An investigation into inequalities in parent-child involvement in active play

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Abstract

This thesis is concerned with parent-child involvement in active play and, in particular, social inequalities which may exist for mother-child and father-child participation and facilitation. Following a literature review which pointed to a lack of quantitative evidence, interview data from a contemporary study of families in the UK, the Millennium Cohort Study (MCS), were analysed. A dataset of children aged four to six years old living with their birth mothers (n=12,437), and a subset of those who were also living with their birth fathers (n=7997) were used in the analyses.

Two modes of parent-child involvement were investigated: frequency of playing active games together (participation), and frequency of going to parks or outdoor playgrounds together (facilitation). Adjusted multinomial logistic regression analysis was used to explore whether factors relating to child and family attributes, background and circumstances independently predicted high-frequency or low-frequency participation/facilitation, compared to mid-frequency participation/facilitation.

The findings suggested that a variety of social inequalities exist. For example, children with siblings were more likely than those without siblings to have lower frequency active opportunities with their mothers and fathers. Boys were more likely to have higher frequency involvement in active play with their parents than girls, more-so with fathers than mothers. There was also indication that frequency of involvement was significantly affected by parents' health and their hours in employment.

Many of the findings were supported by qualitative research on children's and parents' perspectives discussed in the literature review. Through this first-stage analysis of the UK's major study of contemporary childhood, this thesis aims to contribute to knowledge on inequalities in parent-child involvement in active play. It is hoped that this will inform further research and the development of strategies to improve equality in children's opportunities for active play.

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Preface

This thesis is primarily concerned with parent-child involvement in active play. There were two main elements to the research. Initially, a broad range of qualitative and quantitative research on the topic was identified in a literature review. This was used to inform secondary quantitative analyses of a contemporary UK birth cohort study, the Millennium Cohort Study (MCS). Children aged 4 to 6 years old were the focus of this study, and data collected earlier in their childhoods were also used.

The research has been developed in collaboration with Play England, an organisation which aims to improve children's play opportunities. The Head of Policy and Research, Issy Cole-Hamilton, has been involved in its development as a member of its Research Advisory Group, and has informed the direction, focus and format of the thesis.

In addition to meeting university criteria for an MPhil, the research is intended to be a useful and informative resource for readers outside the academic community, for example those working to develop policy. An accessible writing style has been deliberately adopted and simplified terminology has been used where possible. Graphics in the results chapters have been developed to convey the statistical analyses in original ways.

Acknowledgments

I would like to express considerable gratitude to my supervisor, Professor Hilary Graham, for guiding me for the previous two years. As well as her academic expertise, I appreciate the time and patience she has given me throughout this journey.

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A big thank you goes out to the children and their families who have taken part and continue to take part in the Millennium Cohort Study. Also, to the Centre for Longitudinal Studies, Economic and Social Research Council and other organisations that fund and administrate the study.

Finally, thank you to Play England and the University of York for providing funding for this research.

Author's Declaration

All research presented in this thesis was initiated and conducted by the author, with guidance from members of Play England and the University of York. Secondary data from the Millennium Cohort Study were used: descriptions of the study were obtained from previous publications and described. The author is responsible for the research presented in the thesis.

Structure of the Thesis

The thesis is divided into six chapters. The background and rationale is presented in the first chapter. Literature is presented in the second and third chapters, followed by a methods chapter and results chapter. Finally there is a discussion chapter.

Chapter 1. Background and rationale for the thesis *p14*

This provides an introduction to a few key concepts relating to physically active play and health inequalities among children in particular. Three areas of background reading which were used to inform the research topic are introduced: children's rights and government policy in England; previous research on inequalities and children's play; and secondary sources of quantitative data. The overall thesis aim was and four additional research aims are given.

Chapter 2. Introduction to literature on children's physical activity *p36*

This chapter looks at a number of introductory issues relating to children's physically active play and refers to historical and contemporary literature to help explain these. The chapter highlights difficulties in investigating physically active play, and introduces some inequalities in children's physically active play.

Chapter 3. A review of contemporary literature on parent-child involvement in active play *p53*

Research is presented on a variety of concepts relating to parent-child involvement in active play in modern society, from the UK and similar rich industrialised and democratic nations. The chapter discusses qualitative and quantitative research and is focused on four main types of involvement: playing or being active together; instrumental support; encouragement; supervision and allowing autonomy. Evidence is presented on factors which may impact on these types, including those relating to social diversity and inequalities.

Chapter 4. Methods: MCS Study Design, Measures and Analyses *p101*

The design of the Millennium Cohort Study (MCS) is discussed: the sampling and recruitment strategies, and methods of data collection are described. Justification and explanation of the variables investigated in the analyses are given. The methods of the analyses and reporting are described in detail, with examples of tables and figures.

Chapter 5. Results: Parent-Child Involvement in Active Play *p143*

Three main areas relating to parent-child involvement in active play were researched using the MCS data: mother-child involvement, father-child involvement, and the impact of children's other activities. A statistical method of analysis called multinomial logistic regression was used to investigate the importance of various potential predictors relating to the child's, the household's and parents' background and circumstances on two modes of involvement: participation through playing physically active games together, and facilitation through going to parks and playgrounds.

Chapter 6. Discussion and Conclusions to the Thesis *p206*

This Chapter summarises the results, relating them to contemporary background literature. Strengths and limitations of the thesis are discussed, as well as some ideas on what research could follow this thesis.

Appendices

The full tables and descriptions of results from the statistical analyses.

Reference List

A list of publications referred to in this thesis

Chapter 1.
Background and rationale for the thesis

Chapter 1
Background and rationale for the thesis

This chapter ‘sets the scene’ for the thesis by discussing some of its core concepts, and introducing the aims of the research .

1.1. Introduction to concepts: play, physical activity, and active play *p16*

Definitions of play, physical activity and active play are presented and discussed.

1.2. Introduction to inequalities in children’s health *p19*

An introduction to a few of the key concepts relating to health inequalities among children.

1.3. Rationale for the thesis aim *p23*

Three areas of background reading which were used to inform the research topic are introduced: children’s rights and government policy in England; previous research on inequalities and children’s play; and secondary sources of quantitative data

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1.4. Aims of the research *p35*

The overall thesis aim and four additional research aims are given.

1.1. Introduction to concepts: play, physical activity, and active play

What is play?

Play is a difficult concept to define since it can include such a wide variety of things that children (and adults) do. Four definitions generated from a search of an electronic dictionary are presented in Figure 1-1 below.

1-1. What is play? Four definitions.

Definitions of 'play' adapted from those on Princetown University's *Wordnet*

These descriptions give different perspectives on how play may be viewed, and even seem to contradict each other. For example, participation in games or sports usually involves following rules: in contrast to taking part in activity that is guided more by the imagination. Developing a concise definition of play is something however that many researchers and policy-makers have tackled. Through doing this there tends to be a focus on one particular perspective. For example, the focus on Play England's work is on what is termed 'free play', and a description they have given is:

> '..children choosing what they want to do, how they want to do it and when to stop and try something else….' (Santer et al., 2007, Executive summary page xi)

Others have avoided defining play, allowing flexibility in its use but therefore risking confusion for readers about what is being discussed. Bruce (2004, p143) described play as being an umbrella term for many different activities, and a 'very hazy concept.'

What is physical activity?

Two simple definitions of the term *physical activity* presented in contemporary literature are given below.

> "any bodily movement produced by skeletal muscles that results in energy expenditure" (Biddle et al., 1998, p2)

> "All locomotor physical activity, which involves large muscle groups to move the body around and to apply force to objects" (Livingstone et al., 2003, p682)

These are definitions which have been written by adults, but contemporary researchers have sought to find out if physical activity means something different to children. MacDougall et al. (2004) carried out research with children aged 4 to 12 years in Australia, using creative methods which involved them drawing, taking photos and actively contributing in small focus group discussions. The children's opinions and understandings of different words relating to physical activity were examined. 'Physical activity' and 'exercise' were not regarded highly by the children: they thought of them as being adult words. 'Sport' was also thought of as being something they did but that adults usually controlled. 'Play' on the other hand was seen as something fun and spontaneous that the children could control themselves, but of course play also included activities that may not be regarded as physically active.

What is active play?

Categorising play into different types is widely accepted as important in order to study children's play and to develop practices in different areas such as childcare and playwork. The term 'physically active play' or just 'active play' are commonly used to refer to play which involves children moving around and using their bodies.

In their report on play and exercise in the early years for the UK's Department for Culture, Media and Sport, Brady et al. (2008) emphasised the importance of physically active play for children. Based on the concepts of free play, they defined this as:

> "any physical activity where the child is doing what they want to do for their own reasons". (Brady et al., 2008, p6)

Researchers have emphasised the need to draw a distinction between children's physical activity in the context of free play, where children have autonomy over what they do and follow their own interests, and children's physical activity which is more structured and adult-led (Burdette and Whitaker, 2005). Drawing such a distinction can however be very difficult in research. The literature reviews for this thesis made it clear that, for many of the studies identified, it was not possible to determine the context in which physical activities took place, i.e. whether in play or more structured environments. Thus it has been necessary to include literature for children's physically active play and other physical activity together.

There are many reasons for children to want to take part in active play. Perhaps one of the most important is the feeling of enjoyment and exhilaration that children can feel from it, and opportunities it can provide for them to socialise with others (Lester and Russell, 2008). In Chapter 2, Section 2.1., research on potential benefits of physical activity for children are discussed, particularly those relating to health and well-being.

1.2. Introduction to inequalities in children's health

In health research, the term *inequality* refers to unequal opportunities and particularly unequal health-related outcomes according to the different characteristics and backgrounds that people share (Shaw et al., 2007), for example, by their sex, level of income or ethnicity. All of these are measurable characteristics for which people can be compared, to see whether outcomes differ between groups. We can compare groups to find out if inequalities exist, to answer questions such as:

- Are boys are more likely to have asthma than girls?
- Are children living in households below the poverty-line more likely than those above it to go for treatment at accident and emergency?
- Are adolescents in minority ethnic groups less likely to smoke cigarettes than white children?

Knowing the answers to such questions through empirical research can help service providers make informed decisions about which populations may gain the greatest benefit from support and interventions.

In recent years, health policy in England and internationally has become concerned with how people from more disadvantaged backgrounds tend to suffer from worse health outcomes than those from more advantaged backgrounds (WHO, 2008). Among adults for example, there is evidence that level of physical activity is associated with people's socio-economic background and circumstances (CDC, 2005). Socio-economic factors relating to a person's background may include factors such as their education and past employment; their current circumstances may include current employment, income and home-ownership. These sorts of factors indicate the degree of disadvantage which a person may experience in society. Graham (2007) notes how closely linked factors are: for example, increased educational attainment tends to go hand-in-hand with greater financial wealth, higher status employment, and better housing. These factors impact on each other, and on health outcomes.

Inequalities in health are evident from early in life. Evidence suggests, for example, that children born to poorer parents are more likely to have mental health problems, accidental injuries, and most seriously, of mortality during their childhood (Roberts, 2002, Petrou et al., 2006, ONS, 2009a). In recent years there has been increased research interest into the co-existence of socio-economic inequalities in obesity and underweight among children (Armstrong et al., 2003), which associated with increased chance of illness and earlier mortality during adulthood.

There is strong evidence of gender inequalities in health outcomes. Data from the UK's Office of National Statistics suggested that among children born from 2005 to 2007, the life expectancies for boys would be 77.2 years and for girl 81.5 years (if mortality rates were to remain the same as they were in that year) (ONS, 2009b). One of the biggest impacts on the disparities in life expectancy is the greater susceptibility among men to develop cardiovascular disease at an early age (Doyal, 2001). Evidence suggests that gender differences in a risk factor for this disease, blood pressure, may exist from childhood and adolescence with boys at increased risk compared to girls (Din-Dzietham et al., 2007). Evidence which is presented in more detail later in this thesis, however, suggests that another risk factor, lack of physical activity, is greater among girls.

Socio-economic and gender are two of the most prominently researched dimensions of inequality, and research has also looked at links between them. It is likely that socio-economic factors have an important impact on gender inequalities. Boys and girls tend to have differing outcomes with regards to their education for example, and during adulthood in their experiences of employment, partnerships and parenthood. Evidence suggests that these factors may all have important influences on health outcomes (Graham, 2007).

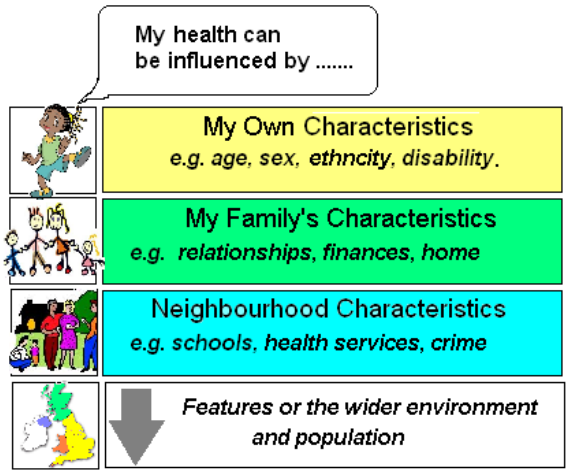
Inequalities in health also exist between different ethnic groups, with minority ethnic groups particularly vulnerable to poor health outcomes. Research using data from a large national cross-sectional survey called the Health Survey for England (HSE) from 1993 to 1996 (Cooper, 2002) and 1998 to 2004 (Smith et al., 2009) have shown that socio-economic inequality can explain much, but not

all, ethnic disparities in health. Researchers have suggested that ethnicity a concept which reflects a number of other underlying factors which can be linked to inequalities (Nazroo, 1998, Platt, 2006, Platt, 2007), including genetics, cultural beliefs, language, migration and acculturation, discrimination and racism.

The mechanisms behind inequalities in health involve complex causal pathways consisting of many different interlinking factors (Graham, 2007). As well as social characteristics such as those discussed above, beliefs and behaviours are essential to these pathways. Specific health behaviours such as diet, alcohol intake, and physical activity are widely recognised as having an impact on health outcomes, and so they are often used as proxy measures to indicate health. These factors can all lead to physiological and biological changes or continuities which directly affect a person's health. This thesis is concerned with inequalities relating to one type of health behaviour, physical activity, specifically in the form of play, as an indicator for health and well-being.

Pathways to inequalities not only involve factors relating to an individual, but also to their family and the wider society that they are part of. Researchers have identified characteristics which exist in different 'domains' or 'levels' which are likely to impact on an individual child's health (Law et al., 2007a). Figure 1-2 has been designed to illustrate this concept.

1-2. Illustration of levels of influences on child health



Although features of the wider environment and population are important, this thesis focuses on characteristics which fall into the top three levels shown: children's own characteristics, their family's characteristics, and their neighbourhood characteristics. These all involve factors which are central to children's own lives and experiences. Child's characteristics relate to individual differences between children, such as their age, sex, ethnicity and disability status. The family's characteristics relate to those socio-economic factors discussed previously that relate to the family unit such as financial situation or vehicle ownership, and also to the family structure and relationships. Some characteristics are specific to individual parents such as their age, education or employment. Neighbourhood characteristics can include many aspects which families in the same neighbourhood share, and there are measures which combine factors to give an indication of area-level deprivation (Shaw et al., 2007, p72). Factors from each of these levels emerged as important when researching the literature for the main topic of this thesis which is presented in Chapter 3.

In summary, there are multiple and complex relationships between factors which contribute to inequalities in children's health. This thesis considers physically active play as a proxy outcome for children's health and well-being, and looks at a variety of factors that may impact on parent-child participation in activities. Factors relating to three main levels are investigated: a child's characteristics, their families characteristics and their neighbourhood characteristics.

1.3. Rationale for the thesis aim

In October 2007, it was known that this research would involve secondary analyses of a quantitative dataset to investigate inequalities in children's play and play-related health in the context of their families. The specific aspects of play, health and families to be investigated, and the data source for analyses, were yet to be decided. The aim at this stage was to choose a thesis aim which was important to children and their families, and for which there was a need for new and distinct contemporary investigation. Three areas of background reading were used to inform the research topic:

- Children's rights and government policy in England
- Previous research on inequalities and children's play
- Secondary sources of quantitative data

In the following sections, the research undertaken for each of these areas is briefly discussed.

Children's Rights and Government Policy in England

The United Nations Convention on the Rights of the Child (CRC) was adopted by the United Nations General Assembly in 1989. It has guided changes in policy relating to childhood across the United Nations countries including the UK. Governments are obliged to ensure that children's rights are recognised through each of its Articles: there are 54 altogether. The Convention has been on UK government agendas since it was ratified in the UK in 1991, and in the last five years strategies have increasingly taken shape to try to make improvements in children's rights during early childhood.

The movement on improving children's opportunities for play in the UK has largely been motivated by the CRC, in particular by Article 31:

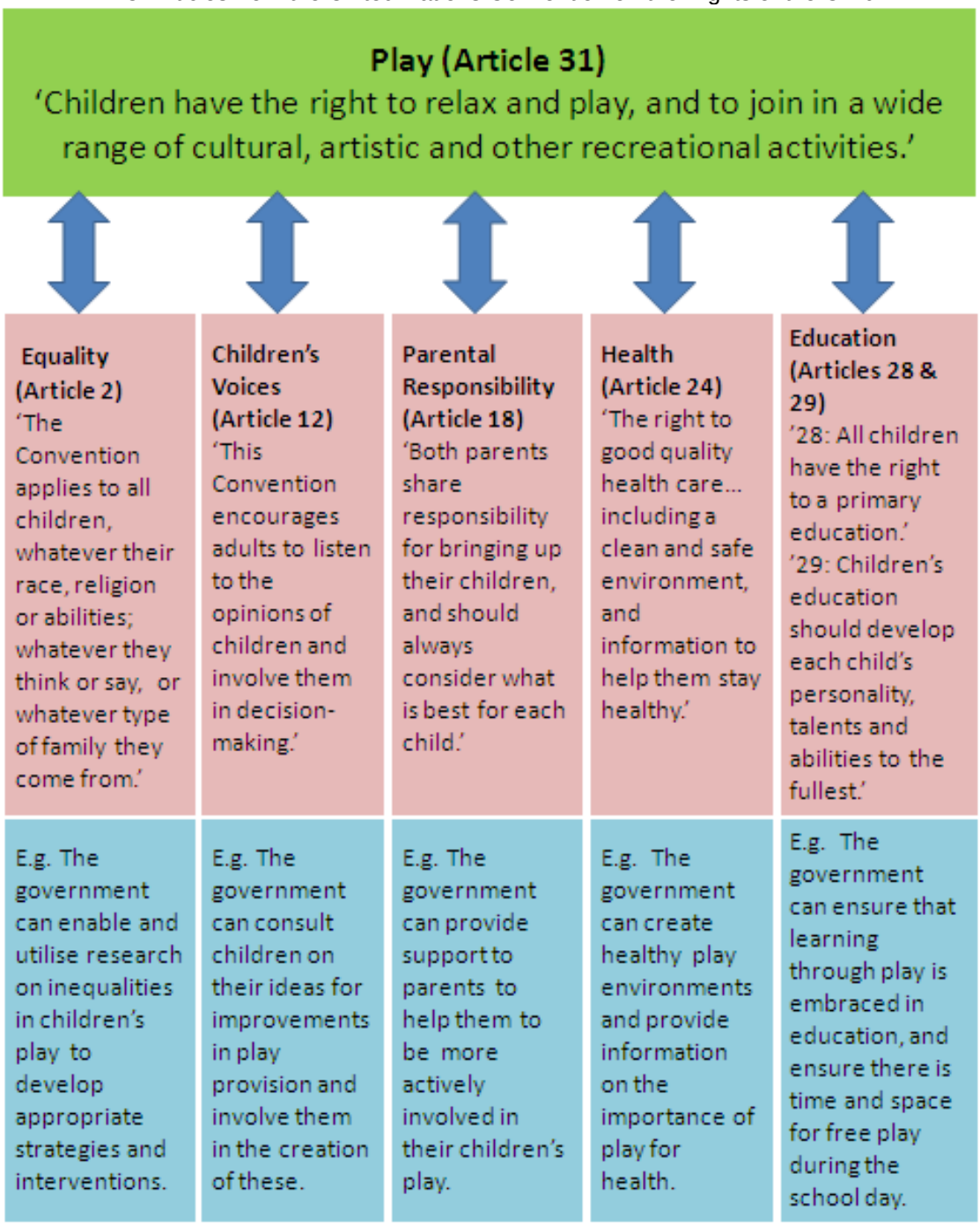
> ‘1. State Parties recognise the right of the child to rest and leisure, to engage in play and recreational activities appropriate to the age of the child and to participate freely in cultural life and the arts.’
>
> ‘2. State Parties shall respect and promote the rights of the child to participate fully in cultural and artistic life and shall encourage the provision of appropriate and equal opportunities for cultural, artistic, recreational and leisure activity.’ (CRIN, 2007)

Researchers have considered that this can be closely linked to other Articles in the CRC, for example those relating to health and education (CRIN, 2007). By making improvements in play, there are likely to be beneficial impacts on other areas, and vice-versa. In order for the government to make substantial improvements in children’s rights to play, ‘joined up thinking’ between this and other Articles in the Convention is therefore likely to be essential.

Figure 1-3 on page 25 is an original illustration created to introduce this concept. Article 31 is linked to five further Articles in CRC relating to equality, children’s voices, parental responsibility, health and education. Examples are given at the bottom of the diagram on what the government can do in relation to each article in order to improve children’s rights to play. These examples have been identified in UK policies documents, although the relationships to the CRC were not explicitly stated in most cases. The extracts for each Article are in simplified form, taken from a UNICEF factsheet.

One of the initial tasks in forming the research question for this thesis was to find out what had been presented in contemporary government policy in England in order to work towards improvements in young children’s rights to play, specifically active play. Key documents in childhood published in the previous five years in England were sought and reviewed to see whether play was discussed. Links with equality and parental responsibilities were also observed. The other Articles, children’s voices, health and education, are discussed later in the thesis.

1-3. Articles from the United Nations Convention on the Rights of the Child



Article wording adapted from text on the Factsheet on The United Nations Convention on the Rights of the Child (UNICEF, 2006). Examples seen in UK policy docments.

The Chief Secretary to the Treasury published the Green Paper *Every Child Matters* in 2003 (CST, 2003), which was the foundation for an on-going England-wide initiative of the same name. The paper made little reference to play beyond proposals to increase the number of playworkers and leisure workers, and provision for out-of-school and after-school clubs. More recent *Every Child Matters* publications from the Department for Children, Schools,

and Families (DCSF) included recommendations on play, such as guidance on Sure Start Children's Centres (DCSF, 2006) which suggested, in the section titled 'reducing obesity', that parents should help their children to be physically active. *The Children's Plan: Building Better Futures* (DCSF, 2007) included a section on play (p28-30), focusing on the need to improve play facilities and activities particularly among disadvantaged communities. Improved access for children with disabilities was also highlighted. In setting out their 'family policy' (p19-20), the report did not explicitly refer to play, but pointed out that parents need better services to enable them to support their children's healthy development and that some families in particular need to be "reached out" to.

Two notable policy guidance documents were published by the Department for Culture, Media and Sport (DCMS). *Getting Serious About Play - A Review of Children's Play* (DCMS, 2003) focused on play provision: that is 'space, some facilities or equipment or a set of activities intended to give children the opportunity to play' (p9). The report noted that adult support, guidance and supervision of children's play was important. It highlighted some issues regarding inequalities: that improved access was needed, particularly for girls and for children with disabilities, who it stated experienced more barriers to accessing play provision. It recommended that in order to be accessible to children from low-income families, activities should be free where possible. Beyond this there was little recognition of inequalities. The publication *Time for Play, Encouraging greater play opportunities for children and young people (DCMS, 2006)* included a section 'Tackling Inequalities' (p24), but the only inequality it addressed was regarding children's disability status. Under 'Inclusion' the report stated that:

> '…children from certain groups are often disadvantaged and have poorer access [to play provision] than others.' (DCMS, 2006, p37)

The report went on to state that the government would ensure access to play better facilities, and that initiatives would target children who were more likely to face disadvantage in play provision including girls of school age, children with disabilities and children from ethnic or religious minority groups.

The Play Strategy, published by the DCFS in 2008, set out their objectives for improving children's opportunities for play (DCSF, 2008b). The Strategy was developed following consultations with 9409 children and 234 adults, and presented case studies from a number of local authorities. The focus was on places to play, and ideas relating to making these places interesting, safe, welcoming, engaging and accessible to all children and young people. As with the documents previously introduced, supporting children with disabilities was addressed to a greater extent than any other area of inequality. There was discussion of strategies for other groups of children who it was thought had fewer opportunities to play, including those from deprived areas, from minority ethnic groups and teenagers. There was a section on physical activity, physical education and sport (page 38) which included pilots of outdoor play zones for pre-school children in deprived communities and multi-skill sports clubs for 7 to 11 year olds. Parental involvement was discussed in the case studies, including voluntary parent groups supporting their children's play.

England's Department of Health (DH) published *Tackling Health Inequalities: A Programme for Action* (DH, 2003), which set out plans to reduce health inequalities. Although it referred to some recommendations, such as those emerging from 'local exercise action pilots', on reducing inequalities in children's physical activities, these were consistently in the context of physical education, school sport and other structured activities. There was brief mention of parental responsibilities for children's exercise, and how this factor could impact on other health inequalities (p45), but throughout the document there no reference to physical activity in the context of play.

The DH published several policy documents on physical activity, two of which are introduced here. The White Paper *Choosing Health: making healthy choices easier (DH, 2004b),* laid out principles for supporting people to make informed choices about health. The paper pointed out that many children have few opportunities for physical activity, and proposed that guidance and practical support should be increasingly available for parents and their children. It suggested that this should be aimed particularly at those who are disadvantaged in the early years. In tackling disadvantage in childhood, there

was a proposal to increase 'take-up of sport and activity opportunities.' (p42) This paper was followed by *Choosing Activity: A Physical Activity Action Plan (DH, 2005)* a publication to promote physical activity participation among people of all ages. It emphasized that children benefit from a range of formal and informal activities, and recognized the importance of parental involvement:

> 'Having a supportive, encouraging, inspiring family; practical support from parents; and having the opportunity to do things with other family members can motivate young people to be active.' *(DH, 2005, p13)*

The report recommended that parents should be provided with information and support, so that they can help their children. There was, however, little acknowledgment that there may be inequalities in access to physical activity opportunities beyond a recommendation that the needs of children with disabilities should be 'prioritized given the low levels of participation' (DH, 2005, p13).

Summary of findings in government policy

- Children's informal play opportunities were discussed, often in relation to environments built specifically for children.

- When it came to looking at 'physical activity', much of the policy documentation focused on structured activities.

- Policy-makers did seek to address inequalities: they suggested that children with disabilities, girls, children from poorer families, and those from minority ethnic groups had worse access to play provision.

- There were recommendations that parents have an important part to play in encouraging children to be active.

- More recently children's opinions have been sought on what they think about their play opportunities.

Previous research on inequalities and children's play

Previous research helped shape the focus of this research. Initially a broad collection of research on childhood was sought through the University of York's library catalogue, through online bibliographic database searches and consultation with Play England. An invaluable source was Play England's comprehensive literature review underpinning current thinking on play: *Play for a Change* (Lester and Russell, 2008).

On one hand, it was clear that a lot of contemporary research had been undertaken on children's play, but little of this was concerned with exploring inequalities. As with policy, 'inclusion' tended to be investigated only outside the family context, for example in accessing structured activities. On the other hand, there was research about socio-economic inequalities during childhood in the context of poverty research, but although outcomes relating to health had been investigated, play was rarely an area of enquiry in this field.

Further bibliographic database searches led to a large body of quantitative research on inequalities in the amount of physical activity that children experienced. This was mainly concerned with overall step-counts or fitness, but did not look into the context of their activities, and so was not informative about children's play. Qualitative research was identified on children's activities, included those with family and friends. Within these studies, there were various findings which pointed to inequalities in the involvement parents had with in children's play, much of which was concerning physically active play or with 'sedentary' alternatives such as television viewing.

This research, much of which is presented in Chapter 2 and Chapter 3, pointed to the following.

Summary of findings in previous research

- Initially, there were many studies identified on play and on inequalities in childhood, but few studies which combined these two concepts.

- Further searches led to quantitative studies on inequalities in children's physical activity, but these were generally not informative about children's play.

- Qualitative studies were identified on inequalities in parents' involvement in children's play, including physically active play.

Secondary sources of quantitative data

Three large studies involving children in the UK were investigated in detail in the early stages of the research process, to find out if one of these would be suitable for the main analyses. The author of this thesis produced reports in 2008, in order to assess the suitability of each of these studies as a data source for the main analyses of the thesis. The findings are summarised below.

The Family and Children Study (FACS) is a prospective longitudinal study of families with dependent children living in Britain (Conolly and Kerr, 2008). The study began in 1999 and has consisted of annual waves of face-to-face interviews with main (usually the mother) and partner respondents where available. Information is collected on many factors including the families' well-being, health, care, education, employment, economic and social backgrounds. The latest available data was from the eighth wave carried out in 2006, in which there were 6928 families included. Investigation of the data from this wave and previous waves in the study revealed that it was an excellent resource for the investigation of the socio-economic circumstances of families and the relationships between these, but there were no appropriate questions which could be used to investigate inequalities in children's play or activities. Thus it was deemed as unsuitable as a secondary data source for the main analyses in the thesis.

The Health Survey for England (HSE) is an annual cross-sectional survey of households in England (Craig and Mindell, 2008). From 1996, detailed data has

been collected on children, and has included health, behaviours, lifestyle, socio-economic factors and other characteristics of household members. Physical activity among children, was introduced into the survey in 1997, and this topic was subsequently included in further years. The 2006 survey included 6889 children aged 2 to 15 years old. Although adults were the main respondents, for this section children were asked to either answer or to contribute to answering questions on three different types of out-of-school physical activity: active play; walking; sport and exercise. In the survey's publication of findings for the 2006 survey, there was indication that variations existed in children's physical activity according to their age, sex and socio-economic circumstances based on household income. On looking at the data, there was scope for further investigation of these inequalities using more complex methods. However, there was a major limitation of using this study: it is a cross-sectional study with a new sample of households each year, so details from the families' pasts have not been collected in the same level of detail as is usually the case in a longitudinal study.

The Millennium Cohort Study (MCS) is a longitudinal study of children and their families living in the UK (Dex and Joshi, 2005). It is a birth cohort study: the children were all born around the year 2000, and have been followed up over time. Data was available from three sweeps, when the children were approximately nine months old, three years old, and five years old. In the latest of these sweeps there were 15,246 families. At each stage in the study so far, there have been interviews with a main respondent (usually the child's mother) and a partner respondent where available. The interviews have covered many topics including the family's circumstances and their background, and specific questions about the child's health, care and development. Many questions have been included relating to children's activities across the three sweeps, for example their school journeys, drawing and painting, musical activities, places visited, electronic media use, and parent-child active play. Further to this, there have been questions relating to the family's social circumstances and background.

Summary on sources of quantitative data

The Family and Children Study (FACS) was an excellent data source for investigating childhood inequalities, but no questions were identified relating to children's play.

The Health Survey for England (HSE) contained questions which enabled investigation of inequalities in physically active play, but was a cross-sectional study which would have limited the possibility of research on families social histories, as well as future research.

The Millennium Cohort Study (MCS) contained a wide range of questions allowing investigation of inequalities in play, including physically active play. The longitudinal nature of the study made it possible to include details on families' social histories, and allowed scope for future research using data from the same sample of children.

All three of the studies had their strengths, but for research on inequalities in children's play, the MCS contained the most comprehensive questions on the family's situation and background, and play-related activities. Also, the longitudinal nature of the study enabled details on the family's social history to be investigated, and potentially further research involving the sample using future sweeps of data. It was therefore chosen as the dataset for the main analyses of this thesis. The design of the MCS, and the selection of the questions for analysis are described in Chapter 4.

Summary on rationale for the research

Three areas of background reading were used to inform the research: children's rights and government policy in England; previous research on inequalities and children's play; and secondary sources of quantitative data. Government policy indicated that children's rights relating to play were on the agenda but that there were a limited number of examples found on how these were being addressed

alongside other rights such as parental responsibilities and equality. Previous research indicated that there was little quantitative research on inequalities in children's play. An investigation of secondary sources of data lead to the MCS being selected for the main analyses.

Together, evidence from these three areas led to the formation of the overall thesis aim, which was developed in December 2008:

To investigate inequalities in parent-child involvement in active play

Recent Publication

Since the publication of the research and policy documents which provided the rationale for the thesis, an important milestone was England's Department of Health commissioning the National Institute for Health and Clinical Excellence[1] (NICE) to produce the Guidance Paper, *Promoting physical activity, active play and sport for pre-school and school-age children and young people in family, pre-school, school and community settings* (NICE, 2009). This was accompanied by a series of supporting documents.

The guidance, produced in January 2009, recommended that, both nationally and at local strategic level, there should be research with children and parents from different backgrounds to identify barriers to physical activity and to develop appropriate methods of targeting campaigns. In planning provision, the guidance recommended that decision-makers should consider inequalities:

> "Ensure physical activity facilities are suitable for children and young people with different needs and their families, particularly those from lower socioeconomic groups, those from minority ethnic groups with specific cultural requirements and those who have a disability." (NICE, 2009, p15).

[1] The National Institute for Health and Clinical Excellence (NICE) is an independent organisation in England and Wales which provides guidance on promotion of good health and prevention and treatment of ill health.

The guidance contained recommendations for people working with children and families to promote physical activity within families. Parents and carers were regarded as having particularly important jobs to do in facilitating and encouraging their children to be active:

> "Parents, carers and other family members have a crucial role in encouraging young children to be physically active…. They can do this by providing a range of opportunities for physically active play and by playing active games with them….. In addition, they can offer positive feedback, generally show an interest and act as positive role models." (NICE, 2009, p39).

It also recommended that for younger children, physical activity is best achieved through informal and child-orientated opportunities, particularly play:

> "When encouraging younger children to be physically active the focus should be on fun, enjoyment and active participation, rather than on the need to understand and conform to rules or master complex skills." (NICE, 2009, p37).

The guidance discussed inequalities, and it discussed children's how parents could help their children's play, but it did not bring these recommendations together. Although this guidance was published after the research was underway, it provides further motivation for the thesis aim.

1.4. Aims of the research

As discussed in the previous section the overall thesis aim was:

To investigate inequalities in parent-child involvement in active play

The term 'involvement' is used to describe direct involvement through parents and children playing actively together, and also actions or strategies which parents or children may take to help or restrict active play. Readers should note that terms such as 'involvement', 'support', 'participation' and 'facilitation' are being used within this thesis in the context of physical activity and play, and do not represent parental supportiveness of children in general. Four additional aims were added, in order to ensure that the research untaken was important, relevant, strong and original.

- ***The topic is important to children***
- ***There is a need for new quantitative research on the topic***
- ***The dataset is relevant and methodologically strong analytical approaches are used***
- ***Original research is undertaken***

The first and second of these additional aims shall be addressed in Chapter 3, which is a literature review on inequalities in parent-child involvement in active play. The third and fourth aims shall be addressed in Chapter 4, in which the MCS study and methods of analyses are described, and in Chapter 5, in which the results are presented. All of the aims shall be returned to in the discussion, Chapter 6, to ensure they have been achieved.

Firstly, Chapter 2 follows, which is an introduction to literature on children's physically active play. This sets out to inform reasons about the importance of this field of research.

Chapter 2.
Introduction to literature on children's physical activity

Chapter 2
Introduction to literature on children's physical activity

This chapter provides background research on the area of children's physical activity and their active play. It consists of five sections.

2.1. Why is physically active play important for children? *p38*

Evidence is presented on potential benefits of physical activity relating to physical and mental health, as well as for children's general well-being.

2.2. Overview of investigative methods of children's physical activity *p42*

A variety approaches for researching childhoods are discussed that involve children and adults as participants.

2.3. Play Locations and Playmates *p45*

Studies are presented which suggest that children enjoy the company of different types of playmate, and enjoy a range of playful environments.

2.4. Variation in children's physical activity *p50*

Variations in children's activities are presented according to factors relating to their own characteristics.

2.5. Chapter Summary *p52*

A short summary of the chapter.

2.1. Why is physically active play important for children?

Children's physical activity has been widely discussed in the context of public health considerations. Firstly it is considered that, through promotion of physical activity, children's current health will be enhanced. Much research on the benefits of physical activity during childhood focuses on links with obesity. In a review into research on relationships between physical activity and aspects of health in children and young people, Riddoch (1998) identified several studies suggesting that increased physical activity was associated with decreases in various indications of obesity such as waist:hip ratio and body mass index (BMI). A study using data from over 137,000 children aged 10 to 14 living in 34 primarily European countries suggested that low physical active levels were associated with children being overweight (Janssen et al., 2005). Intervention studies have also suggested that increasing physical activity can be effective in helping to treat obesity among children (Reilly and McDowell, 2002).

A further reason for physically activity being important during childhood is that habits may be retained so that, as adults, they will be more physically active and therefore less prone to illness. This view is based on the assumption that physical activity will last over time or 'track', thus instilling good habits into adulthood. Evidence does suggest that physical activity behaviours track from childhood to adolescence (Malina, 1996, Kristensen et al., 2008), but the evidence is not so strong for tracking into adulthood (Malina, 1996, Goran et al., 1999).

Researchers have also considered that physiological changes which occur during childhood as a result of physical activity may have lasting effects on their future health. High levels of physical activity among children have found to be associated with cardiovascular disease risk factors such as improved concentrations of certain proteins and fat (including apoproteins and lipoproteins, and triglycerides) in the blood, and overall cholesterol (Twisk, 2001, Livingstone et al., 2003, Saakslahti et al., 2004). There is, however, little evidence to suggest that these factors have significant impacts on future health (Livingstone et al., 2003). A further reported health benefit of 'weight-bearing'

physical activities such as dancing, gymnastics, and various ball-sports is that these may improve mineral bone density during childhood (Janz et al., 2001), but again, evidence as to whether this may decrease the risk of loss in bone mass and osteoporosis later in life has been inconclusive (MacKelvie et al., 2002).

Evidence is fairly strong to suggest that there may be psychological benefits of physical activity during childhood. Reviews of studies have indicated that physical activity participation is associated with better mental health, improved self-esteem and reduced symptoms of depression and anxiety among children and adolescents (Mutrie and Parfitt, 1998, Ekeland et al., 2004). Brady et al. (2008) conducted interviews with parents of pre-school children in the UK. Parents cited many reasons for physically active play being considered important for young children: these included being happy and letting off steam. Some parents reported that their child seemed irritable or had trouble sleeping if they had not had much physical activity.

Over the last decade, research has increasingly moved away from studying childhood as a time for development and preparation for adulthood, and focused more on its importance in its own right (James and Prout, 1997). This perspective considers children as social actors who are involved in the construction of their own lives and relationships. This has lead to a new range of methodology in researching children's lives which focuses on children as 'being' rather than 'becoming' (Alanen, 2005). In the context of why play is important, this means that there is greater emphasis on its importance to children at the time of playing, rather than how it could be of benefit to them in their future lives.

Children enjoy taking part in physically active play and this is a reason why it is important. It can provide opportunities for them to establish and develop friendships. In a study in North London, children aged 9 to 11 years referred to how physical activity provided opportunities to have fun with friends (Pearce et al., 2009). Physically active play can also provide opportunities for children to explore their environments and experiment with what they can do with their

bodies. In a study in England children spoke about the benefits of taking part in 'risky' physical activities such as climbing trees and playground equipment (Coster and Gleeve, 2008). These included improved confidence, self-worth and the opportunities for physical and emotional challenges. When children have been asked why they value play, they have come up imaginative responses such as "You need it to concentrate – get fresh oxygen" and "There might as well be no colour if you can't play!" (Kapasi and Gleeve, 2009, p18).

There can however be negative effects of physical activity. Some activities and sports are associated with increased risk of injury for example through falls and collisions (Sherker and Ozanne-Smith, 2004, Goulding, 2007). Borra et al. (2003) carried out research with children, their parents and teachers involving focus groups, interviews, observations and diaries. A recurring theme was low self-esteem relating to physical activity and eating habits. Some of the children discontinued participation in organised sports due to it being too challenging or coaches being too critical. The importance of fun and variety were referred to as critical in helping children to stay interested in physical activity.

Due mainly to concerns over obesity and the risk of cardiovascular disease, government health departments have issued official recommendations for the minimum amount of physical activity people should have. The recommendations vary between countries and have changed over time. The frequently cited Surgeon General's (USA) report on `Physical Activity and Health' recommended 'All people over the age of 2 years should accumulate at least thirty minutes of endurance-type physical activity, of at least moderate intensity, on most, preferably all, days of the week' (CDC, 2005). On their website, the World Health Organisation recommends that school-aged children and youth should have at least sixty minutes of moderate- to vigorous-intensity physical activity per day (WHO, 2008) and this recommendation has been repeated in policy documents in England (DH, 2004a, DH, 2005).

Some researchers feel that such recommendations have little applicability to children. Evidence on the various benefits of physical activity do not provide support that reaching such minimum thresholds would lead to increased health

among children (Twisk, 2001). The recommendations also give little consideration of their physical activity during unstructured play. Goran (1999) suggested that there should be increased focus on allowing children's physical activity to be spontaneous (i.e. play) and integrated into everyday life, rather than the wide-spread trend of enrolling children on scheduled and regimented sports programs. It seems that by focusing on minimum times per day and levels of intensity, the importance of play can be neglected.

In this thesis the phrases 'physically active play' and 'active play' have been used interchangeably but refer to the same concept.

2.2. Overview of investigative methods of children's physical activity

An important implication of the UN Convention on the Rights of the Child is that seeking out the views of children directly has been regarded as increasingly important in local decision-making and in research. Methods have been developed which attempt to facilitate children's exploration of their own experiences and perspectives on the world (Burke, 2005). Many researchers in the field of childhood research are referring to their research 'with' rather than 'on' children (Darbyshire, 2000). Contemporary approaches have moved away from regarding children as study subjects, and towards them being active participants who are experts on their own lives and can be involved in each stage of the process including study design, analysis and dissemination.

Researchers have looked beyond the methodological difficulties, and have developed imaginative methods to engage children (Morrow, 2001, Clark et al., 2003, Greene and Hogan, 2005, Attree, 2006). Contemporary methods in child-centred research involve finding out about children's own views and the things that are important to them, in ways that are appropriate to children (Darbyshire et al., 2005). Research with children through art and creativity, particularly using drawing and writing, are becoming more common approaches. Such activities, which children are often already familiar and confident with, provide informal opportunities for researchers and children to discuss topics, and also lead to an 'end product' that can be used in analyses.

Children tend to take part in a wide variety of activities involving physical activity, and thus it is an ongoing challenge for researchers to find methods that provide useful insight into their physical activity behaviours. Studies that investigate qualitative aspects of children's physical activity have become popular for gaining understanding about activities they enjoy, problems they encounter, people who help them and places they like to go. A multitude of different methods have been identified in this and the following chapter.

Research projects involving photography are becoming increasingly popular. In Burke's Play in Focus study (2005), primary school children from Leeds discussed their ideas about photography prior to taking home cameras to explore their play environments. In unstructured interviews, the child and an adult researcher then each selected a photograph to discuss. The `Mosaic Approach' is a method which was developed by Clark and Moss (2001) involving many children taking their own photographs. When the photographs are developed the children then participate in bringing them together and discussing interpretations of the overall picture. As well as creating maps and taking photos, Darbyshire et al. (2005) encouraged children in their study to jump around during focus groups to elevate their enthusiasm to talk about play and activity. Pearce et al. (2009) suggested that using several imaginative methods within the same study can provide children with a variety of opportunities to express themselves.

Gaining information and perspectives on children's physical activity experiences using more traditional techniques such as questionnaires and interviews also continue to be regarded as important in research. These can involve adults and children as respondents to ensure that both perspectives are gained. One drawback of such retrospective approaches identified by Sirard and Pate (2001) is that that adults and children can give inaccurate responses about past experiences due to not being able to recall events and because opinions or beliefs influence how they think they should answer. Riddoch (1998) suggested that children tend to have better recall of certain types of physical activity experiences such as premeditated exercise sessions, sports, and games, but worse recall of unplanned active play. Prospective methods such as activity diaries may eliminate problems with recall difficulty, but are potentially inappropriate for young children and have the additional limitation that the process of keeping a diary may influence physical activity.

Observation enables researchers to investigate physical activity behaviours. For practical reasons, low numbers of children can usually be observed within such a study, but the data collected can be very detailed. Parents and other adults have also been observed, for example to assess their involvement in and

encouragement of their children's physical activity. "Participant reactivity" however may be an issue (Sirard and Pate, 2001): this is when children and parents exhibit different behaviours than they would normally because they know they are being observed.

Dishman (2004) recommended that three main 'quantity' components of physical activity should be considered: frequency, duration, and intensity. Frequency refers to the number of occurrences of physical activity per time period (for example, day or week); duration refers to the length of time spent doing physical activity over a time period; and intensity is the energy expenditure associated with the physical activity. These three components can be measured or predicted using various methods. Physiological tools such as accelerometers and pedometers are commonly used to measure frequency and intensity of a person's vertical movement, and heart rate monitors can measure activity intensity. These instruments were developed for the measurement of adults' physical activity and whether they are appropriate for the assessment of children's physical activity must be considered (Welk, 2000). Often the reliability and validity of the methods have not been properly established with children (Sirard and Pate, 2001).

2.3. Play Locations and Playmates

> "… When my friends come over to my house, before dinner, my mum lets us go to the waterfalls near my house and there is a big park there and there is a rock island that you can go on the stepping stones and play skimming stones…." (Child aged 7-14 years in UK) (Kapasi and Gleeve, 2009, p24)

Studies have highlighted many types of outdoor environment where children like to play. Streets and neighbourhoods where children live are important because they can provide social, informal and inexpensive opportunities for physical activity (Humbert et al., 2006). Primary school children in North London reported that they went to places close to their homes to take part in physical activity and did not like to travel from the places which were familiar to them and of which they had good knowledge (Pearce et al., 2009). Carver et al. (2008) suggested that children do not need to rely on parents for transport if they can play close to their home.

Parks and playgrounds are common features in many communities, providing opportunities for physical activity for all ages. Many disciplines, including public health and landscape architecture, are now investigating how parks can be designed, modified or better promoted to encourage physical activity and play. Quantitative research has suggested that living close to a park may be associated with increased likelihood of children being physically active (Davison and Lawson, 2006). These environments play a role in social relationships for children and their families, by being places for meeting others and building social ties. Parents of young children in Brady et al.'s study (2008) referred to the opportunities that local parks or green spaces provided for a range of physical activities, including walking, riding bikes, playing ball games, and using different play equipment than was available at home. Several of the children did not have access to a garden or yard at home, so the park provided a much needed space for them to enjoy physical activity.

Natural spaces can also provide children with exciting opportunities to play. In a study involving photographic techniques with children aged 6 to 11 years, many of the participants took photographs of outdoor spaces and referred to play in

natural environments such as on grass, in trees and bushes, on logs and among leaves and flowers (Burke, 2005). Natural water environments including beaches and rivers are also among the places children have said they enjoying playing (Hesketh et al., 2005, Kapasi and Gleeve, 2009).

Active travel is a further context of physically active pay. Children enjoy moving around in their neighbourhoods and being able to travel on bicycles, skateboards, skates, scooters and on foot. Mulvihill et al. (2000) found that among children in their study, several of those in the upper years of primary school were allowed to walk to school without adult supervision and many of these children enjoyed the social aspect of meeting friends en-route.

Further contexts for children's physical activity are pre-school and school. Studies have observed children's enjoyment of active play in pre-school settings (Parsons, 2007, Brady et al., 2008, Cardon et al., 2008). Children's opinions of school were sought in a study of children aged four to eleven in Northern Ireland (Horgan, 2007). Younger children in particular expressed that their favourite aspects of school were playing and having fun with friends. Many of the children, particularly boys from schools in disadvantaged areas, felt that they spent too much time working at school leaving too little time to play. Lunchtimes were felt to be too short to fit in eating and playing. Mulvihill et al. (2000) found that most children reported being physically active during lunch and playtimes, and playground games involving running and chasing were popular. They had positive comments about their enjoyment of physical education (PE) classes and the facilities at school. In Hesketh's study (2005), children also talked about features of their school environment that encouraged physical activity, such as the availability of sports equipment and the necessity to climb stairs to get to lessons.

The popularity of enrolling children in formally organised events outside the home is a common feature in contemporary society in rich countries. Traditionally seen as only a middle-class preference, school-aged and even pre-school children from a variety of backgrounds are now likely to have their evenings and weekends filled with sports and leisure classes or activities

(Clements, 2004, Sener et al., 2008). Options for children in Britain include breakfast clubs, after-school clubs, holiday clubs, and sport specific clubs and classes (collectively known as out-of-school clubs) which are run by adults who organise and supervise activities. These clubs can provide valuable opportunities for children to meet and socialise with other children outside school, and to explore physical abilities within environments deemed to be safe. For some children, these may be the only opportunities they are given to play outside their home during evenings and weekends (Kapasi and Gleeve, 2009).

There is evidence that children do not always appreciate taking part in structured activities (Humbert et al., 2006). Children who are enrolled in different clubs throughout the week may have little opportunity to take part in self-directed play. This may hinder their creativity and curiosity, and lead to increased reliance on adults to provide activities. There may also be impacts on relationships, with less time to play with family and self-chosen friends (Kapasi and Gleeve, 2009). Children may find too much formal exercise boring and repetitive, giving little time for them to experiment with their own abilities (Poulsen and Ziviani, 2004). Spending a large amount of time in structured activities may mean children have less time to initiate their own play (Clements, 2004).

Physical activities can of course take part inside as well as outdoors. Indoor-orientated activities referred to by parents in the Brady et al.'s (2008) study included dancing, swimming and baby massage. A recent phenomena in the UK are indoor commercial centres which house soft play equipment (McKendrick et al., 2000), but so far little academic research has emerged on children's experiences of these environments.

Electronic media such as televisions, computers, video games and handheld devices are key features in the play of most children living in contemporary Britain. These technologies are constantly advancing and adapting, and in recent years products have become increasingly available and widely used by young children (Marsh et al., 2005). Traditionally this sort of activity is thought to be undertaken with little body movement and is perceived by some as

unhealthy in comparison with physical play. Boreham and Riddoch (2001) for example, used the phrase 'sedentary alternatives' emphasising how these activities are seen as distinct from physical activity. The view that electronic-media play involves little movement is however being increasingly challenged with the growing popularity in *active gaming*. Dance-mat games emerged in the last decade and within the last two years, the popular motion sensor games console the 'Nintendo Wii' has become a feature in many households. Children may be just as active taking part in these games as when they are taking part in conventional active play. Again, little research has so far been published on these new technologies, although an experimental study is currently being undertaken by the University of Derby in which the physiological activity levels of children playing on Nintendo Wii and children playing outside over lunch break will be compared (University of Derby, 2008)

Kapasi and Gleeve (2009) carried out focus groups with children aged 7 to 14 across the UK, and found that children were enthusiastic about taking part in active play with friends and siblings. After school and at weekends they enjoyed playing in the streets, in each other's gardens and in natural spaces such as those in the previous quote. Mulvihill et al.'s (2000) study involved 60 children aged 5-11 in schools in England who took part in a drawing and speaking tasks and were interviewed in pairs. The most popular type of activity outside school was playing outside with friends in streets and gardens. They also enjoyed physical activity with their families such as walking, cycling, and going to parks. Mulvilhill et al. found that, overall, children expressed much greater preferences for playing in groups rather than individually, enjoying the social aspects of physical activity and also opportunities for achieving in team sports.

One type of playmate that should not be overlooked are pets. Images of active play with pets have featured in children's photos and pictures in several studies (Darbyshire et al., 2005, Hume et al., 2005, Gabhainn and Sixsmith, 2006) and dogs in particular been mentioned in the context of physical activity through going out for walks (Mulvihill et al., 2000, Veitch et al., 2006, Cutt et al., 2007, DCSF, 2008a).

Research suggests that time with family is very important to children. Edwards et al. (2005) carried out a study in which 58 Children aged 7 to 13 were asked about their everyday lives with their brothers and sisters. This evidence suggested that brother-brother and brother-sister pairings particularly enjoyed playing actively together, whereas for sister-sister pairings there was more emphasis on talking together. Many respondents reported that having a sibling meant they always had someone to play with and were never alone.

Parents are also important playmates for children. Children from England (Pearce et al., 2009), Canada (Holt et al., 2009), Australia (O'Dea, 2003), and the USA (Borra et al., 2003) have expressed views that they enjoy taking part in physical activities with their parents and often want more opportunities to do so. There is evidence that they appreciate receiving encouragement from parents so long as they are given independence to play in ways which they choose (Borra et al., 2003, Cox et al., 2010). Parents can assist in facilitating active play and contribute to increasing or improving opportunities in many ways. They are important providers of support for their children's play, and their involvement is considered by many to be of substantial importance, as indicated by the NICE guidance and associated documents on children's physical activity (NICE, 2009). Parent-child involvement in active play is the central focus of this thesis, and the following chapter is a review of literature on this topic.

2.4. Variation in children's physical activity

There are many ways in which children's play varies. Variations according to children's individual characteristics are discussed in this section: their gender, age, ethnicity and disability status. These factors are discussed in greater detail in Chapter 3 in the context of parent-child involvement in active play, together with several other factors.

Systematic reviews of evidence on the correlates of physical activity levels among preschool children (Hinkley et al., 2008) and children and adolescents (Sallis et al., 2000) have provided evidence to suggest that boys tend to be more active than girls. Armstrong (1993) hypothesised that perceptions of gender-roles are likely to underlie these variations. In our culture, physical activity, sport and exercise are stereotyped as masculine activities, and so boys may be likely to experience more positive reinforcement than girls. Studies have also found variations in girls and boys preferences for particular physical and play activities (Mulvihill et al., 2000, Cherney and London, 2006, Wright et al., 2008).

Longitudinal and cross-sectional studies involving different age groups have suggested that children's physical activity varies with age (Telama and Yang, 2000, Ali and Hirani, 2008). Telama and Yang (2000) followed cohorts of Finnish children of different ages over nine years, and found that reductions in overall physical activity were seen during childhood, and were particularly evident after twelve years of age. The Health Survey for England (HSE) was introduced in Chapter 1: results from the 2006 survey (Ali and Hirani, 2008) suggested that weekly frequency (number of days during the week) and duration (length of time each day) of active play seemed to decrease for boys and girls from ages 2 to 7 years. Frequency and duration of activities considered as sport and exercise, however, increased among boys but were more varied in pattern among girls.

Studies from England and elsewhere have suggested that variations exist in children's active travel according to ethnicity. In a study involving 473 children

aged 9 to 11 years from Birmingham, Alton (2007) reported that in terms of the number of walking trips per week, children from ethnic minority groups walked significantly less than white children. Copperman and Bhat (2007) carried out a study of 1104 children aged 5 to 17 years old in San Francisco, USA. They found that children of 'Asian' ethnic origin were statistically less likely to use active methods of travel compared to white children. A systematic review of studies suggested that children's overall levels of physical activity vary according to ethnicity (Gustafson and Rhodes, 2006), but no studies have been identified which investigate the factors underlying these differences.

Children with disabilities experience more restrictions than other children, which are likely to impact on their opportunities for informal and structured activities (Stuart et al., 2006, Law et al., 2007b, Keeton and Kennedy, 2009, Martin and Choi, 2009). For some children, physical, sensory or cognitive limitations mean it is more difficult for them to take part in activities, and appropriate support or provision is important to overcome these barriers.

As well as variation in physical activity behaviours between different children, there is also variation for the same children on different occasions. Irwin et al. (2005) carried out focus group discussions with 71 parents of children aged 2 to 5 years in Canada. The parents reported that their preschool children usually took part in physical activity anywhere from 1 to 10 hours a day. For young children, physical activity is particularly sporadic: studies have shown that they usually engage in short rather than prolonged bouts of vigorous physical activity, alternating with less active recovery periods (Benham-Deal, 2005, Brady et al., 2008). These findings suggest that caution should be taken when using quantitative measurement of children's physical activity.

2.5. Chapter Summary

This chapter provided an introduction to some important issues relating to children's physical activity and physically active play. Popular methods of researching children's physical activity were introduced. Evidence on the kinds of places children like to go to play, and the playmates they like to have were presented. Finally, a few studies were presented that indicated how children's physical activity can vary according to their individual characteristics.

This introduction to the literature included examples of the roles that parents have in children's active play: they can be playmates for children but they also mediate their play. In Chapter 1, inequalities in health were introduced. Children's environments, family backgrounds, parental behaviours and beliefs as well as their individual characteristics lead to inequalities in their opportunities for physically active play. These are discussed in more detail in Chapter 3, which is a review of literature on parent-child involvement in physically active play.

Chapter 3.
A review of contemporary literature on parent-child involvement in active play

Chapter 3
A review of contemporary literature on parent-child involvement in active play

This chapter considers:

- *Contemporary literature:* literature on children living in rich industrialized countries, published in the last ten years although some older literature was included.

- *Parent-child involvement:* things which parents and children may do which contribute to improving or restricting physically active play opportunities. This focuses on pre-school and primary school aged children, approximately between 2 and 11 years old.

- *Active Play*: As discussed in Chapter 1, this refers mainly to informal physically active play opportunities rather than, for example, structured activities in clubs and physical education classes in school.

The methods and findings for this literature review are presented within six sections in this chapter, as follows.

The reasons for carrying out the review, and in particular taking a mixed-method approach across the thesis are given.

The process of the review is described and the characteristics of the studies are presented.

3.3. Modes of parent-child involvement: children's perspectives p73

This section introduces four main modes of child-parent involvement in active play. For each of these, qualitative evidence is presented on children's opinions.

3.4. Factors that may impact on parent-child involvement in active play p78

Research on the topic is presented, including qualitative and quantitative primary studies, as well as literature reviews. It is shaped by the literature which emerged, much of which relates to social diversity and inequalities.

3.5. Strengths and limitations of the literature review p93

This section considers the methodological quality of the review and the research presented within it. It discusses strengths and limitations considered important by the authors of the studies and by the author of this thesis.

3.6. Summary and conclusions of the review p97

A summary of the review findings is presented.

3.1. Purpose of the literature review

> 'The task of interpretive analysis is to bring together, juxtapose, re-analyse and combine findings from several studies into a whole that ideally provides some theoretical or conceptual development.' (Pope et al., 2007, p75)

This literature review was aligned with the main thesis aim, *to investigate inequalities in parent-child involvement in active play*. The reasons for choosing this particular topic were discussed in Chapter 1.

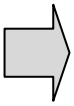
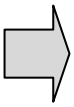
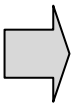
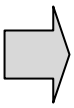
There were a number of reasons for carrying out a literature review prior to the main analysis of the Millennium Cohort Study (MCS). One objective was in order for it to provide what Pope et al. (2007) refer to as 'knowledge support': exploring evidence on the research topic in order to get ideas and generate hypotheses, but not attempting to give conclusive answers to aid policy decision-making ('decision support'). Much of the literature review was untaken before the quantitative analyses of the MCS so that its findings could be used to guide the exploration of factors relating to parent-child involvement and inequalities. The literature review was also useful following the MCS analysis: linking findings from the existing literature with the quantitative findings gave additional insights.

Prior to undertaking the review, it was decided that all types of study design would be eligible for inclusion. Adopting a mixed-method approach of including previous qualitative and quantitative evidence, together with the quantitative MCS analysis, served a number of useful purposes. Based on O'Cathain and Thomas's work (2006), four reasons for including qualitative and quantitative studies (qualitative and quantitative in the literature review and both alongside the MCS analysis) in the thesis are outlined in Table 3-1 on the following page.

The inclusion of qualitative evidence was essential in this the review since this provided opportunity for parent's and children's own thoughts to be included in the research. The structured design of the MCS did not allow the collection of data outside the responses to the set questions. There were no opportunities

for further exploration of issues that may have been raised, and no opportunities for the cohort children to have a say at all. Researchers in the field of qualitative methodology suggest that qualitative studies should lay down a clearly defined research question yet take a holistic approach to enable generation of people's own ideas about their lives (Greenhalgh and Taylor, 1997). This can allow for investigation of questions which are not necessary appropriately investigated through purely quantitative methods, such as 'what sorts of activities do children enjoy doing with their families?' and 'why do parents find it difficult to play with their children?'

3-1. Four reasons for undertaking a mixed-method approach.

Hypothesis Generation 'Qualitative research facilitates quantitative research by generating hypotheses.'		Literature review will be used to guide the questions to be analysed from the Millennium Cohort Study (MCS).
Generalisability 'Quantitative research helps to generalise qualitative findings.'		The design of the MCS may allow generalisability of findings across UK.
Interpretation 'Qualitative research facilitates interpretation of findings from quantitative research.		Findings from the literature review will be re-visited in the discussion chapter to help explain MCS findings.
Richness 'Qualitative and quantitative research used together to provide bigger or richer picture.'		Together, the literature review and MCS analysis will broaden knowledge on inequalities in parent-child involvement in active play.

Extracts taken from (O'Cathain and Thomas, 2006, p104),

In the following section the methods used in the literature review are described, drawing on methodological research on mixed-method reviews.

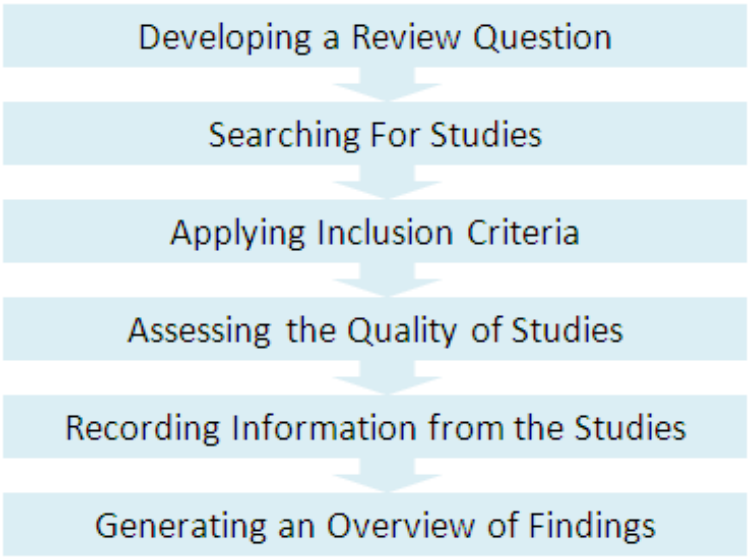
3.2. Methods of the literature review

Review Process

Some literature reviews involve a scientifically rigorous process, following a set of methods which aim to minimise bias, and are referred to as *systematic reviews* (Petticrew and Roberts, 2006). All relevant research on a topic is sought and the methodology of studies is quality-controlled before being included in the review. The included research is critically assessed and summarised, and conclusions are drawn by the reviewers based on the evidence which is brought together. This literature review was systematically conducted, but did not follow the entire process of what is expected of a systematic review. One of the reasons for not developing it into a full systematic review was that the research aim was very broad, and evidence of a wide variety of topics was identified.

The process of the review followed most of the stages of a linear literature review laid out by Pope et al. (2007, p16), as shown in Figure 3-2. Two of the stages proposed by Pope et al. have been omitted: 'development of a review protocol' and 'dissemination.' Although a basic review protocol was developed prior to conducting the review, this included only strategies relating to the search and inclusion criteria. The methods for the later stages of the review were developed following further learning on the types of literature which had emerged. Two of Pope et al.'s stages 'synthesis of findings' and 'reporting of findings' were combined as 'generating an overview of the studies.' These six stages are described in each of the sections which follow.

3-2. Six stages of the literature review



Adapted from Pope et al. (2007) Stages of a Linear Review

Developing a Review Question

The review question represented the thesis aim: '*To investigate inequalities in parent-child involvement in active play.'* As described in Section 1.3. this was developed in December 2008 following scoping searches for research and policy literature, and decisions regarding the use of the Millennium Cohort Study. The thesis aim, and consequently the review question, were purposely broad to allow for any type of inequality to be explored.

Searching For Studies

Guided by the thesis aim, the main search for literature was undertaken from January to March 2009, and updated in August 2009 and January 2010 to include more recent studies. Primarily this consisted of database searches. Six databases related to multiple research disciplines were included. These were:

- Medline
- Embase
- Web of Science
- Childdata
- British Library Integrated Catalogue
- Google Scholar

Due to the capabilities of these databases, the methods applied for searching them differed. Initially Medline and Embase were searched for journal articles: search terms included key words, title words and topic headings relating to physical activities (e.g. physical activity, exercise, sport, play), children and parents. As discussed previously, all types of study design were eligible for inclusion. The searches were intended to have high 'sensitivity' rather than 'specificity', due to the broad review question.

These searches were followed by cross referencing of bibliographies electronically on the Web of Knowledge database, as well as manually upon obtaining relevant papers. Later on, with help from the British Library and the National Children's Bureau Library in London, the British Library Integrated Catalogue and NCS's Childdata were accessed. Searches were carried out to try to identify evidence from other types of source including books and reports, specifically on inequalities in play and physical activities. Similarly Google Scholar was used to search for additional papers: each search generated tens of thousands of results but were only scrolled through until it was felt that a saturation point had been reached on the relevance of studies.

The search terms and number of studies found were recorded for three of the databases and are presented in the appendices on page A/8. These do not represent the number of independent studies however, due to their duplication across the databases. Further studies were identified through automated email updates on related topics, background reading, browsing library shelves, and via word of mouth from colleagues.

Since this study focuses on contemporary childhoods, a eleven-year date restriction on research published between 1998 to 2009 was applied for electronic searches. Other search methods led to the identification of papers which were published prior to 1998, but most of this research was not included in the review due to caution about the possibility of changes in children's active play over time (Valentine and Mckendrick, 1997). Care was taken to try to ensure only up-to-date and relevant evidence was included in the review.

Applying Inclusion Criteria

Inclusion criteria were applied to studies alongside the searches undertaken in 2009. Although sometimes related to physical activity, findings on the following list of topics were generally excluded: obesity, eating, food and nutrition; physiological measures or indicators of fitness; children's competence at physical activity. The search terms used in the database searches were not designed to exclude such studies but they were rejected based upon abstract or full paper if not considered suitable for inclusion according to the review question.

The populations of interest were pre-school and primary school aged children (approximately 2 to 11 years) and parents of any age. Studies that focused only on young people aged 12 and over were excluded, since they did not include the population of interest. Studies that included this age group as well as children in the primary or pre-school age group (for example, age 8 to 13) were included. All primary studies were required to include children and/or parents or family carers as respondents: those which included only a general adult population or careworkers/playworkers, etc, were excluded since the focus of the review was on parent-child involvement. Literature reviews with systematic methodologies were also eligible for inclusion if they reported on primary studies that fulfilled these criteria.

The review only sought to include studies of children living in rich industrialised and democratic nations, and their parents. As a guideline, these nations were usually, but not exclusively, those within the Organisation for Economic Co-operation and Development (OECD). This was because lifestyles and play opportunities for most children in poorer nations were likely to be different from the UK and the purpose of the review was to inform the analyses of a UK-based study. Only English-language databases were used to search for studies, and although some abstracts of non-English papers were identified, none of these studies were deemed suitable for inclusion in the review.

Following application of the inclusion criteria, there were thirty-nine primary studies identified which were eligible for the next stage of the process. There were seven literature reviews identified which were thought to be of relevance, although some of these looked at similar research questions and so contained a number of the same studies.

Assessing the Quality of Studies

Appraisal was carried out on the studies eligible for inclusion. For primary studies, this was carried out in September 2009 following initial data extraction and reporting of findings. For the systematic reviews, this was not completed until December 2009. Ideally, this stage of the process should have been completed earlier to avoid possibility of quality criteria being partially determined by the quality of the evidence.

A quality criteria checklist was devised to assess whether primary studies should be included in the review. The checklist combined criteria set out in Spencer et al.'s framework for assessing qualitative evaluations on behalf of the UK Cabinet Office (Spencer et al., 2003), the STROBE checklist for epidemiological studies (von Elm et al., 2007), and information gained from further reading (Pope and Mays, 2006; Ritchie and Lewis, 2003). A sample copy of this checklist can be found on page A/9 in the appendices, but the completed checklists have not been presented in this thesis.

In order to complete the quality assessment, primary studies were categorised as being either qualitative or quantitative. When a study used mixed methods it was categorised according to the method which was predominant in regard to the research relevant to this review. The checklist contained three questions which were specific for qualitative studies, three which were specific for epidemiological quantitative studies and seventeen which were mutual to both study types. For inclusion, a study was required to fulfil the first criteria, that it was published in a peer-reviewed journal or by/in collaboration with a recognised research body/organisation, and 15 of the other 19 questions.

Formal quality assessment was not initially used for the literature reviews included in this review, although judgements on study quality were made based on background reading on systematic reviews (Petticrew and Roberts, 2006, CRD, 2008). A quality checklist for reviews was later identified (Pope et al., 2007, p153), and adapted to form a list of nine questions. This can be found on page A/11 of the appendices. Unlike the quality assessment carried out on the primary studies, no threshold was set for whether a review should be included or excluded, but rather it was used to make an informed judgement about its overall level of quality.

These checklists were more simplified and less rigorous than is often the case in systematic reviews: they contained only criteria which were considered important in order to inform the quantitative analysis, rather than ensuring a top-quality review. When further information on a study was required for establishing its quality for inclusion in the review, its author or organisation was contacted by email with an explanation and a list of questions from the checklist. More details were retrieved for eight of the included studies (O'Dea, 2003, Beets et al., 2007, Coster and Gleeve, 2008, Davies et al., 2008, Kapasi and Gleeve, 2009, Marryat et al., 2009, Martin and Choi, 2009, Cox et al., 2010). Nine primary studies and one systematic review were excluded due to the perceived quality of the study based on the reporting available.

Recording Information from the Studies

A simple method of data extraction was applied to studies as they were retrieved. Basic details about the study design were recorded in an Microsoft Excel table: type of study, location, participant details, and inequalities explored. In a separate Microsoft Word file, sections of text which were thought to be relevant according to the review question were extracted, either through copying and pasting electronically or manually typing in. Extractions from all the studies were included in the same Word file in order to aid the next stage of the review process.

Generating an Overview of Findings

An overview of the review material was carried out from April 2009, and subsequently updated as more studies were identified and the quality criteria applied.

Firstly, a process was developed which involved highlighting extracts collated in the MS Word document with different colours according to the area of inequality which they addressed. It soon became clear from the literature that as well as themes relating to inequality, there were themes relating to the types of parent-child involvement in active play (referred to as modes of involvement). In order to identify where the modes of involvement and inequalities met, a matrix was created. This consisted of the sixteen inequality themes as rows and five modes of involvement as columns. The review papers were re-read and the boxes in the matrix were populated with the study names, brief notes and page numbers of relevant extracts. Since only a small amount of evidence was identified on some of the original inequality themes, composite groups of themes were created reducing the number from sixteen to ten. These can be seen at the beginning of section 3.4. One of the original modes of involvement, parental role-modelling, was also combined into other categories. The remaining four formed the acronym PIES, which are introduced in section 3.3.

The matrix data was used to convert the overview of findings into narrative form. Early on in the review process, it was thought that findings from different types of study designs would be presented as separate parts of the review. It became evident that there were a far less evidence to report from quantitative studies and literature reviews than from qualitative studies, in terms of the amount of text that had been extracted. Thus it was decided that a more appropriate approach was to present all types of evidence within a single review, structured into two main parts.

1. Modes of Parental Support: Children's Perspectives

The evidence highlighted various ways in which parents and children could be involved together in active play. It seemed most appropriate to present these modes of involvement at the beginning of the review findings. In order to ensure that the review was driven by children's views, evidence on children's opinions on involvement in active play with their parents was sought from the review studies. This formed the first part of the review presented in Section 3.3.

2. Factors that may impact on parent-child involvement in active play

The findings relating to inequalities were arranged into ten themes. For each of these themes, evidence in relation to different modes of support was identified from the matrix and brought together. To add context to the findings, extracts of quotes from children and parents were taken from the primary studies and added at the beginning of each section (Dixon-Woods et al., 2004). Not all relevant research from selected studies was included due to the large amount on some topic areas, but rather good-quality and relevant examples were sought to add depth to the review. This is presented in Section 3.4.

Summary of Studies in This Review

Overall, thirty-six studies were included in the literature review: six of these were literature reviews and thirty were primary studies. Table 3-3 showing details of the studies is found on pages 68 to 72.

A large number of the studies identified through the search process were on factors associated with children's physical activity levels, often measured using equipment such as accelerometers and pedometers as well as self-report and diaries. For such studies, it was usually impossible to determine whether activity levels were from informal active play opportunities, or structured activities which was not the main focus of this review. Rather than describing primary studies on these topics, literature reviews on them were included if they investigated

parent-child involvement. Further literature reviews were also included on parenthood and pregnancy, active travel, and electronic media use. Five systematic reviews were included, two of which used methods of calculating pooled statistics from different studies called meta-analyses. One further literature review was also included which reported systematic approaches.

Qualitative research provided a rich body of research for this review. The methods varied and although traditional approaches of interviews and focus groups continued to be used, more imaginative methods were used within some of the studies to help children to express their views. Studies which took an approach of researching 'with' rather than 'on' children and/or their parents enabled a deeper insight into parent-child involvement in active play. These studies revealed a wide range of relevant themes. Twenty-two primary studies were included in the review that were categorised as using mainly qualitative methods. Seven of these only involved children as respondents, seven only involved parents, and eight gained perspectives of both parents and children.

Quantitative research included in the review also involved varied methods: these could be divided into two main types of design called cross-sectional and longitudinal. *Cross-sectional studies* involve the collection of data from a sample of individuals (sometimes random, sometimes not), and statistical comparisons are made to investigate relationships between different factors. *Cohort studies* involve the collection of quantitative data from the same individuals or families longitudinally, over a period of time. Eight papers categorised as using quantitative methods were included in the review: Five of these were cross-sectional research and three used data from cohort studies.

The majority of the primary studies included in the review were on children and families living in England and the rest of the UK (11 studies). There was also a high proportion of primary studies from the USA (9). Other studies were from Australia (4), Canada (2), New Zealand (1), Spain (1), and Norway (1). One primary study included children and families living in different nations enabling cross-cultural comparisons. The literature reviews (6) included studies from a variety of nations.

Table 3-3 on the following pages provides a summary of each of the thirty-six studies. This is followed by the first section of the review findings on children's perspectives on modes of parent-child involvement.

3-3. Table showing details of papers included in the literature review

Paper Reference	Predominant method type for review & data collection methods	Country & region/city if known	Details of Participants (or studies if review)	Modes of Parent-Child Involvement	Factors which may Impact
(Ahlport et al., 2008)	Qualitative: focus groups with parents & children.	USA: North Carolina.	Children from a variety of backgrounds, 9-11 yrs, n=37. Parents, n=37.	Playing together, Autonomy/Supervision	Safety, Family structure, Time, Motor Vehicles, Knowledge, Season.
(Beets et al., 2007)	Quantitative (cross-sectional): questionnaires with parents, pedometers with child.	USA: rural midwesten town.	Children from one primary school, majority white ethnicity, 8-11 yrs, n=68. Mothers, n=65. Fathers, n=50.	Playing together, Encouragement,	Gender of parents & child, Electronic media.
(Bellows-Riecken and Rhodes, 2008)	Systematic Review of quantitative studies on physical activity & parenthood.	Various.	In total, 31 studies published between 1989 & 2006.	Parent's activity	Gender, Age of child, Family structure, motivation, Socio-economic circumstances, Time & employment.
(Billings et al., 2008)	Qualitative: focus groups with girls.	England: Kent.	Girls from a variety of backgrounds, 11-12 & 14-15 yrs, n=91.	Autonomy/Supervision	Time, Safety.
(Borra et al., 2003)	Qualitative: focus groups, observations, and interviews with parents and children.	USA: various.	Children considered obese from a variety of b/grounds, 8-12 yrs, n=112. Also, children 11-12yrs & parents from additional families interviewed (n=46) & observed (n=6).	Playing together, Encouragement,	Electronic media.
(Brady et al., 2008)	Qualitative: Interviews with parents, observations of children.	England: London.	Children from a variety of backgrounds, approx 2-4 yrs, n=19. Parents, n=19.	Playing together, Autonomy/Supervision.	Safety, Family structure, Season & weather, Features of area.
(Coster and Gleeve, 2008)	Qualitative: focus groups with children.	England: various.	Children from a variety of backgrounds, 8-13 yrs, n=62.	Autonomy/Supervision	Safety.
(Cox et al., 2010)	Qualitative: focus groups with parents & children.	New Zealand: Auckland.	Children at schools in areas of high and low SES, 11-12 yrs. Parents. Total participants n=60.	Encouragement, Instrumental support, Autonomy/Supervision	Safety, Age of child, Socio-economic circumstances, Motor vehicles, Time.

3-3. Table showing details of papers included in the literature review

Paper Reference	Predominant method type for review & data collection methods	Country & region/city if known	Details of Participants (or studies if review)	Modes of Parent-Child Involvement	Factors which may Impact
(Davies et al., 2008)	Qualitative: interviews with parents & children.	Australia: Victoria.	Children from low SES area, 9-12 yrs, n=9. Mothers, n=8.	Autonomy/Supervision	Socio-economic circumstances, Safety, Organised activities.
(Dex and Ward, 2007)	Quantitative (cohort study): interviews with parents.	UK: various.	Children from a variety of backgrounds, 3 yrs. Fathers, n=9207.	Playing together.	Socio-economic circumstances, Ethnicity, Employment.
(Gustafson and Rhodes, 2006)	Systematic Review of parental correlates of physical activity in children.	Various.	In total, 34 studies published between 1985 & 2003.	Encouragement Instrumental support,	Gender, Age of child, Family structure, Socio-economic circumstances, Ethnicity.
(Hart et al., 2003)	Qualitative: focus groups with parents.	England: Surrey, Merseyside.	Children from high & low SES groups, 7-12 yrs. Mothers, n=40. Fathers, n=1.	General involvement.	Socio-economic circumstances, safety, season & weather, motor vehicles, structured activities.
(Hesketh et al., 2005)	Qualitative: creative methods with children, focus groups with parents.	Australia: Victoria.	Children from a variety of backgrounds, but few from low SES and minority ethnic groups, 7-8 & 10-11 yrs, n=119. Parents, n=17.	Playing together,	Socio-economic circumstances.
(Holt et al., 2009)	Qualitative: interviews with children.	Canada: Edmonton.	Children from one primary school with diverse ethnicity, approx 6-14 yrs, n=59.	Playing together, Autonomy/Supervision	Safety, Family structure.
(Irwin et al., 2005)	Qualitative: focus groups with parents.	Canada: London & Middlesex County.	Children from variety of backgrounds, 2-5 yrs. Parents: n=71.	Encouragement,	Time, Season & Weather, Safety, Siblings.
(Jordan et al., 2006)	Qualitative: questionnaires, focus groups & interviews with parents & children.	USA: Chicago, Philadelphia, & Richmond.	Children from variety of backgrounds, 6-13 yrs, n=180. Parents: n=180.	General involvement.	Electronic media.
(Kapasi and Gleeve, 2009).	Qualitative: focus groups with children.	UK: various locations in England, Scotland, Wales and Northern Ireland.	Children from variety of backgrounds, 7-14 yrs, n=71.	Instrumental support, Autonomy/Supervision	Season & weather, structured activities, children's time,.

3-3. Table showing details of papers included in the literature review

Paper Reference	Predominant method type for review & data collection methods	Country & region/city if known	Details of Participants (or studies if review)	Modes of Parent-Child Involvement	Factors which may Impact
(Lopez-Dicastillo et al., 2010)	Qualitative: interviews with parents.	Spain.	Children from an area with low SES families, 5-7 yrs old. Mothers, n=32. Fathers, n=15.	Encouragement, Autonomy/Supervision	Age of child, Electronic media.
(Lorenc et al., 2008).	Systematic Review of quantitative and qualitative studies on attitudes to active travel.	Studies conducted in the UK.	In total, 16 studies published between 1995 & 2005.	Autonomy/Supervision	Safety, Motor vehicles.
(Marshall et al., 2004)	Systematic Review of quantitative studies on electronic media use and physical activity – with meta-analysis	Various	In total. 33 studies published between 1985 and 2002.	Children's activity levels (not with parents)	Electronic media
(Martin and Choi, 2009)	Quantitative (cross-sectional): questionnaires with parents.	USA.	Children of white & African American ethnicity with disabilities, 5-13 yrs, n=56. Mothers, n=47. Fathers, n=21.	Encouragement,	
(Mactavish et al., 1997)	Qualitative: questionnaires with parents, interviews with parents.	USA.	Children with disabilities. Parents, n=65.	Playing together,	Disability, Family structure.
(Marryat et al., 2009)	Quantitative (cohort study): interviews with mothers and fathers	Scotland	Children from a variety of backgrounds, age 4, n= 2280 Parents, n=2280	Playing together	Child's activity levels.
(McGarvey et al., 2006)	Qualitative: focus groups with mothers.	USA: Northern Virginia.	Children from a variety of ethnic backgrounds, approx 2-6 yrs. Mothers, n=25.	Autonomy/Supervision	Safety, Family structure.
(Mulvihill et al., 2000)	Qualitative: interviews with children and parents.	England: North, Midlands & South.	Children from a variety of backgrounds, 5-11 yrs, n=60. Parents, n=38.	Playing together, Encouragement,	Safety, Age of child, Time, Socio-economic circumstances, Family structure, Organised activities.

3-3. Table showing details of papers included in the literature review

Paper Reference	Predominant method type for review & data collection methods	Country & region/city if known	Details of Participants (or studies if review)	Modes of Parent-Child Involvement	Factors which may Impact
(Newman et al., 2007)	Quantitative (cross-sectional): questionnaires with children.	Three countries: Bulgaria, Taiwan & USA.	Children from Bulgaria & Taiwan in urban areas, children from USA in suburban areas. Aged 10-11 yrs. Bulgaria: n=287 Taiwan: n=259 USA: n=196.	Autonomy/Supervision	Culture, Gender of child, Organised activities.
(O'Dea, 2003)	Qualitative: focus groups with children.	Australia: all states/ territories.	Children from a variety of backgrounds, 7-17 yrs, n=213.	Playing together, Encouragement,	Motor vehicles.
(Ommundsen et al., 2006)	Quantitative (cross-sectional): questionnaires with children	Norway: Oslo	Children from a variety of backgrounds, 7yrs, n=2410, and 15 yrs, n=350.	General involvement (composite measure)	Child's age, Child's enjoyment, Parental education, Organised activities.
(Pearce et al., 2009)	Qualitative: creative methods & focus groups with children.	England: London.	Children living in a variety of areas, 9-11 yrs, n=39.	Playing together, Autonomy/Supervision	Season & Weather, Safety.
(Poudevigne and O'Connor, 2006).	Literature Review of quantitative studies on physical activity during pregnancy.	Various.	In total, 31 studies.	Parents' activity	Family structure.
(Propper and Rigg, 2007)	Quantitative (cohort study): interviews with parents	England: South West	Children from a variety of backgrounds, 7 yrs, n=10621 Parents, n=10621	Instrumental Support	Socio-economic circumstances
(Pugliese and Tinsley, 2007)	Systematic Review of Parental Socialization of Child & Adolescent Physical Activity - with meta-analyses.	Various.	In total, 30 studies published between 1997 & 2007.	Encouragement, Instrumental support,	Parent & child gender, child's age.
(Sidebotham, 2001)	Qualitative: interviews with parents.	England: South West.	Children of white ethnicity, 8 yrs. Mothers, n=16. Fathers, n=1.	Playing together, Autonomy/Supervision,	Safety, Time, Socio-economic circumstances.
(Veitch et al., 2006)	Qualitative: interviews with parents.	Australia: Melbourne.	Children attending schools in variety of SES areas, 6-12 yrs. Parents, n=78.	Autonomy/Supervision.	Safety, Age of child, Time & employment, Features of area.

3-3. Table showing details of papers included in the literature review

Paper Reference	Predominant method type for review & data collection methods	Country & region/city if known	Details of Participants (or studies if review)	Modes of Parent-Child Involvement	Factors which may Impact
(Weir et al., 2006)	Quantitative (cross-sectional): questionnaires with parents.	USA: New York state.	Children living in low & high SES areas, 5-10 yrs, n=307. Parents, n=307.	Playing together, Encouragement, Instrumental support, Autonomy/Supervision	Safety, Socio-economic circumstances, Features of area.
(Wright et al., 2008).	Qualitative: focus groups with children.	USA: South Carolina.	Children with high proportion from low-income families & African-American ethnicity, 10-14 yrs, n=52.	Playing together, Encouragement, Instrumental support,	Gender, Family structure, Socio-economic circumstances, Time and employment.

3.3. Modes of parent-child involvement: children's perspectives

The types of involvement identified in the review usually fell into to at least one of the following 'modes' forming the acronym of 'PIES':

Playing or being active together

Instrumental support

Encouragement

Supervision and allowing autonomy

In reality, most parent-child involvement consists of a combination of these modes, but children's perspectives on each of these are introduced separately in the following sub-sections.

*P*laying or being active together

Research suggests that taking part in active play with their parents is important for children. Younger children are particularly dependant on their families: engaging in physical activity as a family is likely to allow for increased social interaction and may help to strengthen emotional bonds.

What children say.....

> "My mum does dance class so I come and watch and sometimes I join in" (Child aged 9 to 11 in England) (Pearce et al., 2009, p619)

Children described the sorts of activities they enjoyed doing with their parents, often giving examples of things which were possible in the local neighbourhoods. For example, Mulvihill et al. (2000) interviewed children aged 5 to 11 in England, who described weekend and holiday activities which they

enjoyed with their families locally, including walking the dog, going to parks and cycling. Holt et al. (2009) carried out school-based interviews with elementary and junior school children in a disadvantaged inner city neighbourhood in Edmonton, Canada. The children referred to enjoying doing activities with their parents, siblings, and other family members, for example riding bikes, walking and jogging.

Children also discussed the benefits of their parents being active, and providing opportunities for them to join in. In a study involving photo-taking, map-marking and focus groups, children aged between 9 and 11 in England discussed how parental interest and involvement in physical activities could help to provide opportunities for them to be physically active too (Pearce et al., 2009). Having more opportunities to be active with parents was also discussed. O'Dea (2003) carried out focus groups with children aged 7 to 17 in Australia. Children aged 10 to 17 said they wanted more opportunities to play outdoor games and activities with their parents. In a study in the USA, children aged 8 to 12 also noted that they would like their parents to participate more in their physical activities (Borra et al., 2003). Wright et al. (2008) carried out focus groups with boys and girls aged 8 to 12 in the USA. Many of children expressed the view that their parents engaged actively with them but that it tended to be infrequent and was often only walking: they wanted their parents to be involved more frequently and in more varied ways.

Instrumental Support

Parents can provide various forms instrumental support for children's physically active play, such as taking them to places where they have space to play, providing toys and equipment, and paying for activities. Sometimes, however, children resent the instrumental 'support' they receive: for many, relying on parents to drive them to places or persistence on making arrangements is perceived as a burden which restricts their independence.

What children say.....

> "When you are in the car, you don't have freedom. You can stop on your bike and look at something, but when you are in the car, you can't stop." (Child aged 9 to 11 in New Zealand) (Tranter and Pawson, 2001, p36)

> "Having the right food so you can be active and play the sports you want to play." (boy aged 11 to 12 in New Zealand) (Cox et al., 2010, p4)

Kapasi and Gleeve (2009) carried out focus groups with children aged 7 to 14 from across the UK. The children gave examples of large garden play equipment that their parents provided for them, including swings, slides and trampolines. Children in Wright et al.'s study (2008) spoke of their appreciation of parent's instrumental support in the form of driving them to places, although this tended to be in the context of structured activities rather than informal play. Negative opinions on instrumental support have also been expressed by children, for example, findings from a study involving questionnaires and interviews with children aged 9 to 11 in New Zealand indicated that some children felt restricted by travelling in the car, and wanted to travel actively (Tranter and Pawson, 2001).

A boy in Cox et al.'s study (2010) made an interesting observation that support through providing good nutrition had an impact on his ability to play actively. Many studies have been identified on parents' and children's opinions on nutrition, but since Cox et al.'s was the only study identified which made the link between parental facilitation through food and this enabling physical activity, this topic is not addressed further in this review.

Encouragement

Verbal encouragement, reassurance, and praise from parents may offer psychological benefits for children, which in turn may impact on their enjoyment of physically active play.

What children say.....

> "I think they should also help with your physical activity by encouraging you to do things, even though they haven't done it before." (Girl aged 11 or 12 in New Zealand) (Cox et al., 2010, p4)

Four studies identified how children wanted their parents to be more encouraging. In Borra et al.'s study in the USA (2003), children reported that they wanted more support from parents to be active, for example, by providing guidance or offering them incentives. In a study with children in Australia (O'Dea, 2003), 10 to 17 year olds suggested that their parent's encouragement would help them to take part in physical activities. Children in Auckland, New Zealand also pointed out that they wanted encouragement from their parents, even if their parents were not active themselves (Cox et al., 2010). In Mulvihill et al.'s study (2000) children referred to instances where parents encouraged them to take part in outdoor play, to prevent what was often described as laziness. In Wright et al.'s study (2008) children spoke of positive encouragement from the parents, but also negative encouragement where they were pressured to take part in activities which they did not really want to do.

Supervision and allowing autonomy

Supervision of children is important to ensure that young children do not come to serious harm. Supervision of children's physically active play may involve keeping an eye on them when they are playing, setting down boundaries and rules, and mediating or disciplining when rules are broken (Brady et al., 2008). From the child's perspective, high levels of supervision can however prevent them from being able to play actively: for example if they are not allowed outdoors or if they are reprimanded for being 'too' active.

In the field of childhood research, the term *autonomy* is sometimes used to refer to the amount of control and independence children have over where they go and how they play. A degree of autonomy is usually considered good for children by parents and those who work with children, in order to allow them to enjoy their play and to develop independence. Although greater supervision is usually associated with decreased autonomy, it is possible for parents to supervise, yet allow children autonomy within certain boundaries.

What children say.....

> " They are our parents but their don't own us" (Boy aged between 8 and 11 in England) (Coster and Gleeve, 2008, p22)

In two recent Play England studies, focus groups were carried out with children in England (Coster and Gleeve, 2008) and from across the UK (Kapasi and Gleeve, 2009). Many children from these studies expressed that they enjoyed being given freedom to explore their environments with friends. They wanted to be able to experiment and practice their physical skills, even if it meant doing some things that parents regarded as risky such as climbing high play equipment and trees. Children usually understood that this was to try to protect them from injuring themselves, but did not necessarily agree, and despite not being permitted to do certain activities under their parents' supervision, many found opportunities to do them when their parents were not present (Coster and Gleeve, 2008). Similarly, children in Borra et al.'s study (2003) emphasised that they did not want to be 'nagged' about their physical activity behaviