for the effects of clustering in the data. Rasbash et al (2004) suggest that the standard errors of estimates in ordinary regression models are underestimated in single level models. In multilevel models, the clustering (or similarities in variation) between those of the children within wards and between the wards themselves is taken account of. The multi-level model estimates both the 'aggregated' and 'child' models mentioned earlier but simultaneously. It allows information relating to the individual child to be taken into consideration. Variation of outcomes scores at the ward level is allowed for and ward level estimates are treated efficiently by reducing the number of estimates required. It also treats the wards as a random sample of wards allowing generalization to the population. It allows the identification of how and where effects are happening. Multilevel models also provide the ability to model and explore the 'relative sizes and effects' of individual, family and ward characteristics.

Rasbash et al (2004), pages 9-11, provide more detail concerning the character of multi-level models. The next section is a brief overview of the theoretical aspects of multi-levels provided by Rasbash et al (2004) in their manual 'User's guide to MLwiN', the Multi-level Modelling for Microsoft Windows computer package. The following overview of MLM uses the context of this study to help in explaining the concepts.

The following theoretical discussion of multilevel models assumes that the dependent variable is a continuous outcome. All wellbeing outcome variables examined in this investigation have been transformed into continuous outcomes. As will be explained, this also has implications for the type of estimation method employed. Level two is the sample point or ward and level one is the child/family (as explained below).

The multi-level model is as follows:

'$y_{ij} = \beta_0 x_0 + \beta_1 x_{1ij} + u_{0j} x_0 + e_{0ij} x_0$' Equation 1 (Rasbash, 2004 p11)

...or put in another way, using the MCS context example,

Well-being outcome (y_{ij}) = (β_0) Intercept(x_0) + (β_1) Child's age (x_{1ij}) +$u_{0j}x_0$ + $e_{0ij}x_0$

'y_{ij}' represents continuous outcomes scores of all the children ($_i$) in the 398 MCS wards ($_j$).

The '$a + bx_{ij}$' is known as the fixed part of the model. The 'e_i' (the error or residual term) represents the difference between the actual individual child wellbeing score and the mean score of the children in his/her ward. It can also be thought of as that portion of the variance that is not explained by the fixed part of the model.

The 'u_j' is the error term at the ward level and represents by how much each individual ward 'mean' wellbeing score deviates from the mean ward wellbeing score for *all* wards.

The '$u_j + e_{ij}$' is now referred to as the random part of the model. The inclusion of these random terms identifies the model as multi-level.

Rasbash et al (2004) suggest a number of assumptions can be made about the variance at the ward (u_j) and individual level (e_{ij}) level. Both are assumed to be uncorrelated with each other. The distributions of these variances are also assumed to be normal with the former known as, 'σ^2_u' and the latter, 'σ^2_e'.

Equation 1 is known as the variance components model, intercept-only models or unconditional models. The random parameters ('σ^2_u' and 'σ^2_e') are the only intercept variances at each level. As will be seen later, this model (sometimes also referred to as the 'Null' model) is useful in identifying the within and between group variability in the dependent variable. In this context it is useful in identifying whether there are differences between wards in their levels of wellbeing indicators. This model would be an initial first step in the modelling strategy. If there are variances between wards, it would mean that further analysis using multi-level models (MLM) is appropriate. The MLM is able to separate out the variances that can be accounted for by 'within ward' differences and those accounted for by the 'between ward' differences. The aim would then be to identify which characteristics of the wards are important in explaining the differences between them.

The intra-class correlation coefficient (ICC) is used to measure the size of the within and between variances (op cit). In this investigation, the ICC is the statistic used to identify the extent of the differences between mean ward scores. The ICC uses information from the two 'random' quantities, the 'σ^2_e' (between child variance) and the 'σ^2_u', (between ward variance) generated by the ML model. The calculation is as follows:

ICC= $\sigma^2_e / (\sigma^2_e + \sigma^2_u)$

The result can be expressed as a percentage.

Having deduced a multi-level model would be appropriate to explore between ward differences, the next stage is to specify a more general model. This will allow the addition of explanatory variables such as gender of the child and ethnicity.

The model can be expressed more efficiently (Equation 2) where all the coefficients from each explanatory variable are combined into the one term '$\beta_{0ij}x_0$'. The composition of the intercept variable (β_{0ij}) can be seen below the first line in the equation.

$y_{ij} = \beta_{0ij}x_0 + \beta_1 x_{1ij}$ Equation 2 (op cit)

$\beta_{0ij} = \beta_0 + u_{0j} + e_{0ij}$

The 'random differences' in the dependent well-being outcome variable have been specified in the coefficient (β_{0ij}) of the intercept variable (x_0). The model is called a 'random intercepts' model and is the one used in all modelling in this investigation.

To complete the full specification of the model, for continuous outcome ML models, the outcome or dependent variable, in this case, the indicator of wellbeing is assumed to have a normal distribution. Notation for such a model is seen in equation 4.

'$Y \sim N (XB, \Omega)$' Equation 3 (op cit, p11)

The 'fixed' (the intercept and any explanatory variables) section of the model is represented by the 'XB' in equation3. The 'Ω' represents 'the variances and covariances of the random' (op cit, p11) (at the child or level one and ward or level two) section of the model.

Figure Three illustrates what is seen on the computer screen when a model is estimated in MLwiN version 2. The example is one employed in this investigation using the School Readiness Assessment score continuous wellbeing outcome. Child's age (mean centred) has been placed in the model to control for the age of the child when taking the test. The 'β_{0j}' represent the School Readiness mean score for the average aged MCS child across the sample. A '0.003' of a year's increase in the child's age (equivalent to one day per year) is associated with one standard deviation increase in School Readiness score. The 'σ^2_e' represents the yet unexplained variation in School Readiness scores that can be attributed to differences between children. The 'σ^2_u' is the as yet unexplained variation in the School Readiness score accounted for between sample points (or wards). If more explanatory variables were added to the model, it is hoped that both the 'σ^2_e' and the 'σ^2_u' figures would be reduced. The -2*log-likelihood figure provides a measure of the goodness of fit of the model. A significant reduction in this figure from a previous model would be a good result.

Figure 3 - Example of multilevel model equation.

School Readiness score $_{ij} = \beta_{0j} + 0.003(0.000)$ (Child's age) $_{ij}$

$\beta_{0j} = 0.051(0.0.23) + u_{0j}$

$u_{0j} \sim N(0, \sigma^2_u)$ $\sigma^2_u = 0.117(0.012)$

$e_{ij} \sim N(0, \sigma^2_e)$ $\sigma^2_e = 0.806$ (0.011)

-2*loglikelihood = 27314.280 (10238 of 10238 cases in use)

4.5.6. Testing for significance in MLM models

To test for significance in continuous outcome multilevel models is slightly different to single level regression models. The 'F-test' is frequently used to test for the significance of each explanatory variable (Pagano, 1998). However, this method is not reliable in the context of multi-level models (Rasbash et al., 2004). For continuous outcomes, the 'deviance' statistic can be used instead. This method does not provide a test for each individual explanatory variable rather it provides a comparison of the estimated model to the previous model. MLwiN version 2 provides a '-2 times the maximum log-likelihood' (-2*LL) figure for each model estimated. This figure is compared to the previous model's -2*LL figure. The difference between the two is then compared to a chi square distribution with the number of degrees of freedom equal to the change in number of explanatory variables in the model. The level of significance used in this investigation is any figure with a p value below or equal to 0.05. However, if more than one variable is placed in the model at any one time, say for instance when controlling for a number of factors, it is difficult to judge the significance of each the variables individually. The rule of thumb used in this investigation for the significance of each individual variable is whether the variable's estimate is more than twice its standard error. Testing in this investigation has shown that variable estimates that are more than twice their standard errors also have -2*LL figures that are significant.

4.5.7. Method of model estimation

The estimation procedure used the 'Iterative Generalised Least Squares' (IGLS) method (Rasbash et al, 2004, p32). MLwiN starts the iteration procedure and experience in this investigation revealed that the model usually converged after around 3 to 4 iterations. MLwiN's default convergence criteria of '10^{-2}=0.01' (op cit) was used throughout the investigation.

4.5.8. Modelling issues

There are several issues relating to the choice of statistical package to be employed in the analysis. One is the disproportionately stratified sample. The second is its clustering. Separate weighting variables have been provided by the MCS development team which can be used when analysing MCS data from all countries in UK or when looking at constituent countries separately. These account for the oversampling of children in some of the strata. One statistical analysis software package which is suggested by the MCS development team to cope with this issue is STATA. STATA version 9 and later versions has a procedure that can accommodate such complex survey issues. In terms of clustered data, STATA also has procedures for multilevel analysis. However, the two procedures cannot be combined in STATA (at the time of this investigation). However, MLwiN does possess procedures able to cope with clustering of the data. This still leaves the issue of the complex survey design issue. An alternative method to cope with the complex survey issue, which will be used in this investigation, is to control for the stratification in the survey by using a categorical explanatory variable which contains a category for each strata by country. This also means the weights do not need to be used which can be problematic in MLwiN (Pfeffermann et al., 1998).

4.5.9. Levels within the multilevel model

How many models, levels in the multilevel model and in which order the explanatory variables are included in the model, will now be discussed. The modelling of each wellbeing outcome uses the same procedure. A two level model is used. The first level will be known as the 'child/family' level. Although this will be the formal name, explanatory variables appropriate for this level are not only directly related to the MCS child (such as age of the child or ethnicity) but indirectly through the family. There are around 230 twins and 10 sets of triplets in the study. There could be an argument for having the child at level one, the family at level two and the ward/sample point at level three in the model. However, the number of twins and triplets is very small compared to the overall size of the sample and therefore accounting for 'between' family clustering was not considered a significant issue. Therefore in this investigation for families with

twins and triplets, only one child for each family has been included. The method for choosing which child to use in these cases was by selecting the child with a child number of one from the variable used to identify children in families. It is not clear from the documentation whether children in these families were allocated child numbers randomly but with such small numbers it was not considered to be a significant issue and may have only affected a small number of child related factors. Level one will also include explanatory variables indirectly related to the child. These 'family' variables have already been mentioned but include such factors as the educational qualifications and age of the mother. Also included in level one child related variables are the first and second of three definitions of neighbourhood factors mentioned earlier in the thesis. To recap, the first definition was derived from the child's mother's subjective opinions of the areas in which they live (within a 20 minute walk). The second definition at this level is derived from the subjective opinions of the interviewers' concerning the streets on which the MCS children and their families live. The reasons for keeping these opinions at level one rather than aggregating individual respondents to create a ward based score was discussed earlier.

The second level in the model will be termed level two or 'sample point' level and all neighbourhood factors referred to earlier as the third definition will be included at this level. These factors include the 2001 census small area statistics for wards, the Stratum factor and the unobserved characteristics of the individual wards.

4.6. Modelling strategy for the wellbeing outcomes

4.6.1. Introduction

Two sets of multilevel models have been estimated for each of the four wellbeing outcome measures. The differences' between the two sets is the sample of children used. In the first set of models the sample will use children from all countries of the UK. This set only includes level one child/family factors and mothers'/interviewers' opinions of the local area. The second set of models uses a reduced sample of children from England and Wales only and these are estimated using factors at level one and two levels. These are the original level one factors already mentioned and the 2001 census small area statistics (level two).

The four dependent outcome indicators being examined in this investigation need to be transformed into standardised, continuous outcomes. For multilevel models with continuous dependent outcomes, according to Rasbash et al (2004) this method helps in the interpretation of the estimates as all scores can be compared to zero. The method employed for standardization is to transform the outcome into a 'z' score. This is achieved by subtracting the raw score from the mean and dividing this figure by its standard deviation. The mean of the new outcome variable will be zero and the standard deviation equal to one. Expressing all dependent factors as units of standard deviations means the coefficients are comparable across outcomes. Rasbash et al (2004) also suggest that continuous explanatory variables are mean centred, again to aid in interpretation.

The method of including the explanatory variables is similar to that used in normal regression through forward elimination. The strategy will be to include more and more factors in the model recording the impact on the child/family and sample variances as they are included. Level one factors followed by level two factors. The exception will be the Stratum factor for reasons which will be explained.

4.6.2. The 'Null' Model

Initially, a variance components model is fitted to identify whether there are spatial differences between sample points in their levels of the wellbeing outcome. This model will be termed the 'Null' model and is found below. The Intra Correlation Coefficient (ICC) will be used to measure the difference. Although this model does not usually contain any explanatory variables, an exception has been made in this investigation and it includes the child age. The reason for this is due to the use of age as an internal standardisation measure and was discussed earlier. The -2*LL for this model is recorded together with the level one and level two variances.

$$y_{ij} = \beta_{0ij}x_0 + \beta_1 Age_{1ij}$$

$$\beta_{0ij} = \beta_0 + u_{0j} + e_{0ij}$$

4.6.3. The 'Base' model

The next phase of the modelling is to estimate a Base model to which all others are compared. It contains the child's age at time of assessment variable from the Null model. The sample design explanatory factor 'Stratum' is also included which also provides one of the estimates of one of the definitions of neighbourhood. As explained earlier in the chapter, this design factor has been included to allow for the disproportionate nature of the selected sample. As also suggested earlier, this factor purports to reflect the advantaged, disadvantaged or ethnic minority characteristics of the areas in which the MCS children were sampled. However, it is noted that this is, in effect, a level two (sample point) variable in the multi-level hierarchy. Unfortunately, this factor has to be added at this stage. The main disadvantage is that the inclusion of this factor can (and does) account for a proportion of the variance found at level two. The strategy was to include level two factors *after* level one factor's. However, the results of this modelling show that the inclusion of the stratum factor in the base model can account for a large amount of the variance at the sample point level (σ^2_u) but only a minimal amount at child or level one. For this reason it is felt that it does not appear to affect the strategy greatly.

The -2*LL is recorded. A significant drop in the absolute value of this figure compared to the Null model's figure indicates the model is a better fit and is able to explain the differences in the child wellbeing outcome more effectively than the previous model.

4.6.4. Base and mothers' and interviewers' opinions of the local area

A logical step in the modelling would be to account for the child/family-related factors which may be associated with the wellbeing of the MCS child. However, in this investigation, the factors that characterise the local area in which the children live are estimated with Base model factors before going any further. Other research, as mentioned in the literature review, has found only limited evidence of associations between neighbourhood influences and various outcomes related to health or wellbeing. Most of the variation can be accounted for by individual level factors. The strategy employed here is to examine how associations between ecological factors and wellbeing

outcomes change during the modelling process. The aim is to identify which factors appear to be related to the outcomes before other controls are added. It is also important to discover what happens to these factors when they are combined with other significant neighbourhood factors.

In the first set of models (UK wide sample), the two perception definitions of neighbourhood are tested (although the Stratum definition is included (but not reported) to account for the sample design). Firstly, the mothers' and interviewers' opinions of the local area are included with the Base model factors individually. The estimates for each factor are then recorded. Ecological factors found to be significant are set aside ready for inclusion in the modelling after the child/family factors' have been included. For the second set of models, that use the England and Wales' sample only, the 2001 census small area statistics are also be estimated separately.

4.6.5. Base and child/family explanatory factors model

The next stage in the strategy is to include the child/family level one factors in the model with Base model factors. Initially, each child/family factor will be estimated in the model separately. All these factors are categorical variables and therefore, although the factor may be significant, some of the individual categories may not be different to the comparison category. In this case, the insignificant categories have been re-coded and included with the comparison category and the factor re-estimated. Any significant child/family factors will then be included in a model together. This will become the child/family model. The one exception to the re-coding of categories within factors will be for the Stratum factor. Even though some categories for this factor may not have become significantly different to the comparison category during the estimation process, they are all included separately. This is done to provide more information about the influence of other factors on this particular one and effectively controls for the nature of the survey design. The -2*LL figure is compared to the Base model figure. There is likely to be a significant drop as child/family factors have been shown to be able to account for differences in child wellbeing.

4.6.6. Base, child/family and mothers' and interviewers' opinions of the local area model

In the first set of models, the Base and child/family factors model are used. Each significant mothers' and interviewers' opinions of the locality found to be significant with the Base model are now included in the Base and child/family factors model individually. Any that are found to be still significant are included together in the model. When these factors are included together, some may become insignificant (their estimates are more than twice their standard errors). The likely explanation for insignificance of these factors is due to being correlated, either with one another or other factors or that they are just not important. In any case, these factors will be dropped from the model. Any level one ecological area factors that remain significant when included in the model together with the Base and Child/Family factors are saved as the full model in the first set (UK sample) of models. However, any mothers' and interviewers' opinions of the local area that were found to be significant when included individually but dropped out when included with others have had their estimates recorded. This information is still important as they do provide an insight into the neighbourhood characteristics that appear to influence a child's wellbeing and to be correlated with individual level information.

4.6.7. All child/family, subjective neighbourhood opinions and 2001 census factors model

In the second set of models using England and Wales' only, the same procedure as above is used. However, after the Base, child/family and mothers' and interviewers' opinions of the local area model have been estimated, a further model is estimated. Using all the factors in this last model, the 2001 census small area factors are entered individually. Again, any found to be significant are included in the model together. Any factors that remain significant after this are included in the full model for this set of models. As explained before, some census factors that are significant individually but not so when included with others may be correlated with one another. Their estimates are recorded and discussed as they are still important.

4.7. Conclusion

MCS and census data will be used to investigate differences in child wellbeing and to identify whether neighbourhood factors can account for any variations found, over and above the geographical variation in individual level predicators. Whether 'where' they live 'makes' rather than 'marks' a difference in the children's wellbeing is explored. The next chapters present the results of the analysis conducted in relation to the two cognitive indicators and the ones that look at the behavioural and physical indicators.

5. Chapter Five – Neighbourhoods and cognitive wellbeing

5.1. Introduction

This chapter reports the first of two sets of results of statistical analysis on the relationship between neighbourhood characteristics and the wellbeing of MCS children. It concentrates on the cognitive dimension of the MCS child's wellbeing as measured using the School Readiness Composite of the Revised Bracken Basic Concept Scale (Bracken, 2002a) and a subtest of the scales the British Ability Scales (BAS), the Naming Vocabulary Assessment (MCS Team, 2006). The children were approximately 3 years old of age when assessed at the second sweep of the MCS. The School Readiness scale was used to measure the understanding of basic concepts which are relevant to the child's educational development whereas the Naming Vocabulary Assessment assesses the expressive language skills of the MCS children.

Two sets of results are presented for each cognitive outcome. Firstly, analysis was conducted using the sample drawn from all MCS children the UK. As mentioned in Chapter Four, the UK sample was to be used to model the child/family explanatory factors together with the mothers' and interviewers' opinions of the neighbourhood. The second set of models was to use a sample of children in England and Wales only and those factors mentioned in the first set of models plus 2001 electoral ward census factors.

5.2. Results of UK MCS sample School Readiness and Naming Vocabulary Cognitive outcomes

As Table 5.1 shows the sample size for the UK School Readiness analysis was 13,039 children. The Naming Vocabulary analysis was 14,073.The raw School Readiness score has a mean of 25.06 and standard deviation of 13.61. The scores range from 0 to 88. The Naming Vocabulary score has a mean of 16.65, a range of 0 to 30 and a standard deviation of 4.79. However, to improve comparability both the raw outcomes scores

have been transformed into 'Z' scores resulting in a mean of 0 and standard deviation of 1.

Neither assessment scores are age standardised before including in the model but age of the child is included in all models as a controlling factor. Descriptive analysis of the general sample can be found in Appendix 1. Proportions in each of the factor categories vary little between all outcomes examined and therefore the School Readiness outcome sample has been used to provide an overview of these figures to reduce repetition of figures.

Table 5. 1 - Cognitive outcomes: UK sample descriptive analysis

	School Readiness	**Naming Vocabulary**
Sample size	13,039	14,073
Mean	25.06	16.65
Standard deviation	13.61	4.79
Min and Max	0-88	0-30

5.2.1. Cognitive outcomes: UK sample - Null model

The first model to be estimated is the Null model, also known as the variance components model. The Null model helps to identify whether the neighbourhoods (and in this case, wards or strictly speaking, the sample points) in which the MCS sample children live differ in their mean School Readiness scores. As noted this model includes the child's age in days at the time of the School Readiness assessment. Table 5.2 shows, that for the School Readiness analysis, children are associated with the equivalent to 0.1 of a standard deviation (SD) higher scores for every month of older age and 0.07 SDs for the Naming Vocabulary. The numbers in brackets are the standard errors. In this analysis, as mentioned in Chapter Four, individual factors and categories within factors are, as a rule of thumb, considered to be significant if the estimate is more than twice the standard error. The child age factor is expressed to 4 places after the decimal point as the factor is measured in days. Changes in the child's age estimate may be very slight

as more factors are included in the model and may not be identified if only 3 decimal places are reported.

Table 5.3 shows that a large proportion of the differences in scores between children can be explained by the characteristics related to the children themselves. The child variance estimates for both cognitive scores are substantially larger than the ward variances.

The ward intra correlation coefficient (ICC) is 13.4%. This is the total variance in the School Readiness score that can be accounted for by the differences between wards in their characteristics. In the Naming Vocabulary this is 13.7%. These differences are associated with as yet undetermined ward characteristics that differ between electoral wards. These figures suggest that further exploration of ward based neighbourhood characteristics is appropriate.

Table 5. 2 - Cognitive outcomes: UK sample - Null model estimates

Variables	**School Readiness β**	**Naming Vocabulary β**
Child's age in days	0.0034 (0.0001)	0.0023(0.0001)

Table 5. 3 - Cognitive outcomes: UK sample - Null model - Ward and child level

	School Readiness scores			**Naming Vocabulary scores**		
Model	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Null	0.125 (0.011)	0.807 (0.010)	34881.950	0.127(0.011)	0.798(0.010)	37454.390

5.2.2. Cognitive outcomes: UK sample -Base model

The next stage in the model is to include a factor to control for the disproportionate stratified design of the MCS survey, which was discussed in Chapter Four.

The Base model includes the child's age at the assessment and the survey design factor, the Stratum factor.

The addition of the survey design factor helps to explain some of the variation between the wards in terms of cognitive scores. Table 5.4 shows that the between ward variance for both outcomes drops by nearly half after the inclusion of the stratum factor. The child level variation has not decreased. For the score the ward variance reduction compared to the Null model is considerably lower (38.40%) than for the Naming Vocabulary (65.35%). This reveals that some of the child level variance is also explained by country or type of ward.

To assess the fit of the model, the deviance Test is employed. This is the difference between the '-2 twice the maximum log likelihood figure' (-2*LL) obtained from the Null model and the Base model. In both outcomes the Base model is a statistical significant improvement on the Null as the reduction in -2*LL is significant based upon a chi square with $p<0.05$.

It should be noted that the Stratum factor is considered a level two ward factor. It has to be placed into the model at this stage due to the requirement to control for the survey design but it also characterises the wards in terms of levels of advantage, disadvantage and for England only, ethnicity. Table 5.5 shows the estimates for the Stratum categories. The England Advantaged Stratum is used as the comparison group. In summary, for the School Readiness score, all other strata are significantly associated with lower child scores apart from the Scotland Advantaged stratum which is not significant different from England Advantaged wards. In the Naming Vocabulary, only the Disadvantaged Stratum wards in England, Wales, and Northern Ireland together with the England Ethnic Minority Stratum are significantly different and negatively so. Children in these ward strata have lower scores. Children in the England Ethnic Minority Stratum have the lowest scores. The estimate is higher in the Naming

Vocabulary analysis for the Ethnic Minority Stratum than in the School Readiness. The child's age estimates have not changed for either outcome.

Table 5. 4 - Cognitive outcomes: UK sample - Base model variances

	School Readiness scores			Naming Vocabulary scores		
Model	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Base	0.077 (0.008)	0.807 (0.010)	34740.810	0.044(0.005)	0.799(0.010)	37170.540
Reduction from Null model	38.40%	0.00%	141.140	65.35%	-0.13%	283.85

Table 5. 5 - Cognitive outcomes: UK sample - Base model estimates

Variables	**School Readiness β (s.e)**	**Naming Vocabulary β (s.e)**
Child's age in days	0.0034 (0.0001)	0.0023(0.0001)
Stratum-(England advantaged)		
England Disadvantaged	-0.358(0.049)	-0.326(0.040)
England Ethnic	-0.701(0.077)	-1.180(0.061)
Wales Advantaged	-0.214(0.077)	-0.044(0.063)
Wales Disadvantaged	-0.305(0.057)	-0.259(0.047)
Scotland Advantaged	0.090 (0.067)	0.095(0.055)
Scotland Disadvantaged	-0.251(0.070)	-0.095(0.055)
Northern Ireland Advantaged	-0.216(0.078)	0.008(0.065)
Northern Ireland Disadvantaged	-0.528(0.064)	-0.219(0.053)

5.2.3. Cognitive outcomes: UK sample - Base model plus mothers'/interviewers' opinions of neighbourhood only models

Subjective reports provided by the mothers and the interviewers that characterise the children's neighbourhood are now included in the Base model. A more usual modelling strategy here might be to control for other child related factors before estimating the subjectively defined neighbourhood factors. The opportunity has been taken to estimate the neighbourhood factors before the inclusion of child and family related factors to show whether associations exist before other controls are included. Other research has shown that neighbourhood-related factor associations tend to be small and can therefore go unreported as they drop out of models as a result.

Eight factors related to the mothers' and interviewers' opinions have been included in the Base model individually and significance of each of the models estimated. Each model is judged to be an improvement compared to the Base model if there is a significant reduction in the -2*LL statistic. Table 5.6 and Table 5.7 show the estimates for each neighbourhood factor tested with the Base model factors. The -2*LL statistics are not reported for each subjective neighbourhood factor model. However, during the analysis it was noted that a significant difference between the subjective neighbourhood report model and the Base model corresponded with the neighbourhood report factor being tested also being significant (the estimate being more than twice its standard error).

In the School Readiness analysis, Table 5.6 shows when the mothers' opinions of their neighbourhood are estimated by themselves with Base model factors, common problems with noise, rubbish, racial insults and vandalism are associated with lower child School Readiness scores. A lack of play areas for children also has a negative association. Similar significant results were found for the Naming Vocabulary score, but with the addition of common pollution problems are also associated with lower scores. Issues with access to shops and satisfaction with the area were not significant factors in either cognitive outcome results.

Before the modelling of these subjective reports, an indicator of whether the family had moved address since the first sweep was investigated. This was included as some

respondents had moved and may not have been exposed in a similar way or for the same time to the particular neighbourhood environment. However, this factor was not found to be significant. It would appear here that it does not matter to children's cognitive scores whether they had lived in the area since the sweep one interview or had moved into it or out during that time.

Table 5.7 shows the modelling results for the interviewers' opinions of streets on which the cohort children and families live at sweep two. For the School Readiness analysis, all the factors are significantly associated with lower child scores except for traffic volume. Similar significant results were found for the Naming Vocabulary analysis except that the common presence of security blinds and traffic calming measures are not significant factors.

In summary, at this stage of the analysis, common problems in the neighbourhood relating to environmental and social issues are associated with lower child cognitive scores. Neighbourhood factors that were found to be significant will be included in further models. The next step in the modelling is to see whether these associations are independent of variation at the individual level or can be explained other child or family related factors.

Table 5. 6 - Cognitive outcomes: UK sample - Mothers' opinions of neighbourhood estimates

	School Readiness β (s.e)	**Naming Vocabulary β (s.e)**
Satisfaction with area (very or fairly satisfied)		
Very of fairly dissatisfied	0.008(0.033)	0.044(0.031)
Neither satisfied nor dissatisfied	-0.020(0.032)	0.040(0.030)
Noise in the area (not very common)		
Very or fairly common	-0.143(0.023)	-0.112(0.022)
Rubbish in the area (Not very common)		
Very or fairly common	-0.099(0.019)	-0.060(0.018)
Vandalism in the area (Not very common)		
Very or fairly common	-0.121(0.021)	-0.064(0.020)
Racial insults in area (Not very common)		
Very or fairly common	-0.134(0.038)	-0.080(0.036)
Access to shops (Not very common)		
Very or fairly common	-0.030(0.024)	-0.005(0.023)
Pollution in the area (Not very common)		
Very or fairly common	0.025 (0.021)	0.057(0.020)
Play areas in the locality (Yes)		
No places to play	-0.131(0.018)	-0.098(0.017)

Table 5. 7 - Cognitive outcomes: UK sample - Interviewers' opinions of neighbourhood estimates

	School Readiness β (s.e)	Naming Vocabulary β (s.e)
Street conditions (good or fair)		
Not good	-0.343(0.034)	-0.283(0.032)
Security blinds in shops (none or only some)		
A lot	-0.251(0.072)	-0.132(0.070)
Traffic calming measures (No Measures)		
Measures	-0.055(0.021)	-0.034(0.020)
Traffic volume (No, little or moderate traffic)		
Heavy traffic	0.031(0.035)	-0.004(0.034)
Litter (None or virtually no litter)		
Some or a lot of litter	-0.130(0.045)	-0.393(0.043)
Dog mess (None or little)		
A lot or some	-0.310(0.033)	-0.172(0.031)
Fighting in the street (1, 2,3 or 4 people seen fighting)		
No one on the street or no hostility	-0.372(0.090)	-0.275(0.085)
Interviewer feels safe (Feel safe up to feel comfortable)		
Uncomfortable up to feel for safety	-0.397(0.027)	-0.351(0.026)
Graffiti (No or little graffiti)		
A lot of graffiti	-0.288(0.028)	-0.213(0.026)
Vandalism (No signs of vandalism)		
Signs of vandalism	-0.320(0.037)	-0.207(0.035)

5.2.4. Cognitive outcomes: UK sample - All level one child/family related factors model (including mothers' and interviewers' opinions of neighbourhood)

The next stage of the modelling was to include all significant level one child/family and significant mothers' and interviewers' opinions of the neighbourhood factors in one model. The child/family factors would then act as controls to see whether the neighbourhood factors remained independently significant. Initially, all child/ family factors were estimated individually with the Base model factors. Any significant factors were then kept in the model. The neighbourhood factors were then placed into model with all significant child/family factors. The results for this final model for the UK sample analysis can be seen in Tables 5.8, 5.9, 5.10 and 5.11. It should be noted that in the following discussion, when individual factors estimates are detailed, the phrase 'all else being equal' should apply, in other words, the factors have been estimated with all other factors controlled for.

Firstly, compared to the Base model, the inclusion of the child/family and neighbourhood factors has reduced the variation at the ward and child level. Table 5.8 shows, that for the School Readiness score, there has been a 40.26% reduction in the ward level variance and 19.58% reduction in the child level variance from the Base model. The reduction was higher for the Naming Vocabulary analysis, with the ward variance reduction being 63.64% and 20.65% for the child level variance. Child/family and neighbourhood factors were able to explain a fair proportion of the differences between children in their cognitive scores. It should be noted that including the neighbourhood variables has significantly improved both the cognitive scores models compared to a model with individual child and family factors only and is shown in Table 5.8.

Table 5.9 shows the fullest model possible with the UK data. It finds that the child's age estimate increases very slightly for both cognitive outcomes compared to the Base model by 0.0004 for the School Readiness score and 0.0003 for the Naming Vocabulary score. It would appear that as all individual factors are accounted for in the model, the child's age (or the time when assessed) becomes more important. Children who were a

few months older at assessment are now associated with even higher scores although the difference is small. One notion to help explain these results is that children from less privileged backgrounds seem to have been interviewed later, distorting the age effects until child/family characteristics are controlled for.

The inclusion of child/family and neighbourhood factors appears to reduce the influence of the Stratum factor characteristics. The remaining significant strata are all associated with lower children's School Readiness scores. Table 5.10 shows the England Ethnic Minority stratum (-0.177(0.064)) has a reduction in estimate of 74.75% from the Base model; Wales Advantaged (-0.160(0.063)) a 25.23% reduction; Northern Ireland Advantaged (-0.168(0.063)) a 22.22% reduction and Northern Ireland Disadvantaged (-0.214(0.053)), a 59.47% reduction. These wards' general characteristics of either disadvantage or ethnicity still appear to play an important role in explaining some of the lower scores in the School Readiness assessment at age 3.

In the child Naming Vocabulary score analysis, Table 5.11 shows that only the England Ethnic Minority (-0.238(0.047)) Stratum remains significantly different to the England Advantaged with a 79.83% reduction from the Base model. Children in these wards still do worse after allowing for the other terms to be included in the model. The estimate has been reduced by around 5 times. Child, family and neighbourhood factors are able to explain a substantial amount of the differences between wards. It is unclear what other factors might be important for children in Ethnic Minority wards. Interestingly, children in the Scotland Advantaged (0.085(0.040)) wards now do significantly better than the comparison group.

The next section concentrates on the 'level one' child/family estimates in multiple multilevel regressions shown in Table 5.9 which holds other included terms constant. In the School Readiness analysis, compared to White children, Pakistani/Bangladeshi (-0.339(0.048)) and Black children (-0.219(0.051)) had lower scores. The Mixed, Indian and Other's groups were not significantly different from White children.

Dissimilar finding were seen for Naming Vocabulary. Bangladeshi/Pakistani (-0.629(0.049)), Indian (-0.228(0.056)), Black (-0.329(0.048)) and Others' (-0.508(0.047)) groups all associated with significantly lower scores. Ethnicity appears to play an important role in cognitive scores, with most of the minority groups doing

less well than White children. The differences are more striking in the Naming Vocabulary analysis. Bangladeshi/Pakistani children do particularly less well in this score.

Girls have better cognitive scores. Compared to boys, in the School Readiness analysis, girls (0.195(0.014)) scored on average better and in the Naming Vocabulary analysis the estimate was 0.218(0.014).

In terms of low birth weight and preterm birth, both factors were found to have negative association with School Readiness scores. Only birth weight was related to the Naming Vocabulary score, all else being equal. Low birth weight recorded as being less than 2.50 kg. In the School Readiness score, low birth weight children (-0.108(0.036)) had slightly lower scores. The estimate was -0.145(0.029) in the Naming Vocabulary.

A similar result was found with preterm children in the School Readiness analysis. A child that was born before it reached the calculated gestation date was defined as a pre-term birth. Pre-term babies (-0.107(0.033)) achieved lower scores.

Long term health problems of the child were an important factor in determining Naming Vocabulary scores. Compared to having no problems, those who did had lower scores (-0.046(0.019)).

Having one sibling at sweep two was associated with lower (-0.144(0.018)) School Readiness scores than having none. The estimates become progressively lower as the number of siblings increases. A similar story is seen for Naming Vocabulary. The estimates increased from -0.090(0.017) for one sibling, -0.224(0.022) for two, -0.294(0.031) for three and -0.408(0.042) for four or more siblings.

The mother's mental health, age, and education were found to be associated with the child's cognitive scores. Children whose mothers were depressed or had serious anxiety problems had lower School Readiness scores (-0.048(0.016)). However, this factor is not significant in the Naming Vocabulary score.

Compared to mothers under 20 when their child was born, children of older mothers had better cognitive scores. Mothers aged 20-24 were associated with higher scores with estimates of 0.112(0.031). The estimates got progressively higher with the mother's age, with those aged 25-29 having estimates of 0.215(0.031) and those aged 30-34

(0.259(0.033)). The estimates reduced slightly for those aged 35-39 (0.212(0.036)) but then increased again for those over 40 (0.246(0.058)).

For the Naming Vocabulary, the results were slightly different. Mothers aged 20-24 were not significantly different from those under 20. Again, there was a similar theme of generally better scores with increasing age. Higher estimates were recorded up to the ages of 30-34 (0.141(0.021)) which then lowered slightly and then increased for those aged over 40 (0.210(0.049)).

The hypothesis that the higher the academic qualifications achieved by the mother, the better the child's cognitive scores is borne out. In the School Readiness score, the comparison group is mothers who had degrees or higher qualifications. Children whose mother's highest qualification was A' levels (-0.125(0.028)), O'levels (-0.197(0.021)), GCSE's graded D to G (-0.329(0.030)), with other qualifications (-0.311(0.053)) or none of the aforementioned qualifications (-0.321(0.028)) were associated with lower scores.

Similar results were seen in the Naming Vocabulary analysis. Children whose mothers highest qualification was A' levels had estimates of -0.109(0.026), those with O' levels -0.172(0.019), those with GCSE's graded D to G -0.268(0.028), those with other qualifications -0.425(0.050) and with none of the above qualifications -0.356(0.026) were all associated with lower scores.

Educational inputs provided by the family around the time of the cognitive assessments were considered important factors in explaining the differences between children in their cognitive wellbeing. Three indicators were examined which were thought to have an influence. These included the amount of time spent reading with the child and whether they taught their child the alphabet and counting numbers. Findings showed that the less time spent reading or teaching the alphabet went with lower cognitive scores. Time on counting was not a significant factor, all else being equal.

More time spent reading to the child by the mother was associated with higher cognitive scores. In the School Readiness analysis, compared to the child being read to every day, those read to less often achieve lower scores. Children read to several times per week (-0.186(0.019)), once or twice per week (-0.242(0.022)), once or twice per month

(-0.285(0.046)) and less often than that (-0.329(0.053)), all did less well. Finally, children who were not read to at all (-0.448(0.048)) had the lowest scores.

For the Naming Vocabulary, similar results were recorded. Children read to several times per week (-0.156(0.018)), once or twice per week (-0.270(0.020)), once or twice per month (-0.246(0.044)), less often (-0.352(0.050)) and not at all (-0.561(0.045)) all did less well compared to be being read to everyday.

In terms of being taught the alphabet, in the School Readiness analysis, compared to those whose families who did teach their child, children who were not taught did less well (-0.219(0.019)). The estimate was smaller than in the Naming Vocabulary analysis but not being taught the alphabet was associated with lower scores (-0.093(0.018)).

The speaking of English at home was also thought to have an important influence on the child's ability in the cognitive assessments. In the School Readiness analysis, compared to those homes where English only was spoken, children from homes where English *and* other languages (-0.076(0.031)) were spoken had lower scores. For those children in homes where no English was spoken, only other languages, the child did even less well (-0.194(0.055)). This factor was more important in the Naming Vocabulary scores. In those homes where English *and* other languages were spoken, the children did considerably less well (-0.404(0.033)). In those homes where no English was spoken, children had even lower scores (-0.706(0.054)).

The next group of characteristics thought to be associated with child cognitive scores related to the families' socio-economic status, annual income and housing tenure. Higher social status, income and better housing were found to be associated with higher child cognitive scores.

The family social economic class was defined as being the higher of either the mother's or the father's socio-economic classification (NS-SEC 2000, Rose 2000). This factor was derived using a five category variable which summarises the complete classification. In the School Readiness analysis, compared to those families defined as being Professionals and Management, children from all other family classifications did less well. The Intermediate (-0.079 (0.025)), Small employer and self-employed (-0.146(0.029)), Lower supervisory and technical (-0.155(0.031)) and Semi-routine categories (-0.144(0.025)) were all associated with lower scores. Children in families

with no NSSEC recorded (-0.205(0.026)) were associated with scores 0.2 of a SD lower than the comparison group. Further analysis of this latter group using other economic activity related information revealed that they are nearly all workless couple or lone parent families.

In the Naming Vocabulary analysis, the children in the Lower Supervisory and Technical (-0.092(0.027)) group, Semi routine (-0.068(0.021)) and No NSSEC (-0.137(0.022)) were also associated with lower scores. The other categories were not significantly different to the comparison group.

In terms of economic resources in the family, higher family incomes were associated with better cognitive scores. In the School Readiness analysis, couple family income £11-22,000, all lone parent incomes and couple or lone parent family income missing are in the comparison group. Children in married or cohabiting couple family with incomes between £22,000 and 33,000 (0.041(0.021)) did better than the comparison (all other) groups. Those in couple family with £33,000 -55,000 (0.084(0.024)) were associated with higher scores. Those in couple family with over £55,000 have the highest scores (0.149(0.035)).

In the Naming Vocabulary analysis, the comparison group was those couple family income £55,000 plus, all lone parent incomes and couple or lone parent family income missing. There was a similar story at the middle income level as for School Readiness. Those children in couple family with income of between £22,000 and 33,000 (0.053(0.019) did better than the comparison group as did those with £33,000-55,000 (0.068(0.021) incomes. Children in low income couple families did less well than the comparison group (-0.074(0.026).

As mentioned earlier, housing tenure was thought to explain the children's cognitive scores. Children whose families lived in some form of rented accommodation had poorer School Readiness scores. The comparison group was all other groups but mainly comprised home owners (with mortgage or not). Children whose families had shared equity tenancies, rented from the local authority or were housing association tenants did less well (-0.139(0.023)) as did children whose families rented privately (-0.128(0.030)).

On Naming Vocabulary, children whose families had shared equity tenancies, or rented from the local authority or housing association tenancies had lower scores (-0.127(0.021)) as did those who rented privately whose families who were living with parents or squatting.

Another set of factors related to the conditions in which the family lived concerned the physical condition of the home. These included dampness or levels of condensation in the home, the presence of central heating and whether someone smoked in a room the child used. Compared with no one smoking in a room used by the child, children in families where this did occur had lower School Readiness (-0.107(0.020)) and Naming Vocabulary scores (-0.065(0.019)). All else being equal, dampness and central heating were not significant factors in either analysis.

In terms of child/family related factors, which sweep the child entered the MCS was used as a controlling factor. This factor was also included to help control for sweep two entrants who may have had information missing for a number of factors measured at sweep one. The factor was not significant in the School Readiness analysis (although it was kept in the model for methodological purposes). However, this factor was significant in the Naming Vocabulary analysis with those entering the study at sweep two doing less well (-0.205(0.039)).

Finally, in terms of child/family related factors, a number of other variables were found to be not significant when placed in the model. A migration indicator was included in the modelling. This was to see if children who moved ward since the first sweep differed in their results compared to those who did not. This term was not significant in either of the cognitive outcomes. An urban/rural indicator was also found to be insignificant. Also, if the child had lived in a lone parent family when born and continued to live in this situation by the time of the second survey, they did less well but the variable dropped out later in the full UK model. Mothers' and interviewers' opinions of the neighbourhood factors

Most of these factors were not significant when child/family variables were controlled for. In fact, none of the mother's opinions of the neighbourhood were significant but a few of the significant interviewers' opinions of the streets which are purported here to be proxies for the local neighbourhood were shown to be significant. The finding on

mothers' opinions is interesting. It may be that the other family factors including such as socio-economic status are reflecting something that the mothers' feel about the area or it is being picked up in the mothers' mental health factor.

In the School Readiness full model, the presence of a lot of dog-mess (-0.064(0.031)) was associated with lower School Readiness scores. Also the interviewer scores ranging from 'feeling unsafe' to 'feeling for safety' was also associated with lower scores (-0.066(0.026)).

In terms of Naming Vocabulary, a lot of litter (-0.143(0.039)) was associated with lower scores.

Table 5. 8 - Cognitive outcomes: UK sample – Child/family and interviewers' opinions of the neighbourhood variances

	School Readiness scores			Naming Vocabulary scores		
Model variances	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Individual factors plus neighbourhood factors	0.046 (0.005)	0.650 (0.008)	31808.670	0.016(0.003)	0.634(0.008)	33761.220
Individual factors only	0.046 (0.005)	0.649 (0.008)	31821.840	0.016(0.003)	0.635(0.008)	33774.820
Reduction from Null model	63.20%	19.58%	3073.28	87.40%	20.55%	3693.17
Reduction from Base model	40.26%	19.58%	2932.14	63.64%	20.65%	3409.32

Table 5. 9 - Cognitive outcomes: UK sample – Child/family and interviewers' opinions of the neighbourhood

Variables and categories	School Readiness β (s.e)	Naming Vocabulary β (s.e)
Variables		
n	**13,039**	**14,073**
Child's age	0.0038(0.0001)	0.0027(0.0001)
Stratum (England advantaged)		
England disadvantaged	-0.061(0.040)	-0.042(.0029)
England Ethnic	-0.177(0.064)	-0.238(0.047)
Wales advantaged	-0.160(0.063)	0.027(0.046)
Wales disadvantaged	-0.016(0.047)	0.016(0.035)
Scotland advantaged	0.108(0.055)	0.085(0.040)
Scotland disadvantaged	-0.057(0.057)	0.053(0.042)
Northern Ireland advantaged	-0.168(0.063)	0.009(0.048)
Northern Ireland disadvantaged	-0.214(0.053)	0.002(0.040)
Child's gender (Male)		
Female	0.195(0.014)	0.218(0.014)
Child's ethnicity (White, mixed, Indian and other)		
Bangladeshi and Pakistani	-0.339(0.048)	-0.629(0.049)
Indian		-0.228(0.056)
Black	-0.219(0.051)	-0.329(0.048)
Other		-0.508(0.074)
Low birth weight (No)		
Yes	-0.108(0.036)	-0.145(0.029)
No of siblings (None)		

1	-0.144(0.018)	-0.090(0.017)
2	-0.290(0.023)	-0.224(0.022)
3	-0.395(0.033)	-0.294(0.031)
4 or more	-0.459(0.045)	-0.408(0.042)
Pre-term baby(No)		
Yes	-0.107(0.033)	
Child long-term health problems (No)		
Yes		-0.046(0.019)
Mother's age (Under 20)		
20-24	0.112(0.031)	
25-29	0.215(0.031)	0.107(0.020)
30-34	0.259(0.033)	0.141(0.021)
35-39	0.212(0.036)	0.128(0.026)
over 40	0.246(0.058)	0.210(0.049)
Mother depressed (No)		
Yes	-0.048(0.016)	
Smoking in room child inhabits (No)		
Yes	-0.107(0.020)	-0.065(0.019)
NS SEC (Professional and managerial)		
Intermediate	-0.079(0.025)	
Small employer & self employed	-0.146(0.029)	
Lower supervisory & technical	-0.155(0.031)	-0.092(0.027)
Semi routine	-0.144(0.025)	-0.068(0.021)
No NS SEC	-0.205(0.026)	-0.137(0.022)
Mother's highest education qualifications (Degree or higher)		
A-levels	-0.125(0.028)	-0.109(0.026)
O-Levels	-0.197(0.021)	-0.172(0.019)
GCSE d to g	-0.329(0.030)	-0.268(0.028)
Other qualifications	-0.311(0.053)	-0.425(0.050)
None of the above	-0.321(0.028)	-0.356(0.026)

Qualifications missing	-0.444(0.164)	
English spoken at home (English only)		
Yes, English & others	-0.076(0.031)	-0.404(0.033)
No, other only	-0.194(0.055)	-0.706(0.054)
Mother reads to child (Everyday)		
Several times per week	-0.186(0.019)	-0.156(0.018)
Once or twice per week	-0.242(0.022)	-0.270(0.020)
Once or twice per month	-0.285(0.046)	-0.246(0.044)
Less often	-0.329(0.053)	-0.352(0.050)
Not at all	-0.448(0.048)	-0.561(0.045)
Mother teaches alphabet at home (Yes)		
No	-0.219(.019)	-0.093(0.018)
Family income SR-(Couple family income £11-22,000, all lone parent incomes and Couple or lone parent family income missing) NV-(Couple family income £55,000 plus, all lone parent incomes and Couple or lone parent family income missing)		
Couple family income £0-11,000		-0.074(0.026)
Couple family income £22,000.01-33,000	0.041(0.021)	0.053(0.019)
Couple family income £33,000.01-55,000	0.084(0.024)	0.068(0.021)
Couple family income £55,000 plus	0.149(0.035)	
Housing tenure (Own with mortgage or own outright or live with parents rent free or squatting or other)		
Shared equity, rent from local authority and housing association	-0.139(0.023)	-0.127(0.021)
Rent privately	-0.128(0.030)	-0.091(0.029)
Live with parents rent free		-0.104(0.044)
Squatting		-0.168(0.078)
Sweep entered study (sweep 1)		
Sweep2	-0.221(0.167)	-0.205(0.039)

Interviewer opinion of dog-mess on street (Little or no dog-mess and dog-mess missing category)		
A lot or some dog-mess	-0.064(0.031)	
Interviewers' opinion of litter on streets (No or virtually litter or information missing)		
A lot of litter on streets		-0.143(0.039)
Interviewer opinion of feeling safe on street (Feel safe up to feel very comfortable and missing)		
Uncomfortable up to feel for safety	-0.066(0.026)	

Table 5. 10 - Table 5.9 - School Readiness outcome: UK sample analysis - reductions/increases in stratum factor variation

Model description	Base–With child's age and stratum	Base and child/family, mother's/interviewers' opinions of neighbourhood factors	%age reduction/increase in variance between 2 models
England Disadvantaged	**-0.358(0.049)**	-0.061(0.040)	
England Ethnic	**-0.701(0.077)**	**-0.177(0.064)**	74.75% reduction
Wales advantaged	**-0.214(0.077)**	**-0.160(0.063)**	25.23% reduction
Wales disadvantaged	**-0.305(0.057)**	-0.016(0.047)	
Scotland advantaged	0.090 (0.067)	0.108(0.055)	
Scot disadvantaged	**-0.251(0.070)**	-0.057(0.057)	
NI advantaged	**-0.216(0.078)**	**-0.168(0.063)**	22.22% reduction
NI disadvantaged	**-0.528(0.064)**	**-0.214(0.053)**	59.47 % reduction

1. The bold categories denotes that the estimate was significantly different (the estimate is more than twice its standard error) to the England Advantaged category.
2. Percentage reduction in variance only calculated if categories are significant in both models.

Table 5. 11 - Naming Vocabulary outcome: UK sample analysis - reductions/increases in stratum factor variation

Model description	Base and child's age and stratum	Base and child/family, mother's/interviewers' opinions of neighbourhood factors	% reduction/increase in variance between 2 models
England Disadvantaged	**-0.326(0.040)**	-0.042(.0029)	
England Ethnic	**-1.180(0.061)**	**-0.238(0.047)**	79.83% reduction
Wales advantaged	-0.044(0.063)	0.027(0.046)	
Wales disadvantaged	**-0.259(0.047)**	0.016(0.035)	
Scotland advantaged	0.095(0.055)	**0.085(0.040)**	
Scot disadvantaged	-0.095(0.055)	0.053(0.042)	
NI advantaged	0.008(0.065)	0.009(0.048)	
NI disadvantaged	**-0.219(0.053)**	0.002(0.040)	

1. Bold categories denotes that the estimate was significantly different (the estimate is more than twice its standard error) to the England Advantaged category.
2. Percentage reduction in variance only calculated if categories are significant in both models.

5.3. Cognitive modelling using 2001 electoral ward level census small area statistics: England and Wales.

As explained in the Chapter Four, 2001 electoral ward level data with MCS data is only available for those children living in England and Wales. Therefore in the forthcoming set of models the same procedure is repeated as were estimated for all the UK countries but this time, the sample is restricted to those in England and Wales and a further model is estimated to include 2001 electoral ward small area factors. After estimating each electoral ward 2001 census (level two) factors separately with the Base model factors, any that were significant were included in the model that included significant child/family and other level one neighbourhood factors.

The sample size has now dropped by 2,869 to 10,238 from 13,099 in the UK sample for the School Readiness score. The Naming Vocabulary sample has dropped by 3,026 from 14,073 to 11,047.

5.3.1. Cognitive outcomes: England and Wales sample – Null model

As Table 5.12 identifies, 12.6% (C.I.I) of the variance in School Readiness scores could be accounted for by the differences between neighbourhoods in the England and Wales sample. Compared to the UK sample variance, this was lower (UK 13.4%). This was higher for the Naming Vocabulary model at 15.6% which was also higher than the UK sample result (13.7%).

The Naming Vocabulary intercept is slightly lower than for the School Readiness analysis. Associations between the age of the child and the cognitive outcomes vary only slightly between the two outcomes. Age seems to have a higher positive association in the School Readiness score than in the Naming Vocabulary as in the UK sample in Table 5.3.

Table 5. 12 – Cognitive outcomes: England and Wales sample - Null model variances

	School Readiness scores			Naming Vocabulary scores		
Model	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Null	0.117 (0.012)	0.806 (0.011)	27314.290	0.144(0.015)	0.791(0.011)	29290.270

Table 5. 13 - England and Wales cognitive sample - Null model estimates

Variables	**School Readiness β (s.e)**	**Naming Vocabulary β (s.e)**
Child's age in days	0.0035 (0.0001)	0.0022(0.0001)

5.3.2. Cognitive outcomes: England and Wales sample – Base model

The Base model contains the sample design control factor (Stratum) and neighbourhood level factors for the England and Wales sample. It has 5 categories of England Disadvantage, England Ethnic Minority, Wales Advantaged and Disadvantaged. England Advantaged was the comparison category. The estimates for the Stratum categories remained very similar to the UK sample results. Table 5.15 shows that for both School Readiness and Naming Vocabulary analysis, compared to the England Advantaged strata of wards, all others do less well.

The England Disadvantaged Stratum for both the School Readiness and Naming Vocabulary is associated with similarly lower scores than the England Advantaged strata. In the Wales Disadvantaged Strata for both outcomes, the associations are still

negative but the association is not as low in the Naming Vocabulary compared to the School Readiness.

The picture is quite different for the England Ethnic Minority strata. For the School Readiness, these areas are associated with the lowest scores of all the strata. A similar result is seen in the Naming Vocabulary but the estimate is far greater.

The result for the Wales Advantaged strata is again slightly different between outcomes. For the School Readiness, children in Wales Advantaged strata are associated with lower scores than their England counterparts but for the Naming Vocabulary score the results are not significant different. Table 5.15 shows that the child's age estimate remains the same for the School Readiness score but increases by 0.0001 for the Naming Vocabulary score.

Table 5. 14 - Cognitive outcomes: England and Wales sample - School Readiness/Naming Vocabulary Base model variances

	School Readiness scores			**Naming Vocabulary scores**		
Model	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Base	0.073 (0.009)	0.806 (0.011)	27216.410	0.047(0.006)	0.791(0.011)	29068.440
Reduction from Null model	37.61%	0.00%	97.88	65.4%	-0.13%	221.83

Table 5. 15 - Cognitive outcomes: England and Wales sample - School Readiness/Naming Vocabulary Base model estimates

Variables	School Readiness score β (s.e)	Naming Vocabulary score β (s.e)
Child's age in days	0.0035 (0.0001)	0.0023(0.0001)
Stratum-(England advantaged)		
England Disadvantaged	-0.359(0.048)	-0.321(0.040)
England Ethnic	-0.705(0.075)	-1.158(0.062)
Wales Advantaged	-0.214(0.075)	-0.044(0.064)
Wales Disadvantaged	-0.305(0.056)	-0.254(0.048)

5.3.3. Cognitive outcomes: England and Wales sample - Base and mothers'/interviewers' opinions of the neighbourhood and 2001 electoral ward census variables only model

In the UK sample analysis, at this stage, the mother's and interviewers' opinions of the neighbourhood factors were estimated with the Base model. As is shown in Table 5.16 and Table 5.17, in the England and Wales analysis, for both outcomes, the factors that were significant were for the most part, similar. For the mothers' opinions of the neighbourhood, the only differences from the UK estimates were for Naming Vocabulary outcome where the signs of vandalism and racial insults were now not significant. For the interviewers' opinions of the local streets the only difference in School Readiness was the estimate for litter which was considerably larger in England and Wales. In the Naming Vocabulary analysis, the presence of traffic calming measures became significant where it had not been in the UK analysis.

Table 5.18 shows the results of analysis when the 2001 census statistics small area statistics are included one by one in the Base model. Of the 49 variables tested, wards with a higher than average proportion of people with no qualifications were found to be have children with lower School Readiness scores. The opposite was true for those for children in wards where there was higher than average proportion of people aged 17-64 with highest qualifications at level 3 and 4/5 (upper secondary and above). Children in wards with a higher than average proportion of people born in England did worse, whereas wards with a higher than average proportion of people born in Scotland, Wales, Northern Ireland, Republic of Ireland and other EU countries were associated with better School Readiness results. Children in wards with a higher than average proportion of people aged 0-15 and 60-64 did worse but children in wards with a higher proportion of people aged 20-24 did better in the School Readiness score.

The next result relates to the distribution of types of households in the wards. Children in wards with a higher than average proportion of one person households did whereas children in wards with a higher than average proportion of all pensioner households, married couple households with no children or with dependent children, or where all children are non dependent were associated with lower scores. Finally, for the School Readiness score, children in wards with a higher than average proportion of households classified as renting from private landlords or letting agencies achieved significantly better.

The Naming Vocabulary score results showed fewer significant associations with census small area statistics. Wards with a higher than average proportion of people with no qualifications had lower scores whereas those wards with a higher than average proportion of people with qualifications at level 4/5 had higher scores. Wards with a higher than average proportion of cohabiting couple households with no children had better scores.

Table 5. 16 - Cognitive outcomes: England and Wales sample - School Readiness and Naming Vocabulary - Mothers' opinions of neighbourhood estimates

Variables	School Readiness β (s.e)	Naming Vocabulary β (s.e)
Satisfaction with area (very or fairly satisfied)		
Very or fairly dissatisfied	0.019(0.036)	0.061(0.034)
Neither satisfied nor dissatisfied	-0.017(0.035)	0.054(0.033)
Noise in the area (not very common)		
Very or fairly common	-0.134(0.025)	-0.105(0.024)
Rubbish in the area (Not very common)		
Very or fairly common	-0.090(0.021)	-0.041(0.020)
Vandalism in the area (Not very common)		
Very or fairly common	-0.106(0.023)	-0.041(0.022)
Racial insults in area (Not very common)		
Very or fairly common	-0.136(0.041)	-0.062(0.039)
Access to shops (Not very common)		
Very or fairly common	-0.047(0.028)	-0.016(0.027)
Pollution in the area (Not very common)		
Very or fairly common	0.022 (0.023)	0.071(0.022)
Play areas in the locality (Yes)		
No places to play	-0.150(0.020)	-0.099(0.019)

Table 5. 17 - Cognitive outcomes: England and Wales sample - School Readiness and Naming Vocabulary - Interviewers' opinions of neighbourhood estimates

Variables	**School Readiness β (s.e)**	**Naming Vocabulary β (s.e)**
Street conditions (good or fair)		
Not good	-0.330(0.037)	-0.267(0.035)
Security blinds in shops (none or only some)		
A lot	-0.243(0.080)	-0.033(0.077)
Traffic calming measures (No Measures)		
Measures	-0.063(0.024)	-0.071(0.022)
Traffic volume (No, little or moderate traffic)		
Heavy traffic	0.067(0.039)	-0.004(0.037)
Litter (None or virtually no litter)		
Some or a lot of litter	-0.302(0.048)	-0.394(0.045)
Dog mess (None or little)		
A lot or some	-0.316(0.038)	-0.159(0.035)
Fighting in the street (1, 2,3 or 4 people seen fighting)		
No one on the street or no hostility	-0.339(0.103)	-0.284(0.098)
Interviewer feels safe (Feel safe up to feel comfortable)		
Uncomfortable up to feel for safety	-0.401(0.030)	-0.336(0.028)
Graffiti (No or little graffiti)		
A lot of graffiti	-0.279(0.031)	-0.195(0.030)
Vandalism (No signs of vandalism)		
Signs of vandalism	-0.317(0.042)	-0.196(0.040)

Table 5. 18 - Cognitive outcomes: England and Wales sample - School Readiness and Naming Vocabulary – 2001 Census small area statistics for electoral ward estimates.

Variables	School Readiness β (s.e)	Naming Vocabulary β (s.e)
% in ward living in type of household: One person	0.009(0.003)	
% in ward living in type of household: One family and no others: All pensioners	-0.012(0.006)	
% in ward living in type of household: One family and no others: Married couple households: No children	-0.014(0.005)	
% in ward living in type of household: One family and no others: Cohabiting couple households: No children		0.014(0.007)
% in ward living in type of household: One family and no others: Married couple households: With dependent children	-0.034(0.014)	
% in ward living in type of household: One family and no others: Married couple households: All children non dependent	-0.182(0.091)	
% people in ward: Rented from: Private landlord or letting agency	0.006(0.003)	
% people in ward: born in England	-0.006(0.001)	
% people in ward: born in Scotland	0.057(0.025)	
% people in ward: born in Wales	0.007(0.002)	
% people in ward: born in Northern Ireland	0.174(0.076)	
% people in ward: born in Republic of Ireland	0.048(0.022)	
% people in ward: born in other EU countries	0.054(0.015)	
% people in ward: age 16-74 with Highest qualification attained: level 3	0.019(0.007)	

% people in ward: age 16-74 with Highest qualification attained: level 4/5	0.008(0.002)	0.003(0.001)
% people in ward: aged 17-64 ward with no qualifications	-0.007(0.002)	-0.003(0.001)
% people in ward: aged 0-15	-0.014(0.005)	
% people in ward: aged 20-24	0.018(0.007)	
% people in ward: aged 60-64	-0.044(0.015)	

5.3.4. Cognitive outcomes: England and Wales sample - Child/family/interviewers' opinions of neighbourhood and 2001 electoral ward small area census factors model

The results for England and Wales for child/family/mothers' and interviewers' opinions of the neighbourhood models are similar to those in the UK analysis (Table 5.9). For instance, the child's age estimate has increased very slightly for both outcomes from the Base model as in the UK sample. Instead, the results that included the ward level (level two in the multilevel model) 2001 census small statistics are presented and can be seen in the full England and Wales cognitive models (Table 5.20). At this stage, residual normality plots for the full model are provide for diagnostic purposes. Level One and Two residual normality plots for the School Readiness final model (Table 5.20) can be seen Figures 4 and 5 respectively in Appendix 2. Similar plots for the Naming Vocabulary final model (Table 5.20) can be seen in Figures 6 and 7 respectively in Appendix 2.

All the 2001 census ward level key statistics found to be significant when included in the Base model were placed in a model with the level one significant child/family and neighbourhood factors. Each 2001 census factor was included in the model individually and tested for significance. Finally, all of the ward census factors found to be significant were included in a model together and those that remained significant were included in the full model.

As explained earlier, the Stratum factor is also a level two ward as well as a control for the disproportionately stratified survey design. Table 5.22 shows for the School Readiness score analysis, similar to the UK analysis results (Table 5.10), that the England Ethnic Minority wards estimates remain significantly different from England Advantaged wards with an absolute coefficient of -0.29. Both strata in Wales are significantly different from England Advantaged in the full model for England and Wales whereas only Wales Advantaged was significantly different from the reference category in the full model for UK in Table 5.9 but with a 59.29% reduction in the estimate size. Level one factors and other 2001 census area factors appear to explain some of the differences in the child scores in these wards rather than the general nature

of the proportion of ethnic minorities in these wards. However, the Wales Advantaged and Disadvantaged wards show a significant increase in estimates from the England and Wales Base model. The Wales Advantaged wards show a 59.1% increase in estimate and the Wales Disadvantaged wards a 29.1% increase. In fact, nearly all the increase was seen when the significant census factors were included. Their inclusion has made the advantage and disadvantaged nature of these Wales wards more important in helping to explain the lower scores in these areas. Table 5.19 shows that, for both outcomes, significant improvements in models, between an individual child/family factors only model, a model with subjective neighbourhood opinions (but very same small improvements) included and finally, the full model with census factors included (also a small improvement).

Factor estimates shown in Table 5.20 reveal that none of the Strata appear to be significantly different from the England Advantaged Stratum in the children's Naming Vocabulary analyses for England and Wales apart from the England Ethnic Minority ward estimate which was highly associated with poor scores.

5.3.5. School Readiness full model results

In the School Readiness analysis, as seen in Table 5.20, only two 2001 ward level census factors remained significant in the full model. Wards where a higher than average proportion of people were born in England (-0.006(0.001)) were significantly associated with lower scores. I investigated in which regions these types of wards are commonly found. The analysis also identifies whether the ward is classified as being urban or rural. These wards were found in urban Advantaged wards of the East Midlands, the South West and Yorkshire and Humberside. In the England Disadvantaged Stratum, these wards were found more in nearly all of the urban areas of all the regions apart from London, the South East and South West and all rural areas in all the regions apart from the North West, the South West and West Midlands. None of these wards were found to be England Ethnic Minority wards as might be expected. Most of the low scoring-predominantly English born wards were found in urban areas in disadvantaged wards in the North East. It is assumed these areas are of relatively low attraction to international and inter country migrants.

Wards with a higher than average proportion of people are under the age of 15 (-0.012(0.005)) were significantly associated with lower School Readiness scores. They were almost exclusively found in Disadvantaged wards in rural East of England and in the Ethnic Minority wards in the urban areas outside of London.

However, it should be noted that nineteen 2001 census factors were found to be significant when tested individually in the model with all level one control factors. The reason they dropped out of the model was due to the fact they may have been their correlation with other 2001 census factors tested. Table 5.24 and Table 5.25 show the bivariate correlation estimates between 2001 census factors tested for both outcomes respectively. Those highlighted in bold are considered to be mildly up to highly correlated.

The following section provides a summary of results of those factors that were dropped from the full model but were found to be significant when included individually. Results can be seen in Table 5.21. The structure of ward level qualifications appeared to be important. Children in wards with an above average proportion of people with no qualifications had lower than average School Readiness scores whilst those children in a ward with qualifications level 3 or more did better. Ward level family structure was also important. Children living in wards with an above average proportion of married couple households with no dependent achieved lower scores. Interestingly, children in wards with an above average proportion of childless cohabiting couples with no children had better than average scores whilst those in wards with a higher than average proportion of dependent children did less well. Ward level housing tenure was a significant factor. Children in wards where an above average proportion of people or homes rented from Housing Associations, Registered landlords, Private landlords or letting agencies achieved lower than average School Readiness scores. The ward level proportions of people's country of birth showed significant associations. Children in wards with a higher than average proportion of people born in Northern Ireland, the Republic of Ireland or in other EU countries had higher than average scores. The age structure of the ward was also an issue. Children in wards with a higher than average proportion of people who were aged 20-24 or 25-29 were associated with higher scores whilst children in wards with a higher than average proportion of people aged 60-64 achieved lower than average scores. Finally, children in a ward with a higher than

average proportion of one family households categorised as other (i.e. not containing married or cohabiting couples or pensioners) were associated with lower School Readiness scores.

5.3.6. Naming Vocabulary full model results

For the Naming Vocabulary analysis, Tables 5.20 shows that three factors were found to be significant with the Base model and were included in the child/family and other neighbourhood factors model. All three were significant when included individually but only one of these remained significant when placed in the model together. Wards with a higher than average proportion of households containing cohabiting couples with no children (0.014(0.007)) were associated with MCS children having a higher Naming Vocabulary score. These wards were predominantly found in Advantaged wards in the urban areas of the North East and the rural areas of the East Midlands and South West. They were also found in the Disadvantaged wards in rural areas of East of England (East Anglia) and South West.

The other two factors that were significant (but not included in the full model) when included in the model individually had a positive association with the child's score. Children in wards with an above average proportion of people with graduate qualifications also had higher than average Naming Vocabulary scores. Children in wards with an above average proportion of people with no qualifications also did less well. Table 5.25 shows the correlation estimates between these census factors.

Table 5. 19 - Cognitive outcomes: England and Wales sample – Child/family and interviewers opinions of the neighbourhood together with 2001 ward level census statistics model – changes in ward and child variances

	School Readiness scores			Naming Vocabulary scores		
Model	Ward level variance	Child level variance	-2*LL	Ward level variance	Child level variance	-2*LL
Individual factors plus neighbourhood opinions and census factors	0.035 (0.005)	0.640 (0.008)	24744.760	0.013(0.003)	0.616(0.008)	26158.690
Individual factors plus neighbourhood opinions only	0.040 (0.005)	0.640 (0.009)	24768.990	0.014(0.003)	0.616(0.008)	26163.270
Individual factors only	0.040(0.005)	0.640(0.009)	24775.770	0.014(0.003)	0.617(0.008)	26178.190
Reduction from Null model	70.09%	20.60%	2569.53	90.97%	22.12%	2764.93
Reduction from Base model	54.55%	20.69%	2471.65	72.34%	22.12%	2543.10

Table 5. 20 - Cognitive outcomes: England and Wales sample – Child/family and interviewers' opinions of the neighbourhood together with 2001 ward level census statistics model estimates.

Variable & categories	School Readiness β (s.e)	Naming Vocabulary β (s.e)
Variables		
n	**10,238**	**11,047**
Child's age	0.0039(0.0001)	0.0026(0.0001)
Stratum (England advantaged)		
England disadvantaged	-0.035(0.039)	-0.043(.0027)
England Ethnic	-0.287(0.081)	-0.207(0.046)
Wales advantaged	-0.522(0.109)	0.039(0.045)
Wales disadvantaged	-0.430(0.119)	0.032(0.034)
Child's gender (Male)		
Female	0.182(0.016)	0.216(0.015)
Child's ethnicity (White, mixed, Indian and other)		
Bangladeshi and Pakistani	-0.331(0.049)	-0.574(0.048)
Indian		-0.119(0.036)
Black	-0.244(0.052)	-0.350(0.048)
Other		-0.493(0.074)
Low birth weight (No)		
Yes	-0.113(0.040)	-0.164(0.032)
No of siblings (None)		
1	-0.140(0.021)	-0.091(0.019)
2	-0.283(0.026)	-0.221(0.024)
3	-0.431(0.037)	-0.294(0.034)

Variable & categories	School Readiness β (s.e)	Naming Vocabulary β (s.e)
4 or more	-0.480(0.050)	-0.409(0.047)
Pre-term baby(No)		
Yes	-0.115(0.036)	
Ever hospitalised (No)		
Yes		0.049(0.016)
Mother's age (Under 20)		
20-24	0.124(0.035)	
25-29	0.214(0.035)	0.118(0.022)
30-34	0.267(0.037)	0.164(0.024)
35-39	0.224(0.040)	0.169(0.028)
over 40	0.252(0.066)	0.255(0.055)
Mother depressed (No)		
Yes	-0.059(0.018)	
Smoking in room child inhabits (No)		
Yes	-0.112(0.023)	-0.055(0.021)
Central heating in house (No)		
Yes	0.074(0.035)	0.073(0.032)
NS SEC (Professional and managerial)		
Intermediate	-0.085(0.029)	
Small employer & self employed	-0.142(0.032)	
Lower supervisory & technical	-0.170(0.034)	-0.107(0.030)
Semi routine	-0.166(0.028)	-0.099(0.024)
No NS SEC	-0.197(0.031)	-0.161(0.024)
Mother's highest education qualifications (Degree or higher)		
A-levels	-0.097(0.033)	
O-Levels	-0.180(0.024)	-0.144(0.020)
GCSE d to g	-0.300(0.032)	-0.233(0.029)
Other qualifications	-0.328(0.058)	-0.431(0.053)

Variable & categories	School Readiness β (s.e)	Naming Vocabulary β (s.e)
None of the above	-0.279(0.032)	-0.339(0.028)
Qualifications missing	-0.508(0.192)	
English spoken at home (English only)		
Yes, English & others	-0.084(0.032)	-0.417(0.032)
No, other only	-0.235(0.056)	-0.730(0.053)
Mother reads to child (Everyday)		
Several times per week	-0.199(0.021)	-0.143(0.020)
Once or twice per week	-0.246(0.024)	-0.266(0.023)
Once or twice per month	-0.286(0.051)	-0.261(0.047)
Less often	-0.384(0.060)	-0.363(0.056)
Not at all	-0.439(0.051)	-0.526(0.047)
Mother teaches alphabet at home (Yes)		
No	-.234(.022)	-0.096(0.021)
Family income SR-(Couple family income £11-22,000, lone parent family income £11-33,000 and Couple or lone parent household income missing) NV-(Couple family income £11,000 and above and lone parent family income £0-55,000 and Couple or lone parent household income missing)		
Couple family income £0-11,000		-0.094(0.028)
Couple family income £22,000.01-33,000	0.061(0.030)	
Couple family income £33,000.01-55,000	0.050(0.025)	
Couple family income £55,000 plus	0.107(0.038)	
Lone parent family income £0-11,000	-0.093(0.033)	
Lone parent family income £33,000.01-55,000	0.753 (0.234)	
Housing tenure (Own with mortgage or own outright or live with parents rent free or squatting or other)		

Variable & categories	School Readiness β (s.e)	Naming Vocabulary β (s.e)
Shared equity, rent from local authority and housing association	-0.122(0.025)	-0.100(0.021)
Rent privately	-0.115(0.034)	-0.089(0.031)
Live with parents rent free		-0.122(0.050)
Squatting		
Sweep entered study (sweep 1)		
Sweep2	0.303(0.194)	-0.187(0.038)
Interviewers' opinion of litter on streets (No or virtually litter or information missing)		
A lot of litter on streets		-0.154 (0.040)
Interviewer opinion of feeling safe on street (Feel safe up to feel very comfortable and missing)		
Uncomfortable up to feel for safety	-0.074(0.028)	
Significant 2001 electoral ward census factors		
% people in ward born in England	-0.006(0.001)	
% people in ward aged 0-15	-0.012(0.005)	
% Households of type: Cohabiting couple households: No children: One family and no others		0.014(0.007)

Table 5. 21 - Non significant Census variables when included in full model together

Variable & categories	School Readiness β (s.e)	Naming Vocabulary β (s.e)
% in ward: One person household	-0.010(0.003)	
% in ward: One family and no others: Married couple households: No children	-0.015(0.005)	
% in ward: One family and no others: Married couple households: All children non-dependent	-0.019(0.008)	
% in ward: One family and no others: Cohabiting couple households: No children	0.025(0.009)	0.014(0.007)
% in ward: One family and no others: Cohabiting couple households: With dependent children	-0.036(0.014)	
% in ward: One family and no others: Cohabiting couple households: All children non-dependent	-0.187(0.091)	
% people in ward: Renting from: Housing Association / Registered Social Landlord	0.006(0.003)	
% people in ward: Rented from: Private landlord or letting agency	0.007(0.003)	
% in ward: People born in England	-0.006(0.002)	
% in ward: People born in Wales		
% in ward: People born in Northern Ireland	0.185(0.077)	
% in ward: People born in Republic of Ireland	0.052(0.023)	
% in ward: People born in other EU Countries	0.059(0.015)	
% in ward: People aged 16-74 with: Highest qualification attained level 3	0.020(0.007)	
% in ward: People aged 16-74 with: Highest qualification attained level 4 / 5	0.008(0.002)	0.003(0.001)
% people aged 16-74 in ward with no qualifications	-0.008(0.002)	-0.003(0.001)10%*
% in ward: People aged 0-15	-0.014(0.005)	
% in ward: People aged 20-24	0.019(0.007)	
% in ward: People aged 25-29	0.021(0.006)	
% in ward: People 60-64	-0.045(0.015)	

Table 5. 22 – School Readiness outcome: England and Wales sample - reductions/increases in coefficients of stratum variables

	Models		
Stratum factor categories	**Base –With child's age and stratum**	**Base and child/family, mother's/interviewers' opinions of neighbourhood, and census factors**	**% reduction/increase in variance between 2 models**
England Advantaged (Comparison category)			
England Disadvantaged	**-0.359(0.048)**	-0.035(0.039)	
England Ethnic	**-0.705(0.075)**	**-0.287(0.081)**	59.29% reduction
Wales advantaged	**-0.214(0.075)**	**-0.522(0.109)**	59.1% increase
Wales disadvantaged	**-0.305(0.056)**	**-0.430(0.119)**	29.1% increase

1. Bold categories denotes that the estimate was significantly different (the estimate is more than twice its standard error) to the England Advantaged category.
2. Percentage reduction in variance only calculated if categories are significant in both models.

Table 5. 23 – Naming Vocabulary outcome: England and Wales sample reductions/increases in stratum variation.

	Model description		
Stratum factor categories	**Base –With child's age and stratum**	**Base and child/family, mother's/interviewers' opinions of neighbourhood, and census factors**	**%age reduction/increase in variance between 2 models**
England Advantaged (Comparison category)			
England Disadvantaged	**-0.321(0.040)**	0.025(0.030)	
England Ethnic	**-1.158(0.062)**	-0.092(0.049)	
Wales advantaged	-0.044(0.064)	0.080(0.047)	
Wales disadvantaged	**-0.254(0.048)**	0.061(0.036)	

1. Bold categories denotes that the estimate was significantly different (the estimate is more than twice its standard error) to the England Advantaged category.
2. Percentage reduction in variance only calculated if categories are significant in both models.

Table 5. 24 - Ward level correlations: School Readiness: England and Wales sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	1																				
2	-0.06	1																			
3	-0.33	**-0.65**	1																		
4	0.01	**-0.77**	**0.53**	1																	
5	**-0.50**	**0.52**	0.03	-0.39	1																
6	0.45	-0.06	0.01	0.05	0.07	1															
7	0.23	-0.10	0.03	0.13	-0.03	0.38	1														
8	**0.05**	**0.53**	**-0.54**	-0.42	0.07	-0.13	-0.04	1													
9	-0.24	**0.69**	-0.45	**-0.64**	0.49	-0.28	-0.17	0.33	1												
10	-0.13	-0.06	0.22	-0.00	0.20	0.12	0.16	-0.05	-0.00	1											
11	-0.37	**0.50**	-0.24	-0.49	0.37	-0.24	-0.15	0.37	0.44	0.20	1										
12	-0.18	**0.51**	**-0.55**	-0.39	0.08	-0.33	-0.20	0.39	0.39	-0.03	**0.57**	1									
13	**-0.57**	**0.51**	-0.29	-0.45	**0.56**	-0.31	-0.15	0.31	**0.57**	-0.01	**0.50**	0.49	1								
14	**-0.66**	0.35	-0.15	-0.30	-0.37	-0.51	-0.21	0.19	**0.56**	0.07	0.46	0.45	**0.62**	1							

15	**-0.81**	0.32	-0.00	-0.27	0.47	**-0.59**	-0.31	0.19	0.45	-0.04	0.47	0.38	**0.72**	**0.64**	1					
16	**0.63**	-0.00	-0.44	-0.11	**-0.51**	0.29	0.08	0.24	-0.19	-0.17	-0.13	0.08	-0.33	-0.32	**-0.50**	1				
17	0.05	**0.62**	**-0.68**	-0.48	0.27	-0.13	-0.06	0.43	**0.61**	-0.15	0.34	0.45	0.45	**0.54**	0.16	0.16	1			
18	-0.16	**0.72**	**-0.57**	**-0.54**	**0.61**	-0.09	-0.06	0.45	**0.65**	-0.07	0.44	0.45	**0.66**	0.36	0.45	-0.07	**0.69**	1		
19	-0.06	**-0.55**	**0.70**	0.45	-0.25	-0.10	0.03	-0.47	-0.40	0.18	-0.26	-0.37	-0.38	-0.25	-0.11	-0.45	**-0.67**	**-0.67**	1	
20	0.24	0.19	**-0.59**	-0.27	-0.33	-0.36	-0.18	0.34	0.29	-0.15	0.05	0.44	0.10	0.21	0.05	**0.52**	0.49	0.27	-0.41	1
21	0.42	0.24	-0.22	-0.12	0.62	**0.58**	0.26	0.07	-0.01	-0.16	-0.07	-0.08	-0.13	-0.36	-0.36	0.12	0.04	0.08	-0.11	-0.36	1
22	0.21	-0.12	0.08	0.16	-0.16	0.07	-0.09	-0.15	-0.19	**-0.89**	-0.30	-0.26	-0.18	-0.25	-0.10	0.02	-0.11	-0.16	0.08	-0.19	0.24

Note:

1. The following 2001 electoral ward census small area statistics were found to be significant when placed into child and neighbourhood factor model independently. The correlation matrix is used to show why some of these factors become insignificant when all are placed into model together after controlling for child and neighbourhood factors. Those marked in bold are considered to be mildly (0.5 to 0.7) to highly (0.7 to 0.8) correlated.
2. The factors found to significant in the full model have been put in bold. Noticeably, these factors are at most only correlated with one other factor whilst most of the others are correlated with more than one. This maybe one reason why the shaded factors remain significant when placed into the model together.

Legend

1. % people in ward: aged 16-74 no qualifications
2. % in ward: one person household: Other
3. % in ward: one family and no others: Married couple households: No children
4. % in ward: one family and no others: Married couple households: All children non-dependent
5. % in ward: one family and no others: Cohabiting couple households: No children
6. % in ward: one family and no others: Cohabiting couple households: with dependent children
7. % in ward: one family and no others: Cohabiting couple households: All children non-dependent
8. % people in ward: Rented from: Housing Association/Registered Social Landlord
9. % people in ward: Rented from: Private landlord or letting agency
10. % people in ward: born in England
11. % people in ward: born in Northern Ireland
12. % people in ward: born in Republic of Ireland
13. % people in ward: born in other EU Countries
14. % people in ward: aged 16-74 with: Highest qualification attained level 3
15. % people in ward: aged 16-74 with: Highest qualification attained level 4 / 5
16. % people in ward: aged 0-15
17. % people in ward: aged 20-24
18. % people in ward: aged 25-29
19. % people in ward: aged 60-64
20. Ethnic minority stratum indicator
21. Disadvantaged stratum indicator
22. Wales stratum indicator

Table 5. 25 - Ward level correlations: Naming Vocabulary outcomes: England and Wales sample.

	1	2	3	4	5	6	7
1	1						
2	**-0.50**	1					
3	0.15	-0.16	1				
4	**-0.81**	0.48	-0.19	1			
5	0.24	-0.34	-0.20	0.05	1		
6	0.42	0.06	0.26	-0.35	-0.36	1	
7	0.12	-0.16	**0.98**	-0.10	-0.19	0.24	1

Note:

1. The following 2001 electoral ward census small area statistics were found to be significant when placed into child and neighbourhood factor model independently. The correlation matrix is used to show why some of these factors become insignificant when all are placed into model together after controlling for child and neighbourhood factors. Those marked in bold are considered to be mildly (0.5 to 0.7) to highly (0.7 to 0.8) correlated.
2. The factors found to significant in the full model are have been shaded in grey. Noticeably these factors are at most only correlated with one other factor whilst most of the others are correlated with more than one. This maybe one reason why the shaded factors remain significant when placed into the model together.

Legend

1. % people in ward: aged 17-64 no qualifications
2. % one family and no others: Cohabiting couple households: No children
3. % people in ward: born in Wales
4. % people in ward: aged 16-74 with: Highest qualification attained level 4 / 5
5. Ethnic minority stratum indicator
6. Disadvantaged stratum indicator
7. Wales stratum indicator

5.4. Summary and conclusions

The following narrative summarises the analyses of the cognitive outcomes. This details the England and Wales sample models, as these full models include some 2001 census small area statistics. All factors mentioned were found to be significant, all other included factors being equal.

In terms of the child factors, girls and older children had higher School Readiness and Naming Vocabulary scores. Those who were Bangladeshi or Black did worse that white children in the School Readiness score. As well as these two Ethnic Minority groups, Indians and those categorised as other were associated with lower scores.

Birth related child factors, low birth weight and preterm birth were both associated with lower School Readiness but the latter not so for the Naming Vocabulary scores. Having siblings was related to lower cognitive scores with a higher number of siblings associated with lower scores. Having ever been hospitalised was also related to lower Naming Vocabulary scores. Children who lived in homes where English plus other languages were spoken in the home did less well than where English only was spoken. However, in homes where no English was spoken children had even lower scores particularly for the Naming Vocabulary scores.

A number of factors specifically associated with the mother were important. For instance, older mothers were associated with better scores. The older the mother, the better the child score in both cognitive scores. However, in the School Readiness, children of 35-39 year old mothers who, although were associated with better results than those aged 30-34, were not quite as good as those 40 and over. In the Naming Vocabulary scores, children with mother's aged 20-24 were not significantly different from those under 20. Mothers with depression and fewer qualifications were also associated with lower cognitive scores in their children.

Family related factors reflected in the cognitive scores. Families with a lower socio-economic classification as determined by the NS-SEC were related to lower child scores. However, in the Naming Vocabulary analysis, the second (intermediate) and

third (small employer) highest classifications were not significant. In the School Readiness scores, children in couple parented families with higher incomes did significantly well but those with lone parents with very low incomes £0-11,000 achieved lower scores. In the Naming Vocabulary analysis only those children in couple families with incomes £0-11,000 had the lower scores. Living in shared equity and privately rented accommodation was associated with lower School Readiness scores and those families who were living rent free or with parents also had children with lower scores. Children who lived in homes where people smoked in rooms used by the child had lower cognitive scores, those with central heating had higher scores.

In terms of the home learning environment, less time spent reading to the child and being taught the alphabet was associated with lower scores.

However, children who had moved between sweep One and sweep Two were found to have scores that were no different from those who had not moved.

Various neighbourhood-related factors were found to be significant. The neighbourhood was characterised in four ways. These included the Stratum, subjective opinions of the child's mother and interviewer and 2001 census small area statistics and the results are summarised as follows.

In the analysis of School Readiness scores, children who lived in Wales Advantaged and Disadvantaged wards did less well than those in England Advantaged wards. Those who lived in Ethnic Minority wards were associated with the lowest scores. In the UK wide analysis, those in Northern Ireland Advantaged and Disadvantaged wards also did less well. In the Naming Vocabulary analysis, only children in Ethnic Minority wards did less well in the England and Wales analysis. In the UK sample analysis, Scotland Advantaged also did significantly better.

The subjective opinions of the mother were not significant in either of the cognitive score analyses. In terms of the interviewers' subjective opinions, streets considered to be less safe were associated with lower School Readiness scores. In the Naming Vocabulary score analysis, streets with lots of litter were associated with lower child scores.

Those in urban or rural wards were not significantly different from one another in terms of scores.

Finally, in the School Readiness analysis of MCS children, wards with a higher than average proportion of English born people were associated with lower scores as were wards with a higher than average number of children aged under 15 years old. In the Naming Vocabulary analysis, children in wards with a higher than average number of cohabiting couple with no children were associated with higher scores in the full model.

Table 5.26 provides details of the changes in variances at child and ward level as particular factors are included in the models. Similar levels of variation in cognitive scores were found between wards and within the wards before other factors were included that could help to explain the variation. Most of the variation was accounted for by differences in the children themselves and a far smaller amount by differences between wards. The Stratum factor was able to account for nearly half of the variation between the wards in the School Readiness analysis and for nearly two thirds in that of Naming Vocabulary. The Child and family factors explained around half of the variation between wards in the School Readiness score analysis. It was even greater in the Naming Vocabulary. This reveals the extent of geographical clustering of the child/family characteristics. However, as might be expected these factors were also able to explain a large amount of difference between the children within the wards (by around another quarter). Although the figures appear to show that the interviewers' subjective opinions are not able to reduce the variance in the School Readiness and Naming Vocabulary (only by 0.001), the model fit was a significant improvement as measured by the reduction in -2*LL. If the School Readiness variances are expressed to 4 decimal places rather than 3 presented in the analysis, then there is a reduction of 0.0004 in the child level variance.

However, the ward 2001 census factors reduced the variation by a very slight but significant amount. These were 0.005 in the ward level variance and 0.007 in the child level variance. Although there was less systematic variation by ward in the first place, the models have been relatively successful in accounting for it.

Table 5. 26 - Summary of changes in ward/child variance estimates for England and Wales cognitive scores

	School Readiness score		Naming Vocabulary score	
	Ward	**Child**	**Ward**	**Child**
Child's age	0.117	0.806	0.144	0.791
Stratum	0.073	0.806	0.047	0.791
Child/family	0.040	0.640	0.014	0.617
Subject opinions	0.040	0.640	0.014	0.616
Census	0.035	0.640	0.013	0.616
Unexplained remainder	0.035	0.640	0.013	0.616

NB Total variation is equal to 1.00

It would appear that having controlled for child and family related factors, neighbourhood factors as characterised using subjective indicators relating to safety and litter on the streets in which MCS children live can account for some differences in children in their cognitive wellbeing scores. Over and above these factors, a small number of ward level socio-economic factors could also help explain child cognitive differences.

The next chapter provides results of the associations between behavioural and physical measures of wellbeing and neighbourhood factors.

6. Chapter Six – Neighbourhoods and behavioural/physical wellbeing

6.1. Introduction

This chapter concentrates on the relationships between measures of behavioural and physical dimensions of the MCS child's wellbeing and characteristics of the neighbourhood in which they live. The two dimensions were measured, firstly, by using the behavioural 'Difficulties' items from the Strengths and Difficulties Questionnaire (SDQ). The 'Difficulties' questions measure the child's emotional symptoms, conduct problems, hyperactivity/inattention and peer relationship problems (Goodman, 1997). The physical measure is the cohort child's Body Mass Index (BMI=weight in kg/height in metres squared) (Cole et al, 2000). In this analysis, the measure attempts to identify some of the factors that may influence the prevalence of higher or lower than average BMIs.

As with cognitive wellbeing, a series of multi-level models are estimated, with progressively more factors being controlled for. The first phase of modelling includes behavioural outcome data from all four countries in the UK. Neighbourhood factors for this set of models are generated from the type of ward (level two) in which they were sampled plus the cohort children's mothers' opinions of the neighbourhoods and the interviewers' opinions of the street on which the cohort families live. These last two terms are measured at the individual level as the places are not co-terminous with the electoral ward. A full model also includes characteristics of the children and family at level one.

The second phase of the modelling uses only those children sampled in England and Wales. Together with factors mentioned in the first phase, this set of models includes 2001 aggregated ward level census small area statistics to characterise the extended neighbourhood locality. Any of the ward based factors that are still significant following the inclusion of individual level control factors, can then be identified. This will help to

provide greater understanding of relationships between neighbourhood characteristics and wellbeing.

6.2. The behavioural and physical wellbeing sample

In the first phase of the modelling, of the 15,282 children sampled at sweep two of the study, 1,374 did not have a Behavioural Difficulties score and were therefore excluded from the analysis. In the BMI analysis, 2,818 were excluded. The range of BMIs for the complete MCS sweep two sample was between around 8 and 42, with one extreme outlier at 62. A number of issues surround the accuracy of the BMI information due to problems in data input during the fieldwork phase as highlighted by the MCS development team. An attempt to identify an appropriate range for BMI for British born children aged approximately three years was therefore made using other data sources. Cole et al (2001) suggested that the 4th and 98th centile for BMIs ranged from 13 to 22. Having conducted some sensitivity analysis a number of outlying BMI observations were dropped from the analysis as results as they were deemed to be implausible. The final sample sizes for the UK analysis of the Difficulties score was 14,008 and 11,702 for the BMI.

Table 6.1 provides descriptive information concerning the behavioural and physical outcomes. The scores for the raw Difficulties outcome could range from between 0 and 40 but the maximum score for MCS children was 33. The mean score was 9.64 with a standard deviation of 5.32. The higher the score, the more difficult behaviour the child was purported to exhibit.

For the raw BMI score, the mean score was 16.31 with a standard deviation of 1.70. The minimum and maximum scores were 10.10 and 29.64.

All survey wards (398) are represented in the Difficulties analysis with a mean number of children in each ward being 35.17. The minimum was 4 and the maximum 191. For the BMI, the minimum is 4 and the maximum is 234 with the mean being 33.19. Variables entered in the analysis can be found in Appendix 1.

Table 6. 1 - Behavioural and physical dependent outcomes - Descriptives

		Behavioural difficulties	BMI
Sample size		14,008	11,702
Mean		9.64	16.31
Standard deviation		5.32	1.70
Min and Max		0-33	10.10-29.64
Percentiles	**25**	6	15.23
	50	9	16.15
	75	13	17.16

6.3. Results of the UK sample analysis for the Difficulties score and BMI outcomes

The behavioural and physical outcome scores have been transformed into standardised 'Z' scores with means of 0 and standard deviations of 1 for ease of comparison. The significance of individual factor estimates is taken in the context of all else being equal.

6.3.1. Behavioural/physical outcomes: UK sample - Null model

In the Null model, Table 6.3 shows that for neither the Difficulties score nor the BMI is age a significant factor. Table 6.2 shows that the ward intra class correlation coefficient (ICC) for the Difficulties score is 6.1% and 1.98% for the BMI. Therefore, differences in characteristics between wards for the BMI only marginally account for the difference in scores whereas the amount is larger for the Difficulties score. This is likely to mean, compared to the cognitive scores where ward variation is more important, for the BMI analysis, it may be more difficult to attribute the differences in child BMI to the differences between ward characteristics.

Table 6. 2 - Behavioural/physical outcomes: UK sample - Null model – Ward and child variances

	Difficulties scores			BMI scores		
Model	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Null	0.061 (0.007)	0.934 (0.011)	39233.990	0.019(0.004)	0.979(0.013)	33131.670

Table 6. 3 - Behavioural/physical outcomes: UK sample - Null model estimates

Variables	**Difficulties** β (s.e)	**BMI** β (s.e)
Child's age in days	0.0000 (0.0001)	0.0001(0.0002)

6.3.2. Behavioural/physical outcomes: UK sample - Base models

The child's age and Stratum factors are estimated in the Base model. The Stratum variable controls for the stratified nature of the MCS survey design.

Table 6.5 shows that the Base models for both outcomes are significantly different from their respective Null models (chi square ($p=<0.05$) when using the Deviance test. The Base model is able to explain more of the variance in both the behavioural and physical outcomes. For the Difficulties analysis, as the Stratum factor is defined as a level two (ward) variable in the model, it is not surprising to see that the child level variances have not changed from the Null models whereas the ward level variance has changed. In other words, the inclusion of the Stratum factor does not help to explain the differences between children in their behavioural and physical outcomes but it has explained that between wards in scores. There has been a 57.38% reduction in ward level variance.

The BMI ward variance has dropped by 47.37%. The variation at the ward level was small to begin with.

Table 6.4 shows that, for the Behavioural Difficulties, all the UK countries Disadvantaged strata had more child difficulties in comparison to the England Advantaged stratum with the England Ethnic Minority stratum associated with most Behavioural Difficulties. Only the Northern Ireland Advantaged stratum had fewer child difficulties. Wales and Scotland Advantaged strata are not significantly different to the England Advantaged stratum.

In the BMI analysis, the England Ethnic Minority, Wales and Scotland Advantaged and Disadvantaged and Northern Ireland Disadvantaged strata are significantly different to the England Advantaged. The latter four strata are associated with higher BMI's than the comparison stratum. The Ethnic Minority had not only lower BMIs but the largest differential of all the strata.

Table 6. 4 - Behavioural/physical outcomes: UK sample - Base model estimates

Variables	Difficulties β (s.e)	BMI β (s.e)
Child's age in days	0.0001 (0.0001)	0.0002(0.0002)
Stratum-(England advantaged)		
England Disadvantaged	0.350(0.035)	0.046(0.030)
England Ethnic	0.435(0.052)	-0.203(0.043)
Wales Advantaged	-0.087(0.057)	0.094(0.052)
Wales Disadvantaged	0.307(0.042)	0.093(0.038)
Scotland Advantaged	-0.070 (0.049)	0.127(0.047)
Scotland Disadvantaged	0.205(0.051)	0.194(0.050)
Northern Ireland Advantaged	-0.166(0.060)	0.080(0.059)
Northern Ireland Disadvantaged	0.166(0.049)	0.127(0.049)

Table 6. 5 - Behavioural/physical outcomes: UK sample - Base model variances

	Difficulties scores			BMI scores		
Model	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Base	0.026 (0.004)	0.934 (0.011)	39051.490	0.010(0.003)	0.980(0.013)	33071.300
Reduction from Null model	57.38%	0.00%		47.37%	-0.10%	

6.3.3. Behavioural/physical outcomes: UK sample – Base, mothers'/interviewers' opinions of neighbourhood model

As with the cognitive wellbeing models, each of the mothers' and interviewers' subjective opinions of the neighbourhood are placed in the Difficulties and BMI Base models individually and models estimated. This is to identify whether associations between the wellbeing outcomes and neighbourhood characteristics exist before controlling for other factors.

Table 6.6 and Table 6.7 show, that at this stage, all the mothers' neighbourhood factors are significant in the Difficulties analysis. Areas with very or fairly common problems had more child behavioural difficulties. Higher BMIs were associated with common problems of vandalism.

A similar picture is seen for the Interviewers' opinions of the neighbourhood with all factors being significantly associated with more child Difficulties. In the BMI results, neighbourhoods with some or a lot of litter had higher child BMI's.

Table 6. 6 - Behavioural/physical outcomes: UK sample – Mothers' opinions of neighbourhood estimates

	Difficulties β (s.e)	**BMI β (s.e)**
Satisfaction with area (very or fairly satisfied)		
Very of fairly dissatisfied	0.163(0.034)	0.072(0.037)
Neither satisfied nor dissatisfied	0.171(0.033)	0.072(0.036)
Missing	0.449(0.043)	-0.018(0.048)
Noise in the area (not very common)		
Very or fairly common	0.348(0.024)	0.054(0.026)
Rubbish in the area (Not very common)		
Very or fairly common	0.225(0.019)	0.037(0.021)
Vandalism in the area (Not very common)		
Very or fairly common	0.262(0.021)	0.054(0.023)
Racial insults in area (Not very common)		
Very or fairly common	0.230(0.039)	0.034(0.043)
Access to shops (Not very common)		
Very or fairly common	0.096(0.024)	0.031(0.027)
Pollution in the area (Not very common)		
Very or fairly common	0.117 (0.022)	0.014(0.023)
Missing	0.249(0.084)	
Play areas in the locality (Yes)		
No places to play	0.185(0.018)	-0.010(0.020)

Table 6. 7 - Behavioural/physical outcomes: UK sample - Interviewers' opinions of neighbourhood estimates

	Difficulties β (s.e)	**BMI β (s.e)**
Street conditions (good or fair)		
Not good	0.358(0.035)	0.035(0.039)
Security blinds in shops (none or only some)		
A lot	0.138(0.077)	-0.013(0.086)
Traffic calming measures (No Measures)		
Measures	-0.055(0.021)	-0.001(0.023)
Traffic volume (No, little or moderate traffic)		
Heavy traffic	0.076(0.021)	-0.019(0.041)
Litter (None or virtually no litter)		
Some or a lot of litter	0.335(0.048)	0.104(0.052)
Dog mess (None or little)		
A lot or some	0.267(0.033)	0.053(0.036)
Fighting in the street (1, 2,3 or 4 people seen fighting)		
No one on the street or no hostility	0.342(0.093)	-0.079(0.101)
Interviewer feels safe (Feel safe up to feel comfortable)		
Uncomfortable up to feel for safety	0.402(0.028)	0.024(0.031)
Graffiti (No or little graffiti)		
A lot of graffiti	0.258(0.028)	0.043(0.031)
Vandalism (No signs of vandalism)		
Signs of vandalism	0.317(0.038)	0.067(0.043)

6.3.4. Behavioural/physical outcomes: UK sample - Child/family, mothers' and interviewers' opinions of neighbourhood behavioural/physical models

For the analysis of the UK sample, the final phase of the modelling was to include all child/family and mothers'/interviewers' neighbourhood factors with the Base model. The child/family factors are included to act as controls for the composition of the population sampled in each ward. The results for this final UK sample model can be seen in Table 6.8 and Table 6.9.

For the Difficulties score, the placing of these factors in the model has meant a significant reduction in the -2*LL figure from the previous Base model. The same can be said for the BMI but the drop is less than in the Difficulties analysis as few of the factors were significant.

The amount of variance accounted for has increased from the Base model. Table 6.8 shows that in the Difficulties analysis, there has been a 76.92% reduction in ward variance from the Base model. In the BMI analysis this is around 30%. Child level variance in the Difficulties analysis has been reduced by 15.63% from the Base model as might be expected when including child factors. However, the BMI child variance has only reduced by 2.14%. This is mainly a result of few child/family factors being significant. Table 6.8 also shows that, there has been a significant improvement by including the neighbourhood opinion factors compared to a model with child/family individual factors only for the Difficulties analysis. However, for the BMI outcome no neighbourhood opinions were significant.

In the Difficulties analysis, the age of the child estimate has increased in size by 0.0006 and is now negatively associated. Younger children are associated with fewer behavioural Difficulties. However, it should be remembered that this is likely to be exaggerated by the field work administration as mentioned in the last Chapter Five. No changes from the Base model estimates were seen for age in the child BMI analysis.

In the Difficulties full model, the Northern Ireland Advantaged (-0.168(0.048)) and Disadvantaged (-0.127(0.041)) strata are significantly different from the England Advantaged stratum and are both associated with fewer behavioural Difficulties. The

Wales Advantaged stratum is associated with more child difficulties. Table 6.10 shows that only the Northern Ireland Stratum show significant differences in both the Base and full UK models. The strength of the Northern Ireland Advantaged Stratum to explain differences in child difficulties appears to increase by 1.20% between models. Including more factors has shown that ward level factors relating to advantage may have become more important in explaining levels of child behavioural Difficulties. On the other hand, the Northern Ireland Disadvantaged stratum has shown a 123.5% reduction in estimates between models going from a positive to a negative figure.

In the BMI analysis, the Wales Disadvantaged, Scotland Advantaged (0.119(0.045)), Scotland Disadvantaged (0.188(0.048)) and Northern Ireland Disadvantaged Strata are significantly associated with higher BMI scores. Table 6.11 shows that, all these strata were significant in the Base model. The England Ethnic Minority Stratum was the only one that was significant in the Base model but not in the full UK model. It would appear child/family and other factors, for instance, own ethnicity, were able to explain differences in child BMI more effectively than the fact that the ward had a high proportion of ethnic minority people. The individual level disadvantage of those living in Wales, Scotland and Northern Ireland Disadvantaged wards were not able to explain as much of the variance in BMI compared to the Base model with reductions in estimates of 17.20%, 3.09% and 19.69% respectively. Some child related characteristics were more effective. Wards with a high proportion of disadvantage in Scotland became more effective in explaining the variation in child BMI scores with an increase of 56.69%.

Table 6.9 shows, that for BMI, child's ethnicity is still important for all ethnic minority groups, apart from Black children, in lowering rates compared to White children. Indian children have the lowest. For behavioural Difficulties, Bangladeshi/Pakistani, Indian and 'other' had more Difficulties.

Girls (-0.187(0.015)) had fewer behavioural Difficulties and lower BMIs (-0.144(0.018)) than boys. Low birth weight was not significant in the behavioural analysis. However, low birth weight children had lower BMIs (-0.343(0.038)). Being a being preterm child or having siblings were not significant factors in explaining behavioural wellbeing. However, having long-term health problems (0.158(0.021)) was associated with more behavioural Difficulties.

A number of variables directly related to the mother were estimated in the model that may have influenced child wellbeing. Mother's age at sweep two was important. Compared to mothers who were under 20, children of older mothers had fewer behavioural difficulties. The behavioural difficulties estimates reduced as the mother aged.

Children with depressed mothers had more behavioural Difficulties (0.204(0.017)). Mothers with lower educational qualifications had more child behavioural Difficulties. Children with mothers with O-levels (0.107(0.020)), GCSEs grade D to G (0.222(0.029)), other qualifications (0.190(0.058)), none of the aforementioned (0.340(0.028)) and those with information on qualifications not recorded (0.766(0.244)) all had more Difficulties.

Some of the home learning resources which may influence the behavioural outcomes of the child were significantly associated. Children read to less often had more behavioural Difficulties. Compared to being read to everyday, a child read to several times per week had an estimate of 0.069(0.020). The estimates increased the less often the child was read to. Reading to the child once or twice per week (0.073(0.026)) or less often (0.140(0.066)) had higher BMIs.

As opposed to being taught the alphabet at home, those children that were not (0.049(0.020)) had more Behavioural Difficulties. A similar picture was recorded concerning the child being taught counting at home. Those that were not (0.136(0.043)) had more difficulties.

Mother's age, mental health, educational qualifications, how often taught the alphabet or counting were all found to be insignificant in the BMI analysis.

The speaking of English and other languages in the household, though significant in the cognitive analyses was not found to be a significant factor for either of the outcomes.

Three factors were included in the modelling concerning family economic position and conditions. These were a family socio-economic classification rating, family annual income and housing tenure.

When compared to Professional and Managerial and other non significant categories, those children whose families had an NS-SEC of either lower supervisory and technical

(0.082(0.031)), semi-routine (0.116(0.024)) or having no NSSEC recoded (0.153(0.024)) had more Behavioural problems.

Family income was important in the Difficulties analysis. The comparison group was couple family incomes £11-33,000, lone parent family income £0-55,000 and couple or lone parent family income missing. In broad terms, child in two parent families with high incomes had fewer child difficulties whereas those with the lowest incomes had more difficulties. Children living in couple families which had an income of between £0-11,000 were associated with (0.117(0.029)) more behavioural Difficulties. However, children living in couple families with incomes of £33,000.01-55,000 (-0.069(0.023)) or £55,000 plus (-0.113(0.035)) had fewer behavioural Difficulties. Children in lone parent families were not significantly different from the comparison group.

In terms of housing tenure, in comparison to all other types of tenure, those children whose families lived in shared equity accommodation, rented from the local authority or housing association (0.076(0.022)) had more behavioural Difficulties.

The physical environmental conditions or potential risk factors in the home were examined. Smoking in a room used by the child (0.203(0.021)) was significantly associated with more behavioural Difficulties compared to homes where this did not occur. Children living in homes with a lot of dampness (0.108(0.035)) had more behavioural Difficulties. Having central heating was not a significant factor in either the Difficulties or BMI analyses.

The influence of migration between the first and second sweep was also examined. Families who moved ward between sweep one and two (0.045(0.019)) were associated with more behavioural Difficulties compared to those who did not.

NS-SEC, family income, housing tenure, smoking and dampness were not found to be significant in the BMI analysis

When controlling for all other significant factors, those who entered the study at sweep two were not significantly different to those entered at sweep one in either the behavioural or physical outcomes analyses. A variable identifying whether the family lived in an urban or rural ward was also examined but this was found to be insignificant.

The full UK sample behavioural/physical models also include any significant mothers'/interviewers' opinions of the neighbourhood factors. Levels of vandalism and litter as determined by the interviewers' opinion of the neighbourhood in the BMI analysis dropped out of the model after child level control factors were included. However, a number of factors were significant in the behavioural Difficulties analysis. Compared to the following factors being not very or fairly common, children of mothers who said rubbish (0.059(0.019)), pollution (0.064(0.020)) and noise (0.112(0.023)) were very or fairly common had higher than average behavioural Difficulties. Also those who said access to shops was not very common or who had no access at all to shops (0.073(0.022)) had more behavioural Difficulties. A similar story was found for places for children to play. Compared to having areas in which to play, those children who did not (0.050(0.017)) had more behavioural difficulties.

Table 6. 8 – Behavioural/Physical outcomes: UK sample – Child/family and mothers'/interviewers' opinions of the neighbourhood model variances

	Difficulties scores			BMI scores		
	Ward level variance	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Individual factors plus neighbourhood opinions	0.006 (0.002)	0.788 (0.010)	36507.250	N/A	N/A	N/A
Individual factors only	0.006 (0.002)	0.792 (0.010)	36588.800	0.007(0.003)	0.959(0.013)	32797.190
Reduction from Null model	90.16%	15.63%	2,726.74	63.16%	2.04%	334.48
Reduction from Base model	76.92%	15.63%	2,544.24	30.00%	2.14%	274.11

Table 6. 9 - Behavioural/Physical outcomes: UK sample - Child/family factors and mothers'/interviewers' opinions of the neighbourhood model

Variables and categories	Difficulties β (s.e)	BMI β (s.e)
Variables		
n	14,008	11,702
Child's age	-0.0006(0.0001)	0.0002(0.0002)
Stratum (England advantaged)		
England disadvantaged	0.021(0.026)	0.047(.0029)
England Ethnic	0.010(0.039)	-0.063(0.049)
Wales advantaged	0.107(0.043)	0.080(0.050)
Wales disadvantaged	-0.009(0.032)	0.077(0.037)
Scotland advantaged	-0.054(0.037)	0.119(0.045)
Scotland disadvantaged	-0.058(0.039)	0.188(0.048)
Northern Ireland advantaged	-0.168(0.048)	0.069(0.057)
Northern Ireland disadvantaged	-0.127(0.041)	0.102(0.048)
Child's gender (Male)		
Female	-0.187(0.015)	-0.144(0.018)
Child's ethnicity (White)		
Mixed		
Bangladeshi and Pakistani	0.350(0.045)	-0.224(0.051)
Indian	0.175(0.058)	-0.533(0.066)
Black		0.253(0.062)
Other	0.182(0.076)	-0.268(0.087)
Low birth weight (No)		

Yes		-0.343(0.038)
No of siblings (None)		
1		
2		
3		
4 or more		
Pre-term baby(No)		
Yes		
Child long-term health problems (No)		
Yes	0.158(0.021)	
Missing		
Mother's age (Under 20)		
20-24	-0.109(0.033)	
25-29	-0.245(0.032)	
30-34	-0.304(0.033)	
35-39	-0.346(0.036)	
over 40	-0.388(0.059)	
Mother depressed (No)		
Yes	0.204(0.017)	
Smoking in room child inhabits (No)		
Yes	0.203(0.021)	
Dampness in house (None, some, great amount, missing)		
Not much		
A lot of dampness	0.108(0.035)	
NS SEC (Professional and managerial)		
Intermediate		
Small employer & self employed		
Lower supervisory & technical	0.082(0.031)	
Semi routine	0.116(0.024)	
No NS SEC	0.153(0.024)	

Mother's highest education qualifications (Degree or higher)		
A-levels		
O-Levels	0.107(0.020)	
GCSE d to g	0.222(0.029)	
Other qualifications	0.190(0.058)	
None of the above	0.340(0.028)	
Qualifications missing	0.766(0.244)	
Whether moved since sweep 1 (No)		
Yes	0.045(0.019)	
English spoken at home (English only)		
Yes, English & others		
No, other only		
Mother reads to child (Everyday)		
Several times per week	0.069(0.020)	
Once or twice per week	0.173(0.023)	0.073(0.026)
Once or twice per month	0.337(0.049)	
Less often	0.425(0.058)	0.140(0.066)
Not at all	0.484(0.054)	
Mother teaches alphabet at home (Yes)		
No	0.049(.020)	
Counting taught in home (Yes)		
No	0.136(0.043)	
Family income Diffs- (Couple family incomes £11-33,000 and Lone parent family income £0-55,000 and Couple or lone parent family income missing)		
Couple family income £0-11,000	0.117(0.029)	
Couple family income £33,000.01-55,000	-0.069(0.023)	
Couple family income £55,000 plus	-0.113(0.035)	
Housing tenure (Own with mortgage)		

Own outright		
Shared equity, rent from local authority and housing association	0.076(0.022)	
Rent privately		
Live with parents rent free		
Squatting		
Other		
Mothers' opinion of access to shops (Access very or fairly common)		
Access not very common or not at all common	0.073(0.022)	
Information missing	-0.646(0.245)	
Mothers' opinion of rubbish in area (Rubbish not very common or not at all)		
Rubbish very or fairly common	0.059(0.019)	
Mother's opinion of pollution in area (Pollution not very common or not at all)		
Pollution very or fairly common	0.064(0.020)	
Mother's opinion of noise in area (Noise not very common or not at all)		
Noise very or fairly common	0.112(0.023)	
Mothers' opinion of areas in which child can play(Places to play)		
No places to play	0.050(0.017)	
Interviewers' opinion of graffiti on streets (None or little graffiti or graffiti missing)		
A lot of graffiti		
Interviewers' opinion of litter on streets (No or virtually litter or information missing)		
A lot of litter on streets		

Table 6. 10 – Behavioural Difficulties outcome: UK sample - reductions/increases in stratum factor variation.

Model description	Base –With child's age and stratum	Base and child/family, mother's/interviewers' opinions of neighbourhood factors	%age reduction/increase in variance between 2 models
England Disadvantaged	**0.350(0.035)**	0.021(0.026)	
England Ethnic	**0.435(0.052)**	0.010(0.039)	
Wales advantaged	-0.087(0.057)	**0.107(0.043)**	
Wales disadvantaged	**0.307(0.042)**	-0.009(0.032)	
Scotland advantaged	-0.070(0.049)	-0.054(0.037)	
Scot disadvantaged	**0.205(0.051)**	-0.058(0.039)	
NI advantaged	**-0.166(0.060)**	**-0.168(0.048)**	**1.20% increase**
NI disadvantaged	**0.166(0.049)**	**-0.127(0.041)**	**123.5 % reduction**

1. Bold categories denotes that the estimate was significantly different (the estimate is more than twice its standard error) to the England Advantaged category.

2. Percentage reduction in variance only calculated if categories are significant in both models.

Table 6. 11 - BMI outcome: UK sample - reductions/increases in stratum factor variation.

	Model description		
Stratum factor categories	**Base –With child's age and stratum**	**Base and child/family, mother's/interviewers' opinions of neighbourhood factors**	**%age Reduction/increase in variance between 2 models**
England Advantaged (Comparison category)			
England Disadvantaged	0.046(0.033)	0.047(0.029)	
England Ethnic	**-0.203(0.043)**	-0.063(0.049)	
Wales advantaged	0.094(0.052)	0.080(0.050)	
Wales disadvantaged	**0.093(0.038)**	**0.077(0.037)**	**17.20% reduction**
Scotland advantaged	**0.127(0.047)**	**0.199(0.045)**	**56.69% increase**
Scot disadvantaged	**0.194(0.050)**	**0.188(0.048)**	**3.09% reduction**
NI advantaged	0.080(0.059)	0.069(0.057)	
NI disadvantaged	**0.127(0.049)**	**0.102(0.048)**	**19.69 reduction**

1. Bold categories denotes that the estimate was significantly different (the estimate is more than twice its standard error) to the England Advantaged category.

2. Percentage reduction in variance only calculated if categories are significant in both models.

6.4. Behavioural/Physical outcomes: England and Wales sample modelling

The sample has been limited to those living in England and Wales so that 2001 electoral ward census statistics can be estimated in the model at the ward level (level two) in the multi-level model.

The modelling strategy follows the same procedure as for the UK samples. In the England and Wales sample model, the 2001 electoral ward census small area statistics are also estimated individually with the Base model. Those found to be significant are included in a full model with child/family and subjective opinions of the neighbourhood factors.

The sample size has dropped to 10,945 from 14,008 and from 11,702 to 9,476 for the Behavioural Difficulties and BMI analysis respectively.

6.4.1. Behavioural/Physical outcomes: England and Wales sample – Null model

The ward intra class correlation coefficient (ICC) for the Behavioural Difficulties model remains the same as in the UK sample Null model at 6.1%. The variance has dropped marginally in the BMI England and Wales sample to 1.5% from 1.95% in the UK analysis.

Table 6.12 shows that the variances at ward and child level are similar to the UK sample models. There is a slight reduction in the England and Wales ward level variance for both the Behavioural Difficulties and BMI analyses but slightly higher for the child variance. Intercepts and child's age when assessed remain very similar in the Difficulties analysis but the BMI intercept has halved compared to the UK sample model.

Table 6. 12 - Behavioural/Physical outcomes: England and Wales sample - Null model variances.

	Difficulties			BMI		
Model	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Null	0.058 (0.007)	0.936 (0.013)	30653.690	0.015(0.004)	0.983(0.014)	26837.790

Table 6. 13 - Behavioural/Physical outcomes: England and Wales sample - Null model estimates.

Variables	**Difficulties β (s.e)**	**BMI β (s.e)**
Child's age in days	0.0000 (0.0001)	0.0001(0.0002)

6.4.1. Behavioural/Physical outcomes: England and Wales sample – Base model

The significant neighbourhood strata for the England and Wales analysis remain significant in the Behavioural Difficulties and BMI analyses. Table 6.14 shows that the variances are also very similar. The England and Wales Difficulties model ward variance shows a slightly lower percentage (2.28%) reduction in variance compared to the UK sample Base model. The England and Wales BMI Base model is able to explain 5.96% more variance than the UK sample Base model. The Difficulties child level variance remains no different to the Null model as in the UK sample. The BMI model is able to explain less of the child variance compared to the Null model but this was a

similar finding to the UK BMI analysis. Table 6.15 reveals that compared to the England Advantaged stratum, the Ethnic Minority stratum is still associated with highest levels of child difficulties followed by the England Disadvantaged and then the Wales Disadvantaged. Wales Advantaged is not significantly different. In the BMI analysis, the England Ethnic minority stratum had lower BMIs but the Wales Disadvantaged with higher. The importance of this factor will be explained in the later models. As in the UK analysis, child's age is not significant at this stage.

Table 6. 14 - Behavioural/Physical outcomes: England and Wales sample - Difficulties and BMI Base models variances.

	Difficulties scores			**BMI scores**		
Model	**Ward level variance**	**Child level variance**	**-2*LL**	**Ward level variance**	**Child level variance**	**-2*LL**
Base	0.026 (0.004)	0.936 (0.013)	30521.560	0.007(0.003)	0.984(0.014)	26793.950
Reduction from Null model	55.17%	0.00%		53.33%	-0.10%	

Table 6. 15 - Behavioural/Physical outcomes: England and Wales sample – Estimates for Difficulties and BMI Base model

Variables	**Difficulties β (s.e)**	**BMI β (s.e)**
Child's age in days	-0.0001 (0.0001)	0.0001(0.0002)
Stratum-(England advantaged)		
England Disadvantaged	0.347(0.035)	0.047(0.029)
England Ethnic	0.431(0.052)	-0.207(0.040)
Wales Advantaged	-0.086(0.057)	0.094(0.050)
Wales Disadvantaged	0.303(0.042)	0.097(0.037)

6.4.2. Behavioural/Physical outcomes: England and Wales sample - Base and mothers'/interviewers' opinions of the neighbourhood and 2001 electoral ward census small area statistics factors only models

The mothers' and interviewers' opinions of the neighbourhood factors and the 2001 electoral ward census small area statistics were estimated with the Base model factors individually. Table 6.16 and Table 6.17 show that, as with the UK Difficulties sample, all the mothers' opinions are significant with similar sized estimates. In the BMI analysis, the mothers' opinion of the common issue with rubbish is significant. In terms of the interviewers' opinions of the neighbourhood, when estimated individually, street conditions, traffic calming, litter, dog mess, fighting in the street, feelings for safety, graffiti and vandalism were all significant factors. In the BMI analysis, litter and the signs of vandalism were associated with higher BMIs.

Forty nine 2001 electoral ward census area statistics were estimated. Table 6.18 shows that in the behavioural Difficulties analysis, 32 factors are significant when entered individually. In the BMI this number is eight. More discussion of these is not attempted at this stage as child/family factors are yet to be included and may make many factors insignificant.

Table 6. 16 - Behavioural/Physical outcomes: England and Wales sample – Difficulties and BMI models - Mothers' opinions of neighbourhood estimates.

Variables	**Difficulties β (s.e)**	**BMI β (s.e)**
Satisfaction with area (very or fairly satisfied)		
Very or fairly dissatisfied	0.146(0.037)	0.062 (0.040)
Neither satisfied nor dissatisfied	0.182(0.036)	0.071(0.039)
Missing	0.419(0.048)	0.014(0.052)
Noise in the area (not very common)		
Very or fairly common	0.339(0.026)	0.041(0.028)
Rubbish in the area (Not very common)		
Very or fairly common	0.216(0.022)	0.046(0.023)
Vandalism in the area (Not very common)		
Very or fairly common	0.242(0.024)	0.045(0.026)
Racial insults in area (Not very common)		
Very or fairly common	0.191(0.042)	0.040(0.045)
Access to shops (Not very common)		
Very or fairly common	0.106(0.029)	0.042(0.030)
Pollution in the area (Not very common)		
Very or fairly common	0.108 (0.024)	0.009(0.025)
Missing	0.204(0.096)	
Play areas in the locality (Yes)		
No places to play	0.207(0.021)	-0.015(0.022)

Table 6. 17 - Behavioural/Physical outcomes: England and Wales sample – Difficulties and BMI models - Interviewers' opinions of neighbourhood estimates.

Variables	Difficulties β (s.e)	BMI β (s.e)
Street conditions (good or fair)		
Not good	0.350(0.039)	0.043(0.043)
Security blinds in shops (none or only some)		
A lot	0.079(0.085)	-0.038(0.092)
Traffic calming measures (No Measures)		
Measures	0.090(0.024)	-0.029(0.026)
Traffic volume (No, little or moderate traffic)		
Heavy traffic	-0.072(0.040)	-0.036(0.044)
Litter (None or virtually no litter)		
Some or a lot of litter	0.339(0.050)	0.113(0.055)
Dog mess (None or little)		
A lot or some	0.290(0.038)	0.045(0.040)
Fighting in the street (1, 2,3 or 4 people seen fighting)		
No one on the street or no hostility	0.327(0.108)	-0.074(0.116)
Interviewer feels safe (Feel safe up to feel comfortable)		
Uncomfortable up to feel for safety	0.385(0.031)	0.038(0.034)
Graffiti (No or little graffiti)		
A lot of graffiti	0.254(0.033)	0.033(0.035)
Vandalism (No signs of vandalism)		
Signs of vandalism	0.242(0.024)	0.116(0.048)

Table 6. 18 - Behavioural/Physical outcomes: England and Wales sample - Difficulties and BMI models - 2001 Census statistics for electoral wards estimates.

Variables	Difficulties β (s.e)	BMI β (s.e)
% in ward living in type of household: One person: Pensioner	0.003(0.004)	0.002(0.004)
% in ward living in type of household: One person: Other	-0.008(0.003)	0.003(0.002)
% in ward living in type of household: One family and no others: All pensioners	-0.005(0.005)	0.000(0.005)
% in ward living in type of household: One family and no others: Married couple households: No children	-0.001(0.005)	-0.004(0.004)
% in ward living in type of household: One family and no others: Married couple households: With dependent children	-0.007(0.003)	-0.010(0.003)
% in ward living in type of household: One family and no others: Married couple households: All children non dependent	0.018(0.008)	-0.006(0.006)
% in ward living in type of household: One family and no others: Cohabiting couple households: No children	-0.027(0.008)	0.003(0.007
% in ward living in type of household: One family and no others: Cohabiting couple households: Dependent children	0.069(0.013)	-0.005(0.011)
% in ward living in type of household: One family and no others: Cohabiting couple households: All children non dependent	0.171(0.086)	-0.048(0.076)
% people in ward: owner occupiers (all types)	-0.001(0.001)	-0.003(0.001)
% people in ward: owner occupier: owns outright	-0.003(0.002)	-0.003(0.001)
% people in ward: owner occupier: Owns with a mortgage or loan	0.000(0.002)	-0.005(0.001)
% people in ward: Renting (all types)	0.001(0.001)	0.003(0.001)

% people in ward: owner occupied: shared ownership	-0.081(0.026)	0.036(0.021)
% people in ward: Renting from: Council (Local Authority)	0.005(0.001)	0.004(0.001)
% people in ward: Renting from: Housing Association/Registered social landlord	-0.003(0.002)	0.002(0.002)
% people in ward: Renting from: Private landlord or letting agency	-0.011(0.002)	-0.002(0.002)
% people in ward: Renting from: Other	0.009(0.007)	-0.001(0.006)
% people in ward: born in England	0.003(0.001)	0.001(0.001)
% people in ward: born in Scotland	-0.139(0.021)	0.026(0.019)
% people in ward: born in Wales	0.004(0.002)	-0.001(0.002)
% people in ward: born in Northern Ireland	-0.344(0.068)	0.088(0.059)
% people in ward: born in Republic of Ireland	-0.099(0.019)	0.023(0.016)
% people in ward: born in other EU countries	-0.092(0.013)	0.024(0.012)
% people in ward: born elsewhere	-0.010(0.002)	-0.002(0.002)
% people in ward: age 16-74 with Highest qualification attained: level 2	-0.014(0.006)	-0.001(0.005)
% people in ward: age 16-74 with Highest qualification attained: level 3	-0.040(0.006)	0.006(0.006)
% people in ward: age 16-74 with Highest qualification attained: level 4/5	-0.013(0.001)	0.002(0.001)
% people in ward: aged 17-64 in ward with no qualifications	0.017(0.001)	0.002(0.001)
% people in ward: male lone parents in ft employment	0.049(0.082)	0.022(0.070)
% people in ward: female lone parents in ft employment	-0.071(0.030)	0.062(0.024)
% people in ward: female lone parents in pt employment	0.087(0.022)	0.031(0.019)
% people in ward: aged 0-15	0.028(0.004)	-0.007(0.004)

% people in ward: aged 16-19	0.070(0.015)	-0.016(0.013)
% people in ward: aged 20-24	0.002(0.007)	0.003(0.006)
% people in ward: aged 25-29	-0.012(0.006)	0.003(0.005)
% people in ward: aged 30-34	-0.019(0.0015)	0.002(0.004)
% people in ward: aged 60-64	-0.015(0.015)	0.003(0.012)
% people in ward: aged 65 and over	-0.004(0.004)	0.001(0.003)
% people in ward: permanently sick	0.042(0.006)	0.000(0.005)
% people in ward: unemployed	0.236(0.029)	-0.021(0.027)
% people in ward: never worked	0.257(0.054)	0.009(0.044)
% people in ward: long-term unemployed	0.067(0.025)	0.009(0.021)
% people in ward: bad health	0.040(0.006)	0.002(0.005)
% people in ward: all lone parents	0.027(0.006)	0.012(0.005)
% people in ward: female lone parents	0.029(0.006)	0.013(0.005)
% people in ward: male lone parents	0.104(0.049)	0.038(0.040)
Ward in top quartile of lone parenthood and persons aged 16-19 (No)		
Yes	0.146(0.042)	0.067(0.035)

6.4.3. Behavioural/Physical outcomes: England and Wales sample - Child/family factors and mothers'/interviewers' opinions of neighbourhood and 2001 electoral ward census small area factors model

The results of changes in variances and model fit can be seen in Table 6.19. The UK analysis also included Scotland and Northern Ireland children but only level one factors. A comparison (not necessarily a fair comparison but perhaps useful for illustrative purposes) was made between the UK level one analyses and the England and Wales analyses (which included level two ward factors). The inclusion of the 2001 ward census data in the England and Wales analysis was able to reduce the ward variance in the Behavioural Difficulties analysis by a significant but very small margin (0.003). In the BMI analysis the reduction was 0.004%. Table 6.19 also shows that there are gradual improvements in model fit between models with child/family factors only, then a model with neighbourhood opinions included and then finally with census variables included.

Comparing the England and Wales sample Base and Full models, when all significant factors are included in the model, there was an 88.46% reduction in variance in the Difficulties analysis. In the BMI model this was lower at 57.14%. The important point is that the addition of the ward level data was able to explain a marginal but statistically significant amount of the differences between wards in the child behavioural wellbeing outcomes. As in the cognitive analysis, residual normality plots for the full model are provide for diagnostic purposes. Level One and Two residual normality plots for the Behavioural Difficulties final model (Table 6.20) can be seen Figures 8 and 9 respectively in Appendix 2. Similar plots for the BMI final model (Table 6.20) can be seen in Figures 10 and 11 respectively in Appendix 2. It is noted that the distribution of the residuals in the BMI level one plots could be more linear at the higher levels of BMI but it is considered that the results are relatively robust to this issue.

Most of the factors that were significant in the UK sample models are also significant in the England and Wales sample models and with fairly similar estimates. Therefore, only variables or categories within variables that drop out or are found to be significant in the England and Wales models are highlighted at this stage. Table 6.22 shows that when

comparing the England and Wales Difficulties analysis Base model with the full model, the three neighbourhoods Strata of England Advantaged Disadvantaged, England Ethnic Minority and Wales Disadvantaged that were significant now become insignificant. However, in the full model, the Wales Advantaged stratum now becomes significant. Children sampled in this type of ward had fewer difficulties having controlled for all other factors. The characteristics of advantage in these areas appear to have a positive association.

In the BMI analysis, as shown in Table 6.23, none of the strata are significantly different to the England Advantaged strata. Originally, in the Base model, the high proportionality of ethnic minority and disadvantage characteristics in England Ethnic minority wards and Wales disadvantage wards were able to explain some of the variation in children's BMIs. However, after controlling for other factors, this is no longer true. Aggregated ward socio-economic factors as measured in this analysis are not able to account for differences in children's BMIs. Rather, the differences are related to child or family factors.

Table 6.20, compared to the UK sample analyses, in the England and Wales Final Difficulties model, low birth weight children (0.169(0.036)) had more difficulties compared. Children with mothers aged 20- 24 are now no different from those under 20 (the comparison group). 'A lot' of dampness in the home now drops out of the model but having 'some' dampness (0.150(0.039)) comes in and is associated with more Behavioural Difficulties.

For the BMI model, being a preterm birth (0.093(0.044)) emerges as a significant positive factor. Also children of lone mothers with an income of between £11,000 and 22,000 (0.139(0.059)) had higher BMIs than those in the comparison group.

The factor that indicates whether the child's family moved residence between the first and second sweep was significant in the England and Wales analysis. Compared to having not moved, children that did (0.059(0.021)) had more Behavioural Difficulties and lower BMIs (-0.055(0.024)).

All the mothers' opinions of the neighbourhood variables that were significant in the UK sample are also significant in this sample. Only children who lived in places where

the interviewers said there was a lot of litter (0.110(0.054) had higher BMIs which is different to the UK sample where no neighbourhood opinion factors were significant.

In the England and Wales sample, the original thirty two significant factors were examined individually with the significant child/family and mothers'/interviewers' opinions of the neighbourhood factors. In the Difficulties analysis, fourteen were found to be significant and of those only three remained significant when included in the model together. It is thought the main reason why some of the significant factors drop out of the model when placed in together is due to being correlated with one another. In Table 6.24 of bivariate correlations, the bold text shows which 2001 ward census small area factors are judged to be mildly to highly correlated with one another. It is noticeable that the three factors which remain in the full model (in the shaded cells in the table) are correlated with, at the most, only one other factor whilst most of the others are correlated with more. As such, the three census factors in that remain in the full model may be measuring independent characteristics not measured by the other factors.

Wards with a higher than average proportion of female lone parents who were in fulltime employment (-0.046(0.020)) had fewer than average Behavioural Difficulties. These wards were found in Advantaged urban areas of the North East, South West and rural areas. The wards were also found in the urban Disadvantaged areas in London. Wards with a higher than average proportion of household type being 'Married couples with dependent children' (0.006(0.002)) had more than average Difficulties. These wards were to be found in the urban Ethnic Minority areas in the East Midlands, East of England, South East, West Midlands and Yorkshire and Humberside. Wards with a higher than average proportion of 'people born in Scotland' (-0.071(0.016)) had fewer than average behavioural Difficulties. These wards were more proportionately found in urban Advantaged wards of the North East, South West, and rural wards of the East of England, North East and South East. They were also found in the urban Disadvantaged wards of the East of England and rural wards in the West Midlands.

To summarise the other 14 independently significant census area factors, mentioned in Table 6.21, wards with higher proportions of people with no qualifications and married couples with dependent or non dependent children were associated with fewer Difficulties. Conversely, fewer Difficulties were associated with wards with higher proportions of people with qualifications, or were Northern Ireland born, or renting

from the council, or were married couples with no children or were female lone parent families in fulltime employment.

In the BMI analysis, none of the 2001 electoral ward census area statistics were significantly able to improve upon the model with only level one factors included. As with all the wellbeing outcomes analysed, this decision was based upon the Deviance test which compared one model from the previous (without census factors) with a chi square significance value of $p<0.05$. If this criteria is relaxed to $p<0.1$ then wards which were characterised by higher than average proportion of people renting from the council (local authority) had higher BMIs (0.002(0.001)).

Table 6. 19 - Behavioural/physical outcomes: England and Wales sample – Ward and child variances.

	Difficulties			BMI		
	Ward level variance	Child level variance	-2*LL	Ward level variance	Child level variance	-2*LL
Individual factors plus neighbourhood opinions and census factors	0.003 (0.002)	0.783 (0.011)	28426.140	0.003(0.002)	0.959(0.014)	26525.340
Individual factors plus neighbourhood opinions only	0.007 (0.002)	0.783 (0.011)	28460.800	0.003(0.002)	0.959(0.014)	26525.340
Individual factors only	0.007 (0.002)	0.788 (0.011)	28525.740	0.003(0.002)	0.960(0.014)	26533.510
Reduction in variance from Null model	94.83%	16.35%	2227.55	80.00%	2.44%	312.45
Reduction in variance from Base model	88.46%	16.35%	2095.42	57.14%	2.54%	268.61

Table 6. 20 - Behavioural/physical outcomes: England and Wales sample - Child/family and interviewers opinions of the neighbourhood together with 2001 ward level census statistics model estimates.

Variable & categories	Difficulties β (s.e)	BMI β (s.e)
Variables		
n	10,945	9,476
Child's age	-0.0005(0.0001)	0.0002(0.0002)
Stratum (England advantaged)		
England disadvantaged	0.053(0.027)	0.025(.030)
England Ethnic	-0.035(0.042)	-0.092(0.049)
Wales advantaged	-0.147(0.042)	0.080(0.047)
Wales disadvantaged	-0.036(0.035)	0.061(0.036)
Child's gender (Male)		
Female	-0.180(0.017)	-0.135(0.020)
Child's ethnicity (White, mixed, Indian and other)		
Bangladeshi and Pakistani	0.327(0.047)	-0.231(0.051)
Indian	0.140(058)	-0.511(0.066)
Black		0.249(0.062)
Other	0.197(0.077)	-0.259(0.088)
Low birth weight (No)		
Yes	0.169(0.036)	-0.394(0.048)
No of siblings (None)		
1		
2		
3		
4 or more		

Pre-term baby(No)		
Yes		0.093(0.044)
Ever hospitalised (No)		
Yes		
Child has a long-term illness (No)		
Yes	0.164(0.023)	
Mother's age (Under 20)		
20-24		
25-29	0.087(0.036)	
30-34	-0.141(0.027)	
35-39	-0.202(0.027)	
over 40	-0.224(0.032)	
missing	-0.223(0.063)	
Mother depressed (No)		
Yes	0.214(0.019)	
Smoking in room child inhabits (No)		
Yes	0.189(0.024)	
Central heating in house (No)		
Yes		
Dampness in house (none)		
Not much	0.091(0.031)	
Some	0.150(0.039)	
A lot of dampness		
Moved ward since last sweep (No)		
Yes	0.059(0.021)	-0.055(0.024)
NS SEC (Professional and managerial)		
Intermediate		
Small employer & self employed		
Lower supervisory & technical	0.098(0.035)	
Semi routine	0.113(0.028)	
No NS SEC	0.177(0.028)	

Mother's highest education qualifications (Degree or higher)		
A-levels		
O-Levels	0.096(0.023)	
GCSE d to g	0.222(0.032)	
Other qualifications	0.181(0.063)	
None of the above	0.336(0.032)	
Qualifications missing		
English spoken at home (English only)		
Yes, English & others		
No, other only		
Mother reads to child (Everyday)		
Several times per week	0.090(0.023)	
Once or twice per week	0.182(0.025)	
Once or twice per month	0.322(0.053)	
Less often	0.410(0.066)	
Not at all	0.449(0.057)	
Mother teaches alphabet at home (Yes)		
No	0.085(.023)	
Counting taught in home (Yes)		
No		
Family income Diffs-(Couple family incomes £11-22,000, lone parent family income £0-55,000 and couple or lone parent family income missing) BMI-(Couple family incomes £0-55000 plus, lone parent family income £0-11,000 and £22-55,000 and couple or lone parent family income missing)		
Couple family income £0-11,000	0.112(0.032)	
Couple family income £33,000.01-55,000	-0.062(0.026)	
Couple family income £55,000 plus	-0.089(0.039)	
Lone parent family income £11,000-22,000		0.139(0.059)
Housing tenure		

(Own with mortgage or own outright or live with parents rent free or squatting or other)		
Shared equity, rent from local authority and housing association	0.089(0.024)	
Rent privately		
Live with parents rent free		
Squatting		
Sweep entered study (sweep 1)		
Sweep2	0.317(0.045)	
Mothers' opinion of noise in the area (not very common)		
Very or fairly common	0.127(0.025)	
Mothers' opinion of access to shops (Access very or fairly common)		
Access not very common or not at all common	0.067(0.025)	
Mothers' opinion of pollution in the area (Not very common)		
Very or fairly common	0.077(0.022)	
Mothers' opinion of play areas in the locality (Yes)		
No places to play	0.058(0.019)	
Interviewers' opinion of litter on streets (No or virtually litter or information missing)		
A lot of litter on streets		0.110(0.054)
Significant 2001 electoral ward census factors		
% in ward of female lone parents: in fulltime employment	-0.046(0.020)	
% people in ward: Rented from: Council (Local authority)		0.002 (0.001)
% in ward: Households of type: Married couple: Dependent children: One family and no others	0.006(0.002)	
% people in ward: born in Scotland	-0.071(0.016)	
Drop out when put in model together		
% people in ward: aged 16-74 in ward with no qualifications	0.004(0.001)	
% in ward: One person household: Other	-0.006(0.002)	

% in ward: One family and no others: Married couple households: No children	-0.002(0.009)	
% in ward: One family and no others: Married couple households: All children non-dependent	0.017(0.006)	
% people in ward: Renting from: Housing Association / Registered Social Landlord	-0.004(0.002)	
% people in ward: Renting from: Private landlord or letting agency	-0.005(0.002)	
% people in ward: born in Northern Ireland	-0.212(0.050)	
% people in ward: born in Republic of Ireland	-0.035(0.014)	
% people in ward: born in other EU Countries	-0.037(0.010)	
% people in ward: aged 16-74 with: Highest qualification attained level 3	-0.012(0.005)	
% people in ward: aged 16-74 with: Highest qualification attained level 4 / 5	-0.003(0.001)	

Table 6. 21 - 2001 census factors that are significant before being entered into full Behavioural Difficulties model together

Variable & categories	Difficulties β	BMI β
% in ward: One person household: Other	-0.006(0.002)	
% in ward: One family and no others: Married couple households: With dependent children	0.008(0.003)	
% in ward: One family and no others: Married couple households: All children non-dependent	0.017(0.006)	
% people in ward: Rented from: Housing Association / Registered Social Landlord	-0.004(0.002)	
% people in ward: Rented from: Private landlord or letting agency	-0.005(0.002)	
% people in ward: born in Scotland	-0.081(0.016)	
% people in ward: born in Northern Ireland	-0.212(0.050)	
% people in ward: born in Republic of Ireland	-0.035(0.014)	
% people in ward: born in other EU Countries	-0.037(0.010)	
% people in ward: aged 16-74 with: Highest qualification attained level 3	-0.012(0.005)	
% people in ward: aged 16-74 with: Highest qualification attained level 4 / 5	-0.003(0.001)	
% people in ward: aged 16-74 with no qualifications	0.004(0.001)	
% in ward of female lone parents: in fulltime employment	-0.052(0.021)	

Table 6. 22 - Behavioural Difficulties outcome England and Wales sample - reductions/increases in stratum variation.

	Models		
Stratum factor categories	**Base –With child's age and stratum**	**Base and child/family, mother's/interviewers' opinions of neighbourhood factors**	**% reduction/increase in variance between 2 models**
England Advantaged (Comparison category)			
England Disadvantaged	**0.347(0.035)**	0.053(0.027)	
England Ethnic	**0.431(0.052)**	-0.035(0.042)	
Wales advantaged	-0.086(0.057)	**-0.147(0.042)**	
Wales disadvantaged	**0.303(0.042)**	-0.036(0.035)	

1. Bold categories denotes that the estimate was significantly different (the estimate is more than twice its standard error) to the England Advantaged category.

2. Percentage reduction in variance only calculated if categories are significant in both models.

Table 6. 23 – BMI outcome: England and Wales sample - reductions/increases in stratum variation.

	Model description		
Stratum factor categories	**Base –With child's age and stratum**	**Base and child/family, mother's/interviewers' opinions of neighbourhood factors**	**%age reduction/increase in variance between 2 models**
England Advantaged (Comparison category)			
England Disadvantaged	0.047(0.029)	0.025(0.030)	
England Ethnic	**-0.207(0.040)**	-0.092(0.049)	
Wales advantaged	0.094(0.050)	0.080(0.047)	
Wales disadvantaged	**0.097(0.037)**	0.061(0.036)	

1. Bold categories denotes that the estimate was significantly different (the estimate is more than twice its standard error) to the England Advantaged category.

2. Percentage reduction in variance only calculated if categories are significant in both models.

Table 6. 24 - 2001 Census factors correlations for the Behavioural Difficulties outcome: England and Wales sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1																
2	-0.08	1															
3	-0.31	**-0.65**	1														
4	0.04	**-0.68**	0.38	1													
5	0.03	**-0.76**	**0.53**	**0.55**	1												
6	0.03	**0.53**	**-0.52**	-0.33	-0.42	1											
7	-0.25	**0.69**	-0.45	-0.39	**-0.63**	0.33	1										
8	**-0.57**	0.28	0.15	-0.20	-0.31	0.20	0.26	1									
9	-0.39	0.49	-0.22	-0.32	-0.47	0.36	0.42	**0.63**	1								
10	-0.21	0.49	**-0.53**	-0.27	-0.35	0.35	0.38	0.23	**0.56**	1							
11	**-0.57**	**0.52**	-0.31	-0.36	-0.46	0.32	**0.57**	0.46	**0.51**	**0.50**	1						
12	**-0.67**	0.35	-0.16	-0.07	-0.30	0.19	**0.56**	0.39	0.45	0.44	**0.62**	1					
13	**-0.81**	0.35	-0.01	-0.16	-0.29	0.20	0.47	0.48	0.47	0.38	**0.72**	**0.65**	1				
14	-0.09	0.31	-0.42	-0.14	-0.13	0.27	-0.02	0.00	0.17	0.43	0.22	0.09	0.10	1			

15	0.22	0.18	**-0.57**	0.19	-0.25	0.32	0.29	-0.24	0.02	0.42	0.13	0.22	0.06	0.21	1		
16	0.43	0.25	-0.24	-0.46	-0.14	0.09	-0.01	-0.09	-0.04	-0.06	-0.12	-0.36	-0.35	0.12	-0.35	1	
17	0.13	-0.12	0.07	-0.00	0.16	-0.15	-0.18	-0.35	-0.30	-0.27	-0.25	-0.25	-0.11	0.00	-0.19	0.24	1

Note:

1. The following 2001 electoral ward census small area statistics were found to be significant when placed into child and neighbourhood factor model independently. The correlation matrix is used to show why some of these factors become insignificant when all are placed into model together after controlling for child and neighbourhood factors. Those marked in bold are considered to be mildly (0.5 to 0.7) to highly (0.7 to 0.8) correlated.
2. The factors found to significant in the full model have been put into bold text.

Legend

1. % people in ward: 16-74 no qualifications
2. % one person household: Other
3. % one family and no others: Married couple households: No children
4. % one family and no others: Married couple households: With dependent children
5. % one family and no others: Married couple households: All children non-dependent
6. % people in ward: Rented from: Housing Association/Registered Social Landlord
7. % people in ward: Rented from: Private landlord or letting agency
8. % people in ward: born in Scotland
9. % people in ward: born in Northern Ireland
10. % people in ward: born in Republic of Ireland
11. % people in ward: born in other EU Countries
12. % people in ward: aged 16-74 with: Highest qualification attained level 3
13. % people in ward: aged 16-74 with: Highest qualification attained level 4 / 5
14. % female lone parents: in fulltime employment
15. Ethnic minority stratum indicator
16. Disadvantaged stratum indicator
17. Wales stratum indicator

6.5. Summary and conclusions

In the analysis of the whole UK sample, all else being equal children who had more behavioural Difficulties were: younger, boys, Asian and those who had long term health problems. Children with mothers who was depressed, had low level of educational qualifications, a family with a low social class and a family income of less than £11,000 per year and had moved residence since the first interview also more adverse scores. However, not having a mother under twenty was associated with fewer Difficulties as was a family income of above £33,000. The physical home environment was also important. A child living in a home where people smoked, that was damp and was rented from the local authority or housing association had more Difficulties. In terms of the home learning environment, a child that was not read to everyday, taught the alphabet or counting had more Difficulties.

In terms of the neighbourhood environment as subjectively rated by the mother or interviewer, a child whose mother had limited or no access to shops; problems with pollution, noise and no places for children to play had more Difficulties.

Over and above all other significant factors, a child sampled in an Advantaged ward in Wales had fewer Difficulties but those sampled in a Northern Ireland Advantaged or Disadvantaged ward had fewer than average number of Difficulties.

When the sample was reduced to those living in England and Wales, most of the child factors mentioned above were still important. However, over and above these factors, a number of aggregated electoral ward factors which characterised the socio-economic nature of the ward (Stratum) in which the children were sampled were also significant. Advantaged wards in Wales still had fewer difficulties. Wards with higher than average proportions of fulltime employed female lone parents and Scottish born people were associated with fewer difficulties. Children in wards with a higher proportion of couple households with dependent children had more child Difficulties.

In the BMI analysis, there were far fewer significant child factors. Girls, Bangladeshi or Pakistani and other (not Black) children and low birth weight children had lower BMIs. Black children and in general, not read to everyday had higher BMIs. No neighbourhood factors were associated with BMI. This was apart from Stratum factors in the UK analysis with those children living in Scotland Advantaged, Scotland Disadvantaged and Northern Ireland Advantaged wards having higher BMIs.

When the BMI sample was reduced to children living in England and Wales, the same child factors were important. However, a number of other characteristics became important. Preterm births (given birth weight) or those from lone parent families with incomes ranging from £11,000 to 22,000 had higher BMIs. Those who had moved ward now had lower BMIs in this sample. A subjective neighbourhood related factor also became significant. A child living in a neighbourhood with lots of litter as reported by the interviewer had higher BMIs. Over and above these child, family and neighbourhood related factors, no 2001 electoral ward census small area statistics were significant. Only one census area factor was significant if the significance level was relaxed to the 10% level. In this case, wards associated with rented housing tenure had lower BMIs.

The variability of BMI is not well explained by either level of factors considered here. It does not vary very much in the first place. It may be subject to more random measurement error than has been allowed for in the exclusion of outliers, and with its important determinants in terms of diet, exercise and genes not being observed.

Table 6.25 reveals that the Stratum factor was able to account for just over half of the differences between wards in child behavioural Difficulties and BMI. The child and family factors were particularly successful in explaining the variation between wards and that remaining between children within wards. In the Difficulties analysis the ward variance was reduced by another 2/3rds and by around another ¼ at the child level. In the BMI analysis the variance was reduced by another half but only a small amount of variance was explained at the child level. The subjective neighbourhood factors were able to reduce the

child level variance by 0.005 in the Difficulties analysis and by 0.001 in the BMI but none at the ward level.

Table 6. 25 - Changes in ward/child variance estimates for England and Wales behavioural and physical outcomes scores

	Behavioural Difficulties		BMI	
	Ward	**Child**	**Ward**	**Child**
Child's age	0.058	0.936	0.015	0.983
Stratum	0.026	0.936	0.007	0.984
Child/family	0.007	0.788	0.003	0.960
Subject opinions	0.007	0.783	0.003	0.959
Census	0.003	0.783	0.003	0.959
Unexplained remainder	0.003	0.783	0.003	0.959

However, this was more than in the cognitive analyses. Finally, the census factors were able to account for a further half of the remaining variance at the ward level in the Difficulties score. No census factors were significant in the BMI analysis.

The next chapter will relate these findings to the wider neighbourhood research literature and the wellbeing of young children.

7. Chapter Seven–Discussion and conclusions

7.1. Introduction

The aim of this chapter is threefold. Firstly, it briefly summarises the key findings related to the inter-relationships between the child, family and household and the three dimensions of child wellbeing examined as reported in Chapters Five and Six. Secondly, with reference to the literature on this topic, the chapter then provides a more in depth discussion of the neighbourhood related findings which are the main focus of the thesis. Finally, the strengths and weaknesses of the study design and the implications for further research and policy are discussed.

7.2. Summary of findings

The aim in this thesis was to investigate whether factors relating to neighbourhoods in which children live can explain differences in their wellbeing, over and above characteristics at the individual child and family level. I was able to show that, all else being equal, this was so. The size of neighbourhood associations was relatively small compared to most of the control factors. Included in these findings were otherwise unmeasured factors associated with each ward/sample point (neighbourhood) which were allowed for in the multilevel models and represented by the residual variation.

One way to view the impact of accumulated individual-level adversity is to compare a child with a set of characteristics found to have negative associations with the outcomes and a child with positive ones. For instance, if the child was Bangladeshi/Pakistani, had a mother with no qualifications, a low income family and rented housing from the local authority, the School Readiness score would be .948 of a standard deviation (SD) lower than for a child that was white, had a mother with degree level qualifications, higher family incomes and was not renting. For Naming Vocabulary, this would be lower at 1.3 SDs, with 1.149 SDs more Behavioural Difficulties and .224 SDs of higher BMI.

Other significant neighbourhood factors raise these figures by much smaller fractions of a Standard Deviation.

7.3. Discussion of child and family related findings

One of the objectives of the study was to account for child and family related factors which may be associated with child wellbeing outcomes. Perhaps one of the most interesting findings relating to the child and family factors was their ability to explain not only the differences in the outcomes between children within wards but also between wards. In School Readiness and BMI they reduced the variance by around half at the ward level and by around 2/3rds for the child level. Apart from the BMI analysis, these factors were able to explain around a quarter of the child level variance. Much of the child variance remained unexplained for all outcomes indicating other factors still require investigation.

Across all the wellbeing outcomes a number of factors are independently significant. For instance, boys and low birth weight children have consistently adverse outcomes. Family income and maternal education, work in the opposite direction and noteworthy as they vary geographically with ethnic group and may be suitable for targeting in terms of policy. There were varying degrees of disadvantage associated with varying ethnic groups.

The findings reflect those of Bronfenbrenner (1979) whereby influences operate within the 'micro-system' (related to the child) and 'meso-system' (indirectly related through other family influences). Factors representing the former were larger than for the latter and bore out findings of Brooks-Gunn et al (1993), Chase Lansdale et al (1997) and Kohen et al (2002). Ethnicity appeared to be one of the most important factors for all of the outcomes. The ethnic minority finding relating to Naming Vocabulary may have some resonance with Wilson's (1987) theory concerning 'social isolation'.

These results support other research which found factors related to the cohort child's mother including age (Dezateux et al., 2004), mental health (O'Campo, Salmon and Burke, 2008) and qualifications (McCulloch and Joshi, 2001) to be related to child outcomes. At the family level, the findings support other evidence concerning the

negative associations with low socio-economic class, low family income (Leventhal, 1999) and poor housing conditions/housing type (Dezateux et al., 2004). Moving home was not significant in the cognitive analysis whereas staying in one place has been shown to be beneficial in other analysis (Kohen et al., 2002; Raudenbush and Sampson, 1999b). However, children who moved had higher BMIs. It was noted in Chapter Four that most moves were of a short distance. Further analysis needs to identify whether moves were mainly within ward stratification type or not and whether winners and losers are sorting themselves into different sorts of neighbourhoods. Parenting behaviour concerning the home learning environment reflected many similar findings in other cognitive research (Brooks-Gunn et al., 1993; Dezateux et al., 2004; Hansen, 2008; Klebanov et al., 1998; Sylva et al., 2003).

As McCulloch (2006) suggests, the type of factors examined here provide few insights into the mechanisms that explain differences in wellbeing. Further supporting evidence as to the likely mechanisms and further targeted research would be required. This would need to include more control factors or indicators that focus on specific mechanisms.

7.4. The importance of neighbourhood factors in explaining child wellbeing

7.4.1. Mothers' and interviewers' subjective opinions' of the neighbourhood

To summarise, it would appear that, in general, children living in areas with perceived safety and environmental problems had lower cognitive, more problematic behavioural and worse physical outcomes. However, the results were particularly marginal. For instance, those for Naming Vocabulary which had the highest of the subjective neighbourhood estimates, as children in streets with lots of litter had lower child scores (0.154 of a SD). The significant factors in the Behavioural Difficulties analysis were able to reduce the variance at the child level slightly more convincingly. An unresolved issue is of course, how these environmental problems operate to produce such results.

Children had higher BMIs (.110 of a SD) and lower Naming Vocabulary scores in areas reported by the interviewer to have litter. These types of physical conditions have been found to be negatively related to BMI (Cohen et al., 2006). Living on streets that are unattractive (and perhaps a health hazard) may discourage families from taking their children out and prevent them from playing thereby not gaining the opportunity to exercise. Exercise burns off calories and therefore has the potential to reduce BMI (Carver, Timperio and Crawford, 2008). Although reported by the Interviewer, if the mechanisms concerning 'adaptive preferences' are operating, then these areas may well be dissuading families from venturing in to such places and reducing the opportunity for child cognitive and physical stimulation. Staying at home may in turn increase at-home activities such as reading which has also found to be a significant factor for child wellbeing (Sylva et al., 2003). However, further analysis of other factors related to a higher BMI in children are required, for instance, an examination of the eating behaviour of adults in the household, which has been found to have an impact on the child's intake (Salvy, Kieffer and Epstein, 2008).

The subjective opinions on the neighbourhood were most effective in explaining differences in child Behavioural Difficulties. Interestingly, all the significant reports were by the mother which was not true for the other outcomes (all interviewer-related). Children whose mothers said their areas were polluted had more Difficulties by .077 of a SD, a factor found to be important for child's wellbeing (Ellen, Majanovich and Dillman, 2001). Noise being a problem had a higher estimate with children in these areas scoring .127 of a SD more Behavioural Difficulties. Noise, litter and rubbish have been found to have a negative influence on health (Evans, 1997) and negative reading scores (Evans and Lapore, 1993). Further research including factors such as sleep problems and stress might be useful. Noise is also associated with Behavioural Difficulties such as attention and sleep patterns (Bistrup et al., 2001).

Having no places for children to play in the local area was significant for Behavioural Difficulties and supports findings that suggest areas in which to play are important for child wellbeing (Miles, 2008). Children are able to dissipate frustration and energy when playing (Carver, Timperio and Crawford, 2008). Having nowhere to play is more likely to build levels of energy in the child and being discharged in a negative way resulting in Behavioural Difficulties.

Having no shops close-by (found to be significant) might also be a proxy indicator of a general lack of amenities in the area and has in the past been associated with disadvantaged areas (Sooman, Macintyre and Anderson, 1993) which may reduce the amount of time the child spends outside the home being stimulated by such 'adventures'.

Chapter Four outlined a number of issues relating to the subjective measures used in this analysis. Firstly, one problem relates to what constitutes the 'neighbourhood' and how to measure it. To some extent this thesis has been able to illuminate how the differences in neighbourhood definition including size can produce different results to similar questions. For instance, although, many of the questions asked of both mother and interviewer were not necessarily the same, some did reflect similar dimensions of environmental problems. For instance, the mother was asked her opinion of levels of rubbish whilst the interviewer was asked about litter. However, in the School Readiness analysis, the interviewers' opinion of litter was significant whereas the mothers' thoughts on rubbish were not. It is acknowledged that this may be a result of differences in what is being measured and the differences in definition of neighbourhood. On the other hand, the explanation of 'adaptive preferences' discussed in Chapter Four whereby individuals can become de-sensitised to a particular situation if they are exposed to these conditions for a prolonged period of time is plausible. It may be that mothers in these areas are used to the local conditions in relation to litter/rubbish and under report the issue. On the other hand the interviewers may be hyper sensitive in their responses if they are not familiar with an area. If we rely on the interviewers' opinions that litter in the areas are actually a problem then perhaps the mothers are subconsciously not recognising the importance of this feature of the neighbourhood and its impact on the child's wellbeing.

The strategy of including the mothers'/interviewers' perception variables individually rather than deriving a summary index of these variables was considered to be successful as it provided more detailed information as to those factors which have an influence on child wellbeing.

Many of these findings support neighbourhood related theories discussed by Jencks and Mayer (1990) and in particular, the notion of what Wilson (1991a) called 'social isolation' as unattractive and unsafe neighbourhoods may be preventing the families

who live in them from contacting friends and benefitting from local resources. The lack of shops in some of these neighbourhoods may also have an isolating impact. Other literature has shown that affluent families prefer to live in more attractive areas (Atkins et al., 1996) and the finding that children in the Advantaged areas do relatively better may reflect this. Jencks and Mayer (1990) theory of 'contagion' refers to peer influence effects. For instance, anti-social behaviour copied by other individuals. There may be an indirect connection here between children's negative outcomes and the suggested unattractive and unsafe neighbourhood findings. Many of the problems discussed earlier may be a result of anti-social behaviour such as not placing litter in bins, making the area unattractive or keeping noise to acceptable levels thereby inducing stress or making the places feel unsafe.

7.4.2. The Stratum factor

The Stratum factor was a particularly powerful and important measure of neighbourhood used in the analysis. All else being equal, the nature of a ward being classified as Disadvantaged or having a high proportion of Ethnic Minority groups was able to account for around half of the differences between wards in their levels of child wellbeing in School Readiness, Behavioural Difficulties and BMI scores. It was even greater in the Naming Vocabulary analysis. Northern Ireland Disadvantaged wards were significantly different across all the outcomes apart from in the Naming Vocabulary analysis.

The Stratum factor used in this analysis was able to account, for the most part, for around 0.2 of a SD more variation in child scores compared to the subjective and census neighbourhood factors.

Many of the results broadly support other findings in the literature that show children in deprived neighbourhoods tend to have lower cognitive scores (Chase-Lansdale et al., 1997; Duncan, Connell and Klebanov, 1997; McCulloch, 2006; McCulloch and Joshi, 2001), more behavioural difficulties (Boyle and Lipman, 2002; Kalff et al., 2001; McCulloch, 2006) and a higher BMI in older children and adults (Stafford et al., 2007).

The Stratum factor had the greatest association with the School Readiness score compared to the three other child outcomes. Children in Ethnic Minority wards did .287 of a SD worse. Over and above individual child ethnicity, and disadvantage, the socio-economic structure of these wards lowered children's scores, all else being equal.

A point to note for School Readiness was neither Scotland Advantaged nor Disadvantaged wards were significantly different to England Advantaged wards. One possible explanation is the differential non-response in Scotland Disadvantaged wards (Plewis and Ketende, 2006).

Findings in the Naming Vocabulary cognitive scores show only children in England Ethnic Minority wards did significantly less well. They achieved results .207 of a SD lower than those in England Advantaged wards. Individual ethnicity for all the Ethnic Minority groups examined was found to be important in lowering Naming Vocabulary scores but over and above this, there is something about living in an area with a high proportion of ethnic minorities which also acts to lower scores. Although other factors could be explored which focus on differences in this outcome measure, debates surrounding where and why ethnic minority groups' end up living after migration and the effects of these decisions are likely to be pertinent to this finding. Government policies relating to social inclusion may also be important. Another aspect that further research might untangle is whether children in individual ethnic minority groups are affected in the same way.

In the Behavioural Difficulties analysis, with all else being equal, children in Wales Advantaged and both types of Northern Ireland Stratum wards had significantly fewer Difficulties. Children in England Ethnic Minority wards were found to be no different to those from England Advantaged wards. These are interesting findings and further analysis using variables relating to childcare, discipline in the home and neighbourhood might help in further explaining these differences.

In terms of BMI, children in both Scotland Advantaged (.119 of a SD) and Disadvantaged (.118 of a SD) wards and Northern Ireland Disadvantaged (.102 of a SD) wards had higher BMIs than those in England Advantaged. Higher BMIs in disadvantaged wards is perhaps unsurprising as other research with young children has shown disadvantaged children (Armstrong et al., 2003) and those in disadvantaged areas

(Oliver and Hayes, 2008) are more likely to be overweight. However, it was noted that children in Scotland Advantaged wards also had higher BMIs. Scotland has the highest of the positive Stratum estimates. This is an important finding but it is unclear why this might be so.

Using the Stratum factor in the MCS data to help explain differences in child outcomes was one of the objectives of this investigation and has proved to be successful. The definitions for the strata are based upon specific thresholds of the ward based Child Poverty Index (Plewis, 2007) and levels of Ethnicity Minorities within the MCS wards. As a result, the findings should be viewed in terms of how the outcomes are associated with these wards based upon the particular thresholds of socio-economic structure within the wards used.

To conclude this section, economic advantage or disadvantage and ethnicity are powerful neighbourhood related factors used to explain child wellbeing. Living in a disadvantaged community appears to intensify the influence of disadvantage at the family level rather than account for it.

7.4.3. 2001 census small area statistics

Another objective of this investigation was to examine whether the ward (or neighbourhood) as characterised by socio-economic factors could account for differences in child wellbeing outcomes. Findings show they were able to but their associations were relatively small.

Of the 2001 census area statistics for electoral wards that were used to characterise the neighbourhood in which the children were sampled, five added significantly to the explanation of the cognitive or behavioural wellbeing of the child. None did so when estimated for the BMI outcome (at the 5% significance level at least).

There was little residual ward level variation remaining before the census factors were added. This was higher for the cognitive than for the behavioural and physical wellbeing outcomes. The inclusion of the significant level two (ward) census factors was only able to reduce this by a further small amount.

For School Readiness, children in wards which were characterised as having an above average proportion of people who were English born or wards which had a higher than average proportions of children (aged 0-15) did .006 and .012 of a SD less well than those who did not respectively. This was with all else being equal. These differences appear to be very small. The disadvantaged nature of these wards and their negative associations with the outcomes support the findings of Brooks-Gunn et al (1993) and those that show majority white disadvantaged neighbourhoods also do less well (Kohen et al., 2002). It may be that these areas are, in fact, areas of de-industrialisation with low levels of employment but further research linking this type of information to the MCS would be required to identify whether this assumption is correct. However, this explanation has partial support as many urban disadvantaged areas in the North East of England are former industrial areas with high levels of unemployment where many of these wards were found. Other health related outcome research has shown that former industrial type areas have been linked to poorer outcomes in adults (Mitchell et al., 2000) and therefore similar mechanisms may be operating.

The previous section identified the wards in the 'Ethnic Minority' Stratum as being related to negative child cognitive outcomes. As with the similar findings for the predominantly-English born wards discussed in the previous paragraph, Ethnic Minority wards may also be de-industrialised areas as they are, by the MCS definition, also areas with high values of the Child Poverty Index. Therefore, it may be that ethnicity is not the key issue here but other factors related to deindustrialisation. If this is the case then the explanations discussed concerning ethnic minority wards should be treated with some caution. Further research would be required looking at the nature of specific wards to see whether this was true. The distribution of these types of wards appears to support the existence of some sort of North versus South divide in terms of urban disadvantage and cognitive/BMI wellbeing with those in the North doing less well. Arguments concerning the existence of a North/ South divide have been discussed in other adult health related outcomes such as limiting long-term illness (Wiggins et al., 1998).

The other ward census finding concerning higher proportions of children in the ward was more difficult to explain. It is likely that areas with above average levels of concentrated disadvantage and ethnic minorities groups are more likely to have higher proportions of young children (Armstrong et al., 2003). However, it was noted that this

finding was particularly marginal. This finding provides support for Jencks and Mayer's theory of 'competition for resources'. A high density of children in an area that require educational and other resources may heighten competition. Lack of resources can be linked to disadvantaged areas that also tend to have higher levels of unemployment which itself is associated with low income and poorer child wellbeing outcomes (Brooks-Gunn et al., 1993). Wilson (1991b) in his work on US cities suggested that the existence and combination of several socio-economic related problems in an area could have an aggregated effect of lowering achievement.

Children sampled in wards where there was a higher than average proportion of cohabiting couples with no children had 0.014 of a SD higher Naming Vocabulary scores. The explanation may be similar to that discussed in the last paragraph. Many of these wards were Advantaged Stratum wards. If it is assumed these wards are likely to be associated with families with fewer children and more cohabiting couples with no children compared to Disadvantaged areas, then weaker competition for resources or services in these former areas beneficial to the development of a child's Naming Vocabulary may exist. Again, the Jencks and Mayer theory of 'competition for resources' may be supported here but from the opposite perspective to that discussed earlier. Some of these wards which were found to be Disadvantaged Stratum wards are situated in rural areas. In which case, although likely to have fewer economic resources compared to advantaged areas, children here might gain from having smaller and more dispersed communities.

The highest number of significant census factors was found to be related to child Behavioural Difficulties. Children sampled in a ward with a high proportion of full-time employed lone parent mothers were associated with .046 fewer Behavioural Difficulties. Other research appears to show both negative and positive findings concerning employed female lone parents and child behavioural issues in the early years (Roberts, 2002). Interestingly, none of these wards were associated with Ethnic Minority wards and family level lone parenthood was not found to be significant, all else being equal.

Although not particularly important due to the size of the estimate, children in wards with a higher than average proportion of married couple households with dependent children had .006 of a SD more Behavioural Difficulties. Children in these types of areas were found more proportionately in Ethnic Minority wards. Therefore it might be

supposed that this was related to ethnic minority children. Children from all the ethnicity minority groups (apart from Black children) were found have more Difficulties than White children. Interestingly, the Ethnic Minority Stratum was not significant, all else being equal. Other research also found ethnic minority groups tend to have more children per family (Box, Butt and Bignall, 2001). The concentration effect of having a high density of children may have a separate negative influence which is captured in this ward level statistic. Once again, a greater competition for scarce resources (Jencks and Mayer, 1990) may be an explanation here. Jencks and Mayer's (1990) 'contagion' theory may also be operating. However, this seems a little implausible for children of around three years of age as it might be assumed the mother is more likely to control younger/older child interactions. However, this may not always be the case.

Children sampled in neighbourhoods with high proportions of people born in Scotland had .071 SD fewer Behavioural Difficulties. It is unclear what and how mechanisms might be operating to produce this result but it is interesting nonetheless.

Finally, child BMI scores were not related to any of the census factors. However, one ward level census factor was significant at the 10% level of significance. Children sampled in wards with a higher than average proportion of local authority renting tenants had .110 of a SD higher than average BMIs. It is generally acknowledged that children in disadvantaged circumstances are more likely to have problems of obesity (Lake and Townsend, 2006) although a variety of social, economic and cultural factors might contribute to these inequalities.

7.4.4. Policy implications

In conclusion, it would appear that some ecological factors have a role, albeit minor, to play in the wellbeing of very young children. This research has contributed to the UK evidence base regarding the influence of ecological factors on the wellbeing of young children. The findings here seem to bear out research that has examined neighbourhood effects in relation to older children, for example (Leventhal, Fauth and Brooks-Gunn, 2005; Schneiders et al., 2003) but more detailed analysis of other factors are required.

These findings may also have implications for future policies and those already in place aimed at improving child wellbeing. Evidence presented here suggests that, not only can family level initiatives be important in improving child wellbeing but area based initiatives which reach concentrations of disadvantaged families may also be particularly important in helping to reduce inequalities between neighbourhoods in levels of child wellbeing. Some of these results also go some way to support those findings which linked child wellbeing problems with the circumstances in which children live which were outlined in the consultation by Harker (2006) 'Delivery on Child Poverty: what would it take?' and related to 'Every Child Matters'. They also provide support for some of the area based policies mentioned in the 'Children Act' (Department of Children Schools and Families, 2004). The Sure Start (DWP, 2007) initiative is designed to help families and young children in disadvantaged circumstances through the provision of area and individual based initiatives. These findings go some way to support the notion that disadvantage not only affects child outcomes at the family level but concentrated areas of disadvantage can also have a separate negative impact.

7.5. Strengths and weaknesses of the investigation

7.5.1. Strengths

One of the main strengths of the MCS is that it provides data in stratified clusters which have been used here to considerable effect in accounting for differences in child wellbeing. Included in one of these strata is a large sample of ethnic minority children and their families which is not always available in most other studies in the UK. Not only are there large numbers of respondents, sufficient numbers of families are also clustered in small areas for meaningful statistical analysis to be conducted.

Using four sources of data to define and characterise the neighbourhoods in which the cohort children were sampled and lived was particularly useful especially in aiding in the triangulation of results (Singleton, Straits and Straits, 1993) in this investigation. These measures were able to help explore both the compositional and contextual nature of the neighbourhood environment. Three important methodological advantages of this analysis included the following. Firstly, the unique use of England and Wales 2001

ward census small area statistics to characterise the social and economic nature of the wards in which the MCS cohort children were sampled. Secondly, the use of the stratification factor of wards by advantage, disadvantage and ethnicity. Thirdly, the use of subjective opinions of respondents' and interviewers' to characterise two differing definitions of the local neighbourhood. As explained in Chapter Four, this set of information provided a comprehensive picture of the local environment rather than just that collected for the MCS families. The data in the MCS has also helped avoiding the ecological fallacy by allowing information concerning individuals to be accounted for when attempting to draw inferences at the neighbourhood (ward) level.

The data were extracted from National Census datasets by the author using the original 1998 census ward boundaries which were also used in the original survey sampling frame and then matched into the analysis dataset. This has helped to provide a more accurate and detailed socio-economic characterisation of wards in which the MCS respondents and their children were sampled.

The other methodological feature was the use of individual area related factors to characterise the physical nature of the neighbourhoods. Rather than using Principle Components Analysis to reduce the mothers' and interviewers' neighbourhood opinions into a smaller number of summary factors, the decision was made to keep them as individual factors. The same strategy was also employed for the 2001 census small area statistics. By keeping these factors separate, identifying the individual aspects of neighbourhood influence was facilitated and avoided the problem of interpreting over-simplified labels on clustered categories.

7.5.2. Weaknesses

A great deal of information relating to the socio-economic environment, perceptions of safety and environmental conditions were available and used in the investigation. However, information describing the physical resources such as health services, child care and community centres may have been particularly useful. These types of resources which were not available on a nationwide basis, would also be important in explaining further variations in wellbeing between children as suggested by Macintyre et al (2002).

Although 2001 census small area statistics for England and Wales were used to characterise the neighbourhoods, information for Scotland and Northern Ireland was not readily available at the time when the analysis was being conducted.

It was also not possible, at that time of the analysis, to classify the ward destination type of those who had moved between sweep one and sweep two. This may have been helpful in testing hypotheses concerning the impact of moves to similar and differing types of wards on child wellbeing.

One unfortunate aspect from the point of neighbourhood research is that the children in the study are still only very young. As I have shown, many of the significant influences on child wellbeing have been a result of indirect influences either through the parents or the environment. The children are probably too young for more direct associations to be drawn. The children, at this stage of their lives, are perhaps unable to provide their opinions of the neighbourhood in any meaningful way even if they were asked. However, on the positive side, this investigation has highlighted the fact that many of these issues manifest themselves at a very early age and that further research and early interventions may be of benefit.

The issue of relativity bias in perceptions of the neighbourhood is a weakness in this research and is acknowledged here. The mother's perception of the conditions in her neighbourhood might be biased, due to the relative comparisons she makes between her neighbours, those in other neighbourhoods and her limited frame of reference. It might also be the case that the interviewers also suffer from either under or over reporting of neighbourhood issues dependent on their own social and cultural experiences.

7.6. Future research

There are several recommendations for future research. The electoral ward boundary might be considered a rather large area for a neighbourhood and therefore census geographical aggregations of data such as census output area (OA) or super output area

(SOA) which are smaller, might prove interesting measures of the 'close neighbourhood' to explore. This may also solve some of the issues identified in the modifiable areal unit problem (Flowerdew, Manley and Sabel, 2008) argument and allow for more homogenous areas to be selected to represent neighbourhoods with people with similar socio-economic characteristics. Related to this issue is the linking of other types of contextual data which may become more readily available in the future. Examples might include more physical, material and resource based characteristics of the neighbourhood which can be linked to the MCS at different geographical levels.

An aspect of modelling not considered in this investigation is that of interactions between variables at both individual and neighbourhood level. Same level and cross level interactions might generate interesting results (Snijders and Bosker, 1999). However, a decision was taken to leave this analysis for further research in an attempt to concentrate on those objectives outlined at the start of the study. Further analysis of this nature would require further complex analysis and interpretation considered to be beyond the scope of this study. Another aspect that has not been explored is the simultaneous treatment of outcomes in multivariate modelling, again for similar reasons outlined above.

One dimension of neighbourhood influences mentioned in the review of literature but not explored here is that of collective socialisation. This can be examined using measures such as levels of social capital and networks. This may prove to be a fruitful area of further research as variables may be available to characterise this dimension, particularly at the family level.

Other factors at both the child/family and neighbourhood level such as levels of child care, discipline provided by the parents, sibling interactions and other preschool child support have been shown to be important (Sylva et al., 2003) and could be included in further research.

The longitudinal nature of the MCS study design means that the children and their families will be interviewed as they get older. Further sweeps of the study may record more direct interactions and responses between the child and the neighbourhood and therefore loosen the reliance on explanations mediated through family members.

8. Appendix 1 – MCS Sample information

Table 8.1- Child and family level variables

Variable	Obs	%
Total	14073	100
Stratum		
England Advantaged	3938	28
England Disadvantaged	3478	24.7
England Ethnic minority	1506	10.7
Wales Advantaged	654	4.6
Wales Disadvantaged	1471	10.5
Scotland Advantaged	877	6.2
Scotland Disadvantaged	807	5.7
Northern Ireland Advantaged	538	3.8
Northern Ireland Disadvantaged	804	5.7
Sex		
Males	7136	50.7
Female	6937	49.3
Ethnicity		
White	11982	85.1
Mixed	404	2.9
Indian	347	2.5
Bangladeshi/Pakistani	755	5.4
Black	405	2.9
Other	142	1
Missing	38	0.3
Low birth weight		
No	12705	90.3

Variable	Obs	%
Yes	800	5.7
Missing	568	4.0
Longstanding ill health		
No	11931	84.8
Yes	2132	15.1
Missing	10	0.1
Ever hospitalised		
No	9568	68.0
Yes	4505	32.0
Number of siblings		
None	3524	25.0
1	6401	45.5
2	2694	19.1
3	1001	7.1
4 or more	453	3.2
Preterm baby		
No	12521	89.0
Yes	1003	7.1
Missing	549	3.9
Mother's age		
Under 20	1126	8.0
20-24	2468	17.5
-29	3849	27.4
30-34	4277	30.4
35-39	2037	14.5
over 40	316	2.2

Variable	Obs	%
Mother's depression		
No	9967	70.8
Yes	4106	29.2
Smoking in home		
Yes	11525	81.9
No	2548	18.1
Damp problems		
No damp	12091	85.9
Not much damp	999	7.1
Some problems	704	5.0
Great problems	279	2.0
Central heating		
Yes	13260	94.2
No	813	5.8
Lone parent		
No	12772	90.8
Yes	1301	9.2
Family Social-economic class		
Professional and managerial	5189	36.9
Intermediate	1573	11.2
Small employer & self employed	1143	8.1
Lower supervisory & technical	1050	7.5
Semi routine	2391	17.0
No NS SEC	2727	19.4
Mother's highest educational qualifications		

Variable	Obs	%
Degree or higher	3640	25.9
A'levels	1336	9.5
O'levels	4620	32.8
GCSE d to g	1427	10.1
Other qualifications from overseas	303	2.2
None of these qualifications	2168	15.4
Missing	579	4.1
Language spoken at home		
English only	12184	86.6
English and other languages	1563	11.1
Other languages only	326	2.3
How often mother reads to child		
Everyday	8189	58.2
Several times a week	2689	19.1
Once or twice a week	2168	15.4
Once or twice a month	362	2.6
Less often	273	1.9
Not at all	383	2.7
Missing	9	0.1
Child taught the alphabet at home		
Yes	11442	81.3
No	2622	18.6
Missing	9	1.0
Child taught the counting at home		
Yes	13575	96.5
No	488	3.5

Variable	Obs	%
Missing	10	0.1
Family income		
Couple family £11-22,000	3058	21.7
Couple family £0-11,000	1152	8.2
Couple family £22-33,000	2638	18.7
Couple family £33-55,000	2253	16.0
Couple family £55,000-plus	832	5.9
Lone parent family £0-11,000	1606	11.4
Lone parent family £22-33,000	467	3.3
Lone parent family £33-55,000	75	0.5
Lone parent family £55,000-plus	16	0.1
Couple or lone parent family income missing	1975	14.0
Housing tenure		
Own home with a loan	8388	59.6
Own outright	720	5.1
Part rent mortgage, rent from Local authority or housing association	3469	24.7
Rent privately	1016	7.2
Live with parents or rent free	370	2.6
Squatting or other	110	0.8
Urban/Rural indicator		
Urban	8280	58.8
Market town	540	3.8
Rural town	844	6.0
Village, hamlet	834	5.9
Missing	3575	25.4

Variable	Obs	%
Migration indicator		
Not moved by Sweep 2	9124	64.8
Moved by Sweep 2	4399	31.3
Missing	550	3.9

Note:

1. Numbers of observations presented are based on those used in the UK School Readiness outcome analysis. However, the other outcomes examined have approximately similar proportions.

2. The number of observations in each category may change during the modelling process. Factors can be recoded into the comparison group if individual categories are found not to be significant.

Table 8 2- Mothers' subjective opinions of neighbourhood sample descriptive information

Variable (Opinion of neighbourhood)	Obs	%
		%
Total	14073	100
Satisfaction with neighbourhood		
Very or fairly satisfied	11058	78.6
Very or fairly dissatisfied	929	6.6
Neither satisfied nor dissatisfied	993	7.1
Missing	1093	7.8
Noise		
Not very common	11409	81.1
Very common	2085	14.8
Missing	579	4.1
Rubbish		
Not very common	9406	66.8
Very common	4092	29.1
Missing	575	4.1
Vandalism		
Not very common	10633	75.6
Very common	2853	20.3
Missing	587	4.2
Racism		
Not very common	12680	90.1
Very common	691	4.9
Missing	702	5.0
Access to shops		
Not very common	11482	81.6

Variable (Opinion of neighbourhood)	Obs	%
		%
Very common	2013	14.3
Missing	578	4.1
Pollution		
Not very common	10432	74.1
Very common	2949	21.0
Missing	692	4.9
Places for child to play		
Yes	8302	59.0
No	5037	35.8
Missing	734	5.2

Note:

1. Numbers of observations presented are based on those used in the UK School Readiness outcome analysis. However, the other outcomes examined have approximately similar proportions. The number of observations in each category may change during the modelling process. Factors can be recoded into the comparison group if individual categories are found not to be significant.

Table 8.3- Interviewers' subjective opinions of the neighbourhood sample descriptive information

Variable (Opinion of respondents street)	Age	%
Total	14073	100
Street conditions		
Good	12807	91.0
Not good	869	6.2
Missing	397	2.8
Security blinds		
None or few	13492	95.9
A lot of	184	1.3
Missing	397	2.8
Street calming measures		
None	10710	76.1
A lot of	2941	20.9
Not sure of measures or not	29	0.2
Missing	393	2.8
Traffic volume		
None or little	12914	91.8
Heavy	763	5.4
Missing	396	2.8
Litter		
None or little	13183	93.7
A lot of	491	3.5
Missing	399	2.8
Dog mess		
None or few	12612	89.6

Variable (Opinion of respondents street)	Age	%
A lot of	1065	7.6
Missing	396	2.8
Fighting in street		
None or few	13563	96.4
Some	114	0.8
Missing	396	2.8
Safe street		
Safe	12177	86.5
Feel of safety	1502	10.7
Missing	394	2.8
Graffiti		
None	12132	86.2
A lot of	1547	11.0
Missing	394	2.8
Vandalism		
None	12866	91.4
Signs of	746	5.3
Missing	393	2.8

Note:

1. Numbers of observations presented are based on those used in the UK School Readiness outcome analysis. However, the other outcomes examined have approximately similar proportions.

2. The number of observations in each category may change during the modelling process. Factors can be recoded into the comparison group if individual categories are found not to be significant.

9. Appendix 2 – Residual Normality plots

Figure 4 –School Readiness level one residual normality plot for England and Wales' final model.

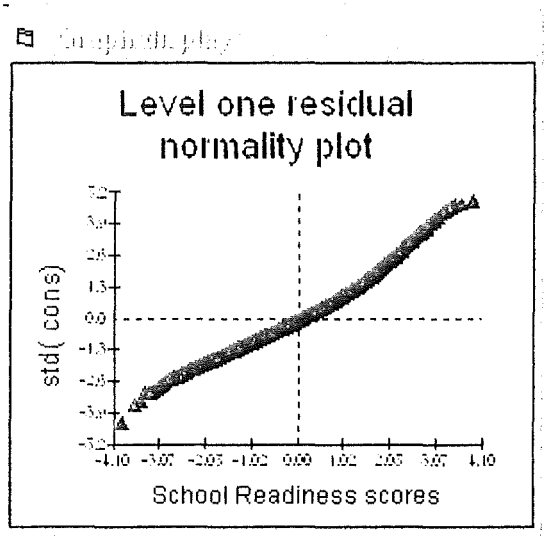


Figure 5 - School Readiness level two residual normality plot for England and Wales' final model.

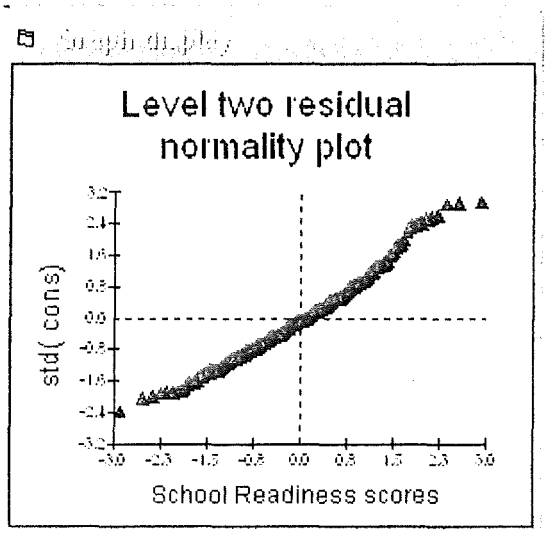


Figure 6 - Naming Vocabulary level one residual normality plot for England and Wales' final model

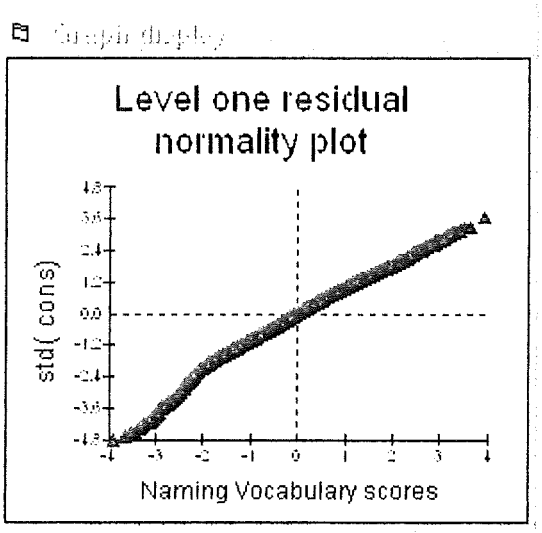


Figure 7 - Naming Vocabulary level two residual normality plot for England and Wales' final model

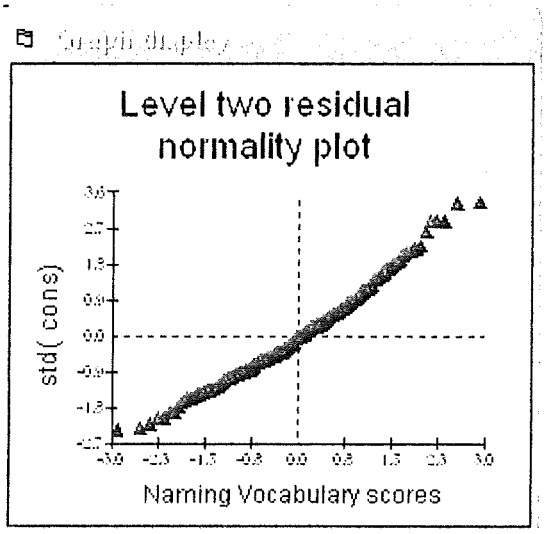


Figure 8 – Behavioural Difficulties level one residual normality plot for England and Wales' final model residual normality plot

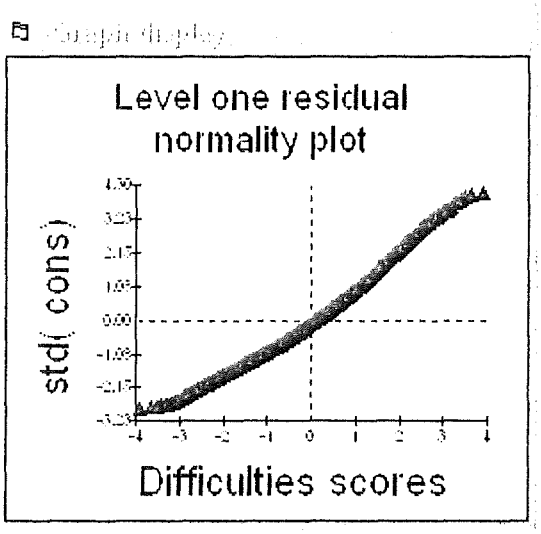


Figure 9 - Behavioural Difficulties level two residual normality plot for England and Wales' final model residual normality plot

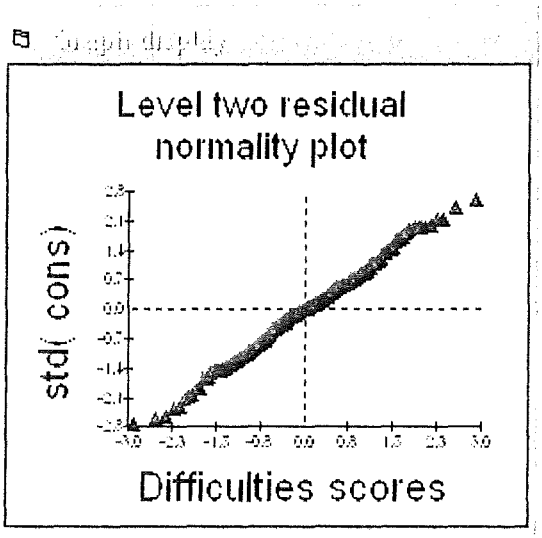


Figure 10 - BMI level one residual normality plot for England and Wales' final model residual normality plot

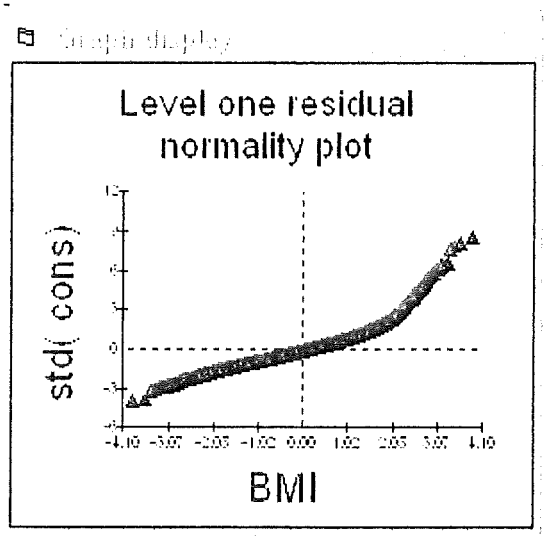
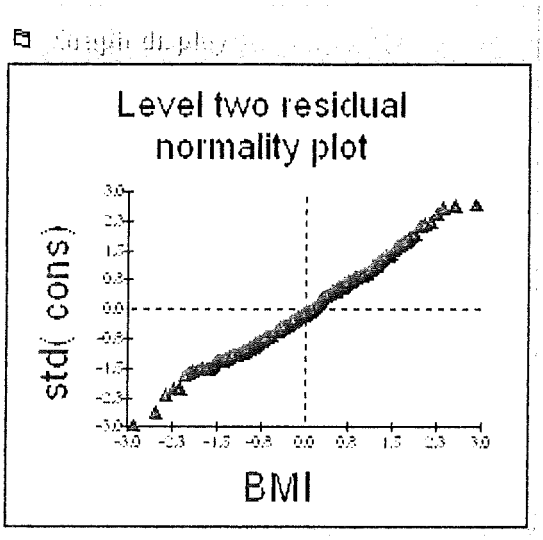


Figure 11 - BMI level two residual normality plot for England and Wales' final model residual normality plot



10. Bibliography

Aber, J. L., Gephart, M. A., Brooks-Gunn, J. and Connell, J. P. (1997), 'Development in Context: Implications for Studying Neighborhood Effects'. In J. Brooks-Gunn, G. J. Duncan and J. L. Aber (eds), *Neighborhood Poverty. Volume 1. Context and Consequences for Children* (Vol. 1, pp. 60). New York: Russell Sage Foundation.

Achenbach, T. M. and Edelbrock, C. S. (1884), 'Psychopathology of childhood. '. *Annual Review of Psychology,* (35), 227-56.

Achenbach, T. M., Edelbrock, C. S. and Howell, C. T. (1987), 'Empirically-based assessment of the behavioural/emotional problems of two - and three-year-old children.'. *Journal of abnormal Psychology,* 15 (4), 629-50.

Altshuler, A. (1970), *Community control: The black demand for participation in large American cities.* New York: Pegasus.

Armstrong, J. A., Dorosty, R., Reilly, J. J. and Emmett, P. M. (2003), 'Coexistence of social inequalities in under nutrition and obesity in preschool children: population based cross sectional study'. *Archives of Disease in Childhood,* 88 (8), 671-675.

Atkins, D., Champion, T., Coombes, M. G., Dorling, D. and Woodward, R. (1996), *Urban trends in England: Latest evidence from the 1991 census.* London: HMSO.

Barker, D. J. P. and Osmond, C. (1987), 'Inequalities in health in Britain: specific explanations in three Lancashire towns'. *British Medical Journal,* 294, 749-752.

Barnes, J. (2007), *Down our way: The relevance of neighbourhoods for parenting and child development.* Chichester: John Wiley and Sons.

Barnes, J., Belsky, J., Broomfield, K. A., Melhuish, E. and the National Evaluation of Sure Start Research, T. (2006a), 'Neighbourhood deprivation, school disorder and academic achievement in primary schools in deprived communities in England'. *International Journal of Behavioral Development,* 30 (2), 127-136.

Barnes, J. and Cheng, H. (2006), 'Do parental neighbourhood perceptions contribute to child behaviour problems? A study of disadvantaged children'. *Vulnerable Children and Youth Studies,* 1 (1), 2 - 14.

Barnes, J., Cheng, H., Howden, B., Frost, M., Harper, G., Dave, S., Finn, J. and the NESS Team. (2006b), *Changes in the Characteristics of SSLP Areas between 2000/01 and 2003/04.* Nottingham.

Berkman, L. and Clarke, C. (2003), 'Neighbourhoods and Networks: The Construction of Safe Places and Bridges '. In I. Kawachi and L. Berkman (eds), *Neighbourhoods and Health.* Oxford: Oxford University Press.

Bernard, P., Charafeddine, R., Frohlich, K. L., Daniel, M., Kestens, Y. and Potvin, L. (2007), 'Health inequalities and place: A theoretical conception of neighbourhood'. *Social Science & Medicine,* 65 (9), 1839-1852.

Bistrup, M. L., Hygge, S., Keiding, L. and Passchier-Vernier, W. (2001), *Health effects of noise on children and perception of the risk of noise*: National Institute of Public Health Denmark,.

Bornstein, M. H., Davidson, L., Keyes, C. and Moore, K. A. (2003), *Well-Being: Positive Development across the Life Course.* New Jersey: Erlbaum Associates.

Bornstein, M. H. and Smith, D. C. (2002), 'Cognition and wellbeing: An overview.'. In M. Bornstein, L. Davidson, C. Keyes and M. KA (eds), *Well-being: Positive*

development across the life course. New Jersey: Lawrence Erlbaum Associates Inc.

Bouchard, T. J. and McGue, M. (1981), 'Familial studies of intelligence: A review'. *Science,* (29), 1055-1059.

Box, L., Butt, J. and Bignall, T. (2001), *Black and Minority Ethnic Families Policy Forum. Discussion Paper 1 Setting the context.* London: Race Equality Unit.

Boyle, M. H. and Lipman, E. L. (2002), 'Do places matter? Socioeconomic disadvantage and behavioural problems of children in Canada'. *Journal of Consulting Clinical Psychology,* 70, 378-89.

Bracken, B. (2002a), *Bracken School Readiness Assessment*: The Psychological Corporation: Hardcourt Assessment Company.

Bracken, B. (2002b), *Bracken School Readiness Assessment, Administrators manual*: The Psychological Corporation: Hardcourt Assessment Company

Bronfenbrenner, U. (1979), *The Ecology of Human Development.* Cambridge, MA: Harvard University Press.

Bronfenbrenner, U. and Morris, P. (1998), 'The ecology of developmental processes'. In W. Damon and R. Lerner (eds), *Handbook of child psychology: Vol. 1 Theoretical models of human development* (5th edition ed., pp. 993-1028). New York: Wiley.

Brooks-Gunn, J., Duncan, G. J., Klebanov, P. K. and Sealand, N. (1993), 'Do neighbourhoods influence child and adolescent development?'. *The American Journal of Sociology,* 99 (2), 353-395.

Buck, N. (2001), 'Identifying Neighbourhood Effects on Social Exclusion'. *Urban Studies,* 38 (12), 2251-2275.

Burchardt, T. (2004), *One Mans Rags are Another Mans Riches: Identifying Adaptive Preferences Using Panel Data*: LSE STICERD Research Paper No CASE086,.

Carver, A., Timperio, A. and Crawford, D. (2008), 'Playing it safe: The influence of neighbourhood safety on children's physical activity-A review'. *Health & Place,* 14 (2), 217-227.

Caspi, A., Taylor, A., Moffit, T. E. and Plomin, R. (2000), 'Neighbourhood deprivation affects children's mental health: Environmental risks identified in a genetic design'. *Psychological Science,* 11 (4), 338-342.

Caughy, M. O., Brodsky, A. E. and Muntaner, C. (2003), 'When being alone might be better: neighbourhood poverty, social capital, and child mental health'. *Social Science and Medicine,* 57 (2), 227-237.

Caughy, M. O. B., Hayslett-McCall, K. L. and O'Campo, P. J. (2007), 'No neighborhood is an island: Incorporating distal neighborhood effects into multilevel studies of child developmental competence'. *Health & Place,* 13 (4), 788-798.

Chase-Lansdale, L. and Gordon, R. (1996), 'Economic hardship and the development of five- and six-year-olds; neighbourhood and regional perspectives'. *Child Development,* 67, 3338-3367.

Chase-Lansdale, P. L., Gordon, R. A., Brooks-Gunn, J. and Klebanov, P. K. (1997), 'Neighbourhood and Family Influences on the Intellectual and Behavioural Competence of Preschool and early School-Age Children'. In J. Brooks-Gunn, C. Duncan and J. L. Aber (eds), *Neighborhood Poverty. Context and Consequences for Children* (Vol. One, pp. 79-118). New York: Russell Sage Foundation.

Cheong, Y. F. and Raudenbush, S. W. (2000), 'Measurement and structural models of children's problem behaviours'. *Psychological Methods,* 5 (4), 477-495.

Child Trends. (2000), *Preventing Problems Vs. Promoting the Positive: What do we Want for Our Children.* [Online]. Available at: [illegible]. Last accessed 20th Sept 2008.

Cohen, D. A., Finch, B. K., Bower, A. and Sastry, N. (2006), 'Collective efficacy and obesity: The potential influence of social factors on health'. *Social Science & Medicine,* 62 (3), 769-778.

Cole, T., Bellizzi, M. C., Flegal, K. M. and Dietz, W. H. (2000), 'Establishing a standard definition for child overweight and obesity worldwide: international survey'. *British Medical Journal,* 320, 1-6.

Coleman, J. (1988), 'Social capital in the creation of human capital'. *American journal of Sociology,* 94 (Suppl), S95-S120.

Collins, P. A., Hayes, M. V. and Oliver, L. N. (2008), 'Neighbourhood quality and self-rated health: A survey of eight suburban neighbourhoods in the Vancouver Census Metropolitan Area'. *Health & Place,* In Press, Corrected Proof.

Coulton, C. J. (1996), 'Effects of Neighbourhoods on Families and Children: Implications for services'. In A. J. Kahn and S. B. Kamerman (eds), *Children and Their Families in Big Cities: Strategies for Services reform* (pp. 87-120). New York: Columbia University School of Social Work, Cross-National Studies Program.

Crane, J. (1991), 'The Epidemic Theory of Ghettos and Neighbourhood Effects on Dropping Out and Teenage Childbearing'. *American journal of Sociology,* 96 (5), 1226-1259.

Crowder, K. and Teachman, J. (2004), 'Do residential conditions explain the relationship between living arrangements and adolescent behaviour'. *Journal of Marriage and the Family,* 66, 721-738.

Cullis, A. (2007), *MCS1 - Infant Mortality in the Millennium Cohort Study (MCS) Sample Areas.* London: Centre for Longitudinal Studies.

Cummins, S., Macintyre, S., Davidson, S. and Ellaway, A. (2005), 'Measuring neighbourhood social and material context: generation and interpretation of ecological data from routine and non-routine sources.'. *Health and Place,* 11, 249-260.

Curtis, L. J., Dooley, M. D. and Phipps, S. A. (2004), 'Child well-being and neighbourhood quality: evidence from the Canadian National Longitudinal Survey of Children and Youth'. *Social Science and Medicine,* 58, 1917-1927.

Curtis, S., Southall, H., Congdon, P. and Dodgeon, B. (2004), 'Area effects on health variations over the life-course: analysis of the longitudinal study sample in England using new data on area of residence in childhood'. *Social Science and Medicine,* 58, 57-74.

Dearden, L., Machin, S. and Reed, H. (1997), 'Intergenerational mobility in Britain'. *Economic Journal,* 107, 47-66.

Department of Children Schools and Families. (2004), *Children Act 2004.* [Online]. Available at: [illegible]. Last accessed 17th Sept 2008.

Department of Children Schools and Families. (2007), *The Children's Plan Building brigher futures.* London: The Stationary Office.

PAGE NUMBERING AS IN THE ORIGINAL THESIS

Glennerster, H., Lupton, R., Noden, P. and Power, A. (1999), *Poverty, Social Exclusion and Neighbourhood: Studying the area bases of social exclusion.* CASEpaper 22, London: CASE, London School of Economics.

Goldstein, H. (1995), *Multilevel Statistical Models*. London: Arnold.

Goldstein, H. (2003), *Multilevel Statistical Models* (3rd ed.). London: Edward Arnold.

Goodman, R. and Scott, S. (1999), 'Comparing the Strengths and Difficulties Questionnaire and the Child Behaviour Checklist: Is small beautiful? '. *Journal of abnormal child Psychology,* 27, 17-24.

Graham, E., Macleod, M., Johnston, M., Dibben, C. and Briscoe, S. (2000), 'Individual deprivation, neighbourhood and recovery from illness'. In H. Graham (ed.), *Understanding Health inequalities* (Vol. 156-169). Buckingham: Open University Press.

Hansen, K. (2008), *Millennium Cohort Study First, Second and Third Surveys: A Guide to the Datasets*. London: Centre for Longitudinal Studies, Institute of Education.

Hansen, K. and Joshi, H. (2007), *Millennium Cohort Study Second Survey. A User's guide to initial findings*: Centre for longitudinal Studies, Institute of Education, University of London

Harker, L. (2006), *Delivering on Child Poverty: what would it take? A report for the Department for Work and Pensions*. London: Department for Work and Pensions.

Hawkes, D. and Joshi, H. (2007), 'The Grandparents: What is their role in the family'. In K. Hansen and H. Joshi (eds), *Millennium Cohort Study Second Survey. A User's Guide to Initial Findings*: Centre for Longitudinal Studies, Institute of Education, University of London.

Hawkes, K., O'Connell, J. F., Jones, N. G. B., Alvarez, H. and Charnov, E. L. (1998), 'Grandmothering, menopause, and the evolution of human life histories'. *Proceedings of the National Academy of Sciences,* 95 (3), 1336-1339.

Hawkins, S. S., Griffiths, L. J., Cole, T. J., Dezateux, C., Law, C. and the Millennium Cohort Study Child Health, G. (2008), 'Regional differences in overweight: an effect of people or place?'. *Arch Dis Child,* 93 (5), 407-413.

Hawkins, S. S. and Law, C. (2006), 'A review of risk factors for overweight in preschool children: a policy perspective'. *International journal of Pediatric Obesity,* (1), 195-209.

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

Haynes, R., Jones, A. P., Reading, R., Daras, K. and Emond, A. (2007b), 'Neighbourhood variations in child accidents and related child and maternal characteristics: Does area definition make a difference'. *Health & Place,* In Press, Corrected Proof.

Hird, S. (2003), *What is wellbeing? A brief review of current literature and concepts.*: NHS Health Scotland.

House, J., Landis, K. and Umberson, D. (1988), 'Social relationships and health'. *Science,* 241, 540-545.

IHDP. (1990), 'Enhancing the outcomes of low-birth-weight, premature infants. A multisite, randomized trial. The Infant Health and Development Program'. *JAMA,* 263 (22), 3035-3042.

Jackson, M. I. and Mare, R. D. (2007), 'Cross-sectional and longitudinal measurements of neighborhood experience and their effects on children'. *Social Science Research,* 36 (2), 590-610.

Jencks, C. and Mayer, S. E. (1990), 'The Social Consequences of Growing up in a Poor Neighbourhood'. In L. E. J. Lynn and M. G. McGeary (eds), *Inner-City Poverty in the United States*. Washington DC: National Academy.

Kalff, A. C., Kroes, M., Vles, J. S. H., Hendriksen, J. G. M., Feron, F. J. M., Steyaert, J., van Zeben, T. M. C. B., Jolles, J. and van Os, J. (2001), 'Neighbourhood level and individual level SES effects on child problem behaviour: a multilevel analysis'. *J Epidemiol Community Health,* 55 (4), 246-250.

Kaplan, G. (1996), 'People and places-contrasting perspectives on the association between social class and health'. *International Journal of Health Services,* 26 (3), 507-519.

Kaufman, J. E. and Rosenbaum, J. E. (1992), 'The Education and Employment of Low-Income Black Youth in White Suburbs'. *Educational Evaluation and Policy Analysis,* 14 (3), 229-240.

Kawachi, I. and Berkman, L. F. (2003), 'Introduction'. In I. Kawachi and L. F. Berkman (eds), *Neighborhoods and Health* (pp. 1-19). Oxford: Oxford University Press.

Keenan, T. (2002), *An introduction to child development*. London: Sage Publications Ltd.

Kendrick, D., Mulvaney, C., Burton, P. and Watson, M. (2005), 'Relationships between child, family and neighbourhood characteristics and childhood injury: A cohort study'. *Social Science & Medicine,* 61 (9), 1905-1915.

Kinra, S., Nelder, R. P. and Lewendon, G. J. (2000), 'Deprivation and childhood obesity: a cross sectional study of 20,973 children in Plymouth, United Kingdom'. *Journal of Epidemiology and Community Health,* 54, 456-460.

Klebanov, P. K., Brooks-Gunn, J., Chase-Lansdale, P. L. and Gordon, R. A. (1997), 'Are Neighbourhood Effects on Young Children Meditated by Features of the Home Environment'. In J. Brooks-Gunn, C. Duncan and J. L. Aber (eds), *Neighbourhood Poverty: Context and Consequences For Children* (Vol. 1, pp. 119-145). New York: Russell Sage.

Klebanov, P. K., Brooks-Gunn, J., McCarton, C. and McCormick, M. C. (1998), 'The contribution of neighbourhood and family income to developmental test scores over the first 3 years of life.'. *Child Development,* (69), 1420-1436.

Kohen, D., Hertzman, C. and Brooks-Gunn, J. (1998), Neighbourhood influences on children's school readiness, *Working Paper W-98-15E*: Applied Research Branch, Human Resources Development Canada.

Kohen, D. E., Brooks-Gunn, J., Leventhal, T. and Hertzman, C. (2002), 'Neighborhood income and physical and social disorder in Canada:associations with young children's competencies'. *Child Development,* 73, 1844-1860.

Kohen, D. E., Hertzman, C. and Wiens, M. (1998), Environmental changes and children's competencies, *WP W-98-25E*. Ottawa: Human Resources Development Canada

Lake, A. and Townsend, T. (2006), 'Obesogenic environments: exploring the built and food environments'. *The Journal of the Royal Society for the Promotion of Health 2006,* 126 (26), 2-7.

Leventhal, T. (1999), *Poverty and Turbulence: Familial and Neighbourhood Influences on Children's Achievement.* Columbia University.

Leventhal, T. and Brooks-Gunn, J. (2000), 'The Neighbourhoods They Live In: The Effects of Neighborhod Residence on Child and Adolescent Outcomes'. *Psychological bulletin,* 126 (2), 309-37.

Leventhal, T. and Brooks-Gunn, J. (2003a), 'Children and Youth in Neighborhood Contexts'. *Current Directions in Psychological Science,* 12 (1), 27-31.
Leventhal, T. and Brooks-Gunn, J. (2003b), 'Moving to Opportunity: an Experimental Study of Neighborhood Effects on Mental Health'. *Am J Public Health,* 93 (9), 1576-1582.
Leventhal, T., Fauth, R. C. and Brooks-Gunn, J. (2005), 'Neighborhood poverty and public policy: a 5-year follow-up of children's educational outcomes in the New York City moving to opportunity demonstration'. *Dev Psychol,* 41 (6), 933-52.
Lewis-Beck, M. S. (1980), *Applied Regression, An Introduction.* London: Sage Publications.
Lobstein, T., Baur, L. and Uauy, R. (2004), 'Obesity in children and young people: a crisis in public health'. *Obesity Review,* 5 (1), 4-85.
Lupton, R. (2003), *Neighbourhood effects: Can we measure them and does it matter*: Centre for Analysis of Social Exclusion, London School of Economics.
Macintyre, S. (1997), 'What are spatial effects and how can we measure them?'. In A. Dale (ed.), *Exploiting national survey data: the role of locality and spatial effects.* Manchester: Faculty of Economic and Social Studies, University of Manchester.
Macintyre, S., and Ellaway, A (2000), 'Ecological approaches:rediscovering the role of the physical and social environment'. In L. Berkman, and Kawachi, I (ed.), *Social Epidemiology* (pp. 332-348). Oxford: Oxford University Press.
Macintyre, S., Der, G. and Norrie, J. (2005), 'Are there socio-economic differences in response to a commonly used self report measure of chronic illness?'. *International Journal of Epidemiology,* 34, 461-466.
Macintyre, S. and Ellaway, A. (2000a), 'Ecological approaches: rediscovering the role of the physical and social environment'. In L. Berkman and I. Kawachi (eds), *Social Epidemiology* (pp. 332-348). Oxford: Oxford University Press.
Macintyre, S. and Ellaway, A. (2000b), 'Neighbourhood cohesion and health in socially contrasting neighbourhoods: implications for the social exclusion and public health agendas'. *Health Bulletin,* 60 (6), 450-456.
Macintyre, S. and Ellaway, A. (2003), 'Neighborhoods and Health: An overview'. In I. Kawachi and L. F. Berkman (eds), *Neighborhoods and Health.* Oxford: Oxford University Press.
Macintyre, S., Ellaway, A. and Cummins, S. (2002), 'Place effects on health: How can we conceptualize and measure them?'. *Social Science and Medicine,* 55, 125-139.
Macintyre, S., Ellaway, A., Hiscock, R., Kearns, A., Der, G. and McKay, L. (2003), 'What features of the home and the area might help to explain relationships between housing tenure and health? Evidence from the West of Scotland'. *Health & Place,* 9 (3), 207-218.
Macintyre, S., Maciver, S. and Sooman, A. (1993), 'Area, Class and Health:Should we be Focussed on Places or People?'. *Journal of Social Policy,* 22 (2), 213-234.
Maslow, A. (1968), *Toward a psychology of being.* (3rd ed.). New York: Van Nostrand.
Massey, D., Gross, A. and Shibuya, K. (1994), 'Migration, segregation and the geographic concentration of poverty'. *American Sociological Review,* 59, 425-445.
Matthews, M. (1987), 'Gender, home range and environmental cognition'. *Transactions Institute of British Geographers,* 12 (43-56).

McCulloch, A. (2001), 'Ward-level deprivation and individual social an economic outcomes in the British Household Panel Study'. *Environment and Planning A,* 33, 667-684.

McCulloch, A. (2006), 'Variation in children's cognitive and behavioural adjustment between different types of place in the British National Child Development Study'. *Social Science and Medicine,* (62), 1865-1879.

McCulloch, A. and Joshi, H. E. (2001), 'Neighbourhood and family influences on the cognitive ability of children in the British National Child Development Study'. *Social Science and Medicine,* 53, 579-591.

MCS Development Team. (2006), *A Guide to the Child Assessment and Measurement Datasets - Preliminary 1st Edition* Centre for Longitudinal Studies, Institute of Education.

MCS Team. (2006), *Millennium Cohort Study - A guide to the second dataset - Preliminary first edition - First and second Survey.*

Meltzer, H., Gatward, R., Goodman, R. and Ford, T. (2000), *Mental health of children and adolescents in Great Britain.* London: The Stationary Office.

Miles, R. (2008), 'Neighborhood Disorder, Perceived Safety, and Readiness to Encourage Use of Local Playgrounds'. *American Journal of Preventive Medicine,* 34 (4), 275-281.

Mitchell, R., Dorling, D. and Shaw, M. (2002), 'Population production and modelling mortality - an application of geographic information systems in health inequalities research'. *Health and Place,* 8, 15-24.

Mitchell, R., Gleave, S., Bartley, M., Wiggins, R. and Joshi, H. E. (2000), 'Do Attitude and Area Influence Health? A Multilevel Approach to Health Inequalities'. *Health and Place* 6(2), 67-79.

Morenoff, J. D. and Sampson, R. J. (1997), 'Violent crime and the spatial dynamics of neighbourhood transition: Chicago, 1970-1990'. *Social Forces,* 76, 31-64.

Mott, F., Baker, P., Ball, D., Keck, C. and Lenhart, S. (1998), *The NLSY children 1992: Description and Evaluation, Revised.*: Center for Human Resource Research, The Ohio State University, Columbus OH.

Noble, M., Smith, A. N., Penhale, B., Wright, G., Dibben, C., Owen, T. and Lloyd, M. (2000), *Measuring multiple deprivation at the small area level: The indices of deprivation, 2000.* London: Regeneration research summary 37, Department of the Environment, Transport and the Regions.

Norman, P., Boyle, P. and Rees, P. (2005), 'Selective migration, health and deprivation: a longitudinal analysis'. *Social Science & Medicine,* 60 (12), 2755-2771.

NYC. (2008), *Head Start Every child Deserves a Head Start.* [Online]. Available at: [illegible]. Last accessed 01 Sept 2008.

O'Campo, P., Salmon, C. and Burke, J. (2008), 'Neighbourhoods and mental well-being: What are the pathways?'. *Health & Place,* In Press, Corrected Proof.

Office of The Deputy Prime Minister. (2002), *Place, people, prospects Neighbourhood renewal Unit - Annual Review 2001/02*: Neighbourhood Renewal Unit ODPM,.

Oliver, L. and Hayes, M. (2008), 'Effects of neighbourhood income on reported body mass index: an eight year longitudinal study of Canadian children'. *BMC Public Health,* 8 (16).

Oliver, L. N., Dunn, J. R., Kohen, D. E. and Hertzman, C. (2007), 'Do neighbourhoods influence the readiness to learn of kindergarten children in Vancouver? A

multilevel analysis of neighbourhood effects'. *Environment and Planning A,* 39 (4), 848-868.
Openshaw, S. (1984), *The Modifiable Areal Unit Problem.* Norwich: Geo Books.
Os, J. V., Driessen, G. E. R., Gunther, N. and Delespaul, P. (2000), 'Neighbourhood variation in incidence of schizophrenia: Evidence for person-environment interaction'. *The British Journal of Psychiatry,* 176 (3), 243-248.
Pagano, R. (1998), *Understanding Statistics in the Behavioural Science.* CA: Brooks/Cole Publishing Company.
Parkes, A. and Kearns, A. (2006), 'The multi-dimensional neighbourhood and health: a cross-sectional analysis of the Scottish Household Survey, 2001'. *Health & Place,* 12, 1-18.
Parsons, T. J., Power, C., Logan, S. and Summerbell, C. D. (1999), 'Childhood predictors of adult obesity: a systematic review'. *International Journal of Obesity,* 23, S1-S107.
Pearce, N. (2000), 'The ecological fallacy strikes back'. *Journal of Epidemiology and Community Health,* 54, 326-327.
Perri. (2002), *Sense and solidarities: politics and human wellbeing - a neo-Durkheimian institutional theory of wellbeing and its implications for public policy.* [Online]. Available at:
. Last accessed 15th August 2008.
Pfeffermann, D., Skinner, C. J., Holmes, D. J., Goldstein, H. and Rasbash, J. (1998), 'Weighting for Unequal Selection Probablities in Multilevel Models'. *Journal of the Royal Statistical Society. Series B (Statistical Methodology),* 60 (1), 23-40.
Pickett, K. E. and Pearl, M. (2001), 'Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review'. *Journal of Epidemiology Community Health,* 55, 111-122.
Plewis, I. (2004), *Millennium Cohort Study First Survey - Technical reporting on Sampling - 3rd ed*: Institute of Education.
Plewis, I. (2007), *The Millennium Cohort Study: Technical Report on Sampling 4th Edition.* London: Centre for Longitudinal Studies, Institute of Eucation.
Plewis, I. and Ketende, S. (2006), *Millennium Cohort Study Technical Report on Response*: Centre for Longitudinal Studies,.
Poe, G. (1986), *Design and Procedures for the 1981 Child Health Supplement to the National Health Interview Survey*: National Center for Health Statistics, Hyattsville, MD.
Pollard, E. L. and Davidson, L. (2001), *Foundations of Child Well-being*: Center for child well-being, UNESCO Education Sector Monograph, No 18/2001.
Poortinga, W. (2006), 'Perceptions of the environment, physical activity, and obesity'. *Social Science & Medicine,* 63 (11), 2835-2846.
Putnam, R. D. (2000), *Bowling Alone - The collapse and Revival of American Community.* New York: Simon and Schuster.
Rajaratnam, J. K., Burke, J. G. and O'Campo, P. (2006), 'Maternal and child health and neighborhood context: The selection and construction of area-level variables'. *Health & Place,* 12 (4), 547-556.
Rasbash, J., Steele, F., Browne, W. and Prosser, B. (2004), *A User's Guide to MLwiN Version 2.0*: Centre for Multilevel Modelling, Institute of Education, University of London.

Raudenbush, S. and Bryk, A. (2002), *Hierarchical Linear Models: Applications and Data Analysis Methods*. Thousand Oaks, California: Sage.

Raudenbush, S. W. and Sampson, R. J. (1999a), 'Assessing direct and indirect effects in multilevel designs with latent variables'. *Sociological Methods and Research,* 28, 123-153.

Raudenbush, S. W. and Sampson, R. J. (1999b), 'Ecometrics: Towards a science of assessing ecological settings, with application to the systematic social observation of neighbourhoods'. *Sociological Methodology,* 29, 1-41.

Rauh, V. A., Parker, F. L., Garfinkel, R. S., Perry, J. and Andrews, H. F. (2003), 'Biological, social, and community influences on third-grade reading levels of minority Head Start children: A multilevel approach'. *Journal of Community Psychology,* 31 (3), 255-278.

Reading, R., Jones, A. P., Haynes, R., Daras, K. and Emond, A. (2007), 'Individual factors explain neighbourhood variations in accidents to preschool children'. *Social Science & Medicine,* In press.

Reijneveld, S. A. and Schene, A. H. (1998), 'Higher prevalence of mental disorders in socioeconomically deprived urban areas in The Netherlands: community or personal disadvantage?'. *J Epidemiol Community Health,* 52 (1), 2-7.

Roberts, P. (2002), *The Effects of Changes in Maternal Employment and Family Composition on Children's Behaviour*: Human Resources Development Canada.

Robinson, W. S. (1950), 'Ecological associations and the behaviour of individuals'. *American Sociological Review,* (15), 351-357.

Ross, N., Tremblay, S. and Graham, K. (2004), 'Neighbourhood influences on health in Montreal, Canada'. *Social Science & Medicine,* 59, 1485-1494.

Rutter, M., Giller, H. and Hagell, A. (1998), *Antisocial behaviour by young people.* New York: Cambridge University Press.

Salvy, S. J., Kieffer, E. and Epstein, L. H. (2008), 'Effects of social context on overweight and normal-weight children's food selection'. *Eating Behaviour,* 9 (2), 190-196.

Sampson, R. J. and Raudenbush, S. W. (1999), 'Systematic Social Observation of Public Spaces: A New Look at Disorder in Urban Neighborhoods'. *American journal of Sociology,* 105 (3), 603.

Sampson, R. J. and Raudenbush, S. W. (2005), 'Neighborhood stigma and the perception of disorder'. *Focus,* 24 (1), 7-11.

Sampson, R. J., Raudenbush, S. W. and Earls, F. A. (1997), 'Neighbourhoods and violent crime:a multilevel study of collective efficacy '. *Science,* 277, 918-924.

Sanbonmatsu, L., Kling, J., Duncan, C. and Brooks-Gunn, J. (2006), *Neighborhoods and Academic Achievement: results from the Moving to Opportunity Experiment*: National Bureau of Economic Research, Inc.

Schneiders, J., Drukker, M., van der Ende, J., Verhulst, F. C., van Os, J. and Nicolson, N. A. (2003), 'Neighbourhood socioeconomic disadvantage and behavioural problems from late childhood into early adolescence'. *Journal of Epidemiology and Community Health,* 57 (9), 699-703.

Schoon, I., Sacker, A., Hope, S., Collishaw, S. and Maughan, B. (2005), 'Children's development in the family environment'. In S. Dex and H. Joshi (eds), *Children of the 21st Century.* Bristol: The Policy Press.

Schwartz, S. (1994), 'The fallacy of the ecological fallacy - the potential misuse of a concept and the consequences'. *American Journal of Public Health,* 84 (5), 819-824.

Sellstrom, E. and Bremberg, S. (2006), 'The significance of neighbourhood context to child and adolescent health and wellbeing: A systematic review of multilevel studies'. *Scandinavian Journal of Public Health,* 34, 544-554.

Shepherd, P., Smith, K., Joshi, H. and Dex, S. (2004), *Millennium Cohort Study First Survey: A Guide to the SPSS Dataset*: Centre for Longitudinal Studies.

Shouls, S., Congdon, P. and Curtis, S. (1996), 'Modelling inequality in reported long-term illness in the UK: combining individual and area characteristics'. *Journal of Epidemiology and Community Health,* 50, 366-76.

Simons, L. G., Lin, K. H., Gordon, L. C., Brody, G. H., Murry, V. and Conger, R. D. (2002), 'Community differences in the association between parenting practices and child conduct problems'. *Journal of Marriage and the Family,* 64 (2), 331-345.

Simons, L. G., Simons, R. L., Conger, R. D. and Brody, G. H. (2004), 'Collective Socialization and Child Conduct Problems: A Multilevel Analysis with an African American Sample'. *Youth Society,* 35 (3), 267-292.

Singleton, R. A. J., Straits, B. C. and Straits, M. M. (1993), *Approaches to Social Research.* (2nd ed.). New York: Oxford University Press.

Sloggett, A. and Joshi, H. (1998), 'Deprivation indicators as predictors of life events 1981-1992 based on the UK ONS longitudinal study'. *Journal of Epidemiology and Community Health,* 52 (4), 228-233.

Sloggett, A. and Joshi, H. E. (1994), 'Higher mortality in deprived areas: Community or personal disadvantage?'. *British Medical Journal,* 309, 1470-174.

Small, M. L. and Newman, K. (2001), 'Urban poverty after The Truly Disadvantaged: the rediscovery of the family, the neighbourhood, and culture'. *Annual Review of Sociology,* 27, 23-45.

Snijders, T. A. B. and Bosker, R. J. (1999), *Multilevel Analysis An introduction to basic multilevel modelling.* London: SAGE publications Ltd.

Sooman, A. and Macintyre, S. (1995), 'Health and perceptions of the local environment in socially contrasting neighbourhoods in Glasgow'. *Health and Place,* 1 (1), 15-26.

Sooman, A., Macintyre, S. and Anderson, A. S. (1993), 'Scotland's Health - a more difficult challenge for some? The price and availability of healthy foods in socially contrasting localities in the West of Scotland'. *Health Bulletin,* 51 (5), 276-284.

Stafford, M., Cummins, S., Ellaway, A., Sacker, A., Wiggins, R. D. and Macintyre, S. (2007), 'Pathways to obesity: Identifying local, modifiable determinants of physical activity and diet'. *Social Science & Medicine,* 65 (9), 1882-1897.

Statistics Canada and Human Resources Development Canada. (1995), *National Longitudinal survey of Children: Overview of survey instruments for 1994-1995.* Canada: Ministry of Industry.

Subramanian, S. V. (2004), 'The relevance of multilevel statistical methods for identifying causal neighborhood effects'. *Social Science & Medicine,* 58 (10), 1961-1967.

Subramanian, S. V., Lochner, K. A. and Kawachi, I. (2003), 'Neighborhood differences in social capital: a compositional artifact or a contextual construct?'. *Health & Place,* 9 (1), 33-44.

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., Taggart, B. and Elliot, K. (2003), *The Effective Provision of Pre-School Education (EPPE) Project: Findings from the Pre-School Period*: Institute of Education.

Terman, L. M. and Merrill, M. A. (1973), *Stanford-Binet Intelligence Scale:Manual for the Third Revision. Form L-M.* Boston, Massechusetts: Houghton Mifflin.
Tienda, M. (1991), 'Poor people and poor places: Deciphering neighbourhood effects on poverty outcomes'. In J. Huber (ed.), *Macro-micro linkages in sociology* (pp. 244-267). Thousand Oaks, CA: Sage.
To, T., Cadarett, S. M. and Liu, Y. (2000), 'Child care arrangements and preschool development'. *Canadian Journal of Public Health* 91 (6), 418-422.
To, T., Caderette, S. and Liu, Y. (2001), 'Biological, social, and environmental correlates of preschool development'. *Child: Care, Health and Development,* 27 (2), 187-200.
Townsend, P., Phillimore, P. and Beattie, A. (1989), *Health and deprivation.* London: Routledge.
UNICEF. (2007), *A comprehensive assessment of the lives and well-being of children and adolescents in the economically advanced nations*: UNICEF Innocenti Research Centre.
Vrijheid, M. (2000), 'Health effects of residence near hazardous waste landfill sites: A review of epidemiologic literature'. *Environmental Health Perspectives,* Suppl1 108, 101-112.
Vygotsky, L. S. (1978), *Mind in society: The development of higher mental processes.* Cambridge, MA: Harvard University Press.
Waitzman, N. and Smith, K. (1998), 'Phantom of the area: poverty-area residence and mortality in the United States'. *American Journal of Health,* 88, 973-6.
Wallace, M., Charlton, J. and Denham, C. (1995), 'OPCS area classifications'. *Population trends,* (79), 15-30.
Wardle, J., Carnell, S., Howard, C. M. A. and Plomin, R. (2008), 'Evidence for a strong genetic influence on childhood adiposity despite the force of the obesogenic environment '. *American Journal of Clinical Nutrition,* 87 (2), 389-404.
Warren, D. (1981), *Helping Networks.* South Bend, IN: Notre Dame University Press.
Weden, M. M., Carpiano, R. M. and Robert, S. A. (2008), 'Subjective and objective neighborhood characteristics and adult health'. *Social Science & Medicine,* 66 (6), 1256-1270.
West, R. R. and Lowe, C. R. (1976), 'Mortality from ischaemic heart disease - inter-town variation and its association with climate in England and Wales.'. *International Journal of Epidemiology,* 5, 195-201.
White, J. (1999), 'Thinking About Assessment'. *Journal of Philosophy of Education,* 32 (2), 201-211.
White, M. (1987), *American neighbourhoods and residential differentation.* New York: Russell Sage.
Wiggins, R. D., Bartley, M., Gleave, S., Joshi, H. E., Lynch, K. and Mitchell, R. (1998), 'Limiting longterm illness: a question of where you live or who you are? A multilevel analysis of the 1971-1991 ONS Longitudinal Study.'. *Risk, Decision and Policy,* 3 (3), 181-198.
Wiggins, R. D., Joshi, H. E., Bartley, M., Gleave, S., Lynch, K. and Cullis, A. (2002), 'Place and personal circumstances in a multilevel account of women's longterm illness'. *Social Science and Medicine,* 54 (5), 827-838.
Wilson, W. J. (1987), *The Truly Disadvantaged: The Innercity, the Underclass, and Public Policy.* Chicago: University of Chicago Press.

Wilson, W. J. (1991a), 'Public Policy Research and the 'Truly Disadvantaged.' '. In C. Jencks and P. E. Peterson (eds), *The Urban Underclass.* Washington DC: Brookings.

Wilson, W. J. (1991b), 'Studying Inner-City Social Dislocations: The Challenge of Public Agenda Research'. *American Sociological Review,* 56 (1), 1-14.

World Health Organisation. (1978), *Declaration of Alma-Ata.* [Online]. Available at: . Last accessed 10 Sept 2008.

Yen, I. and Kaplan, G. (1999), 'Neighbourhood social environment and risk of death: multilevel evidence from the Alameda county Study'. *American Journal of Epidemiology,* 149, 898-907.

Zaff, J. F., Smith, D. C., Rogers, M. F., Leavitt, C. H., Halle, T. G. and Bornstein, M. H. (2003), 'Holistic Well-being and the Developing Child'. In D. Bornstein, Keyes and Moore (ed.), *Wellbeing: Positive Development across the Lifecourse.* Mahwah, New Jersey: Erlbaum.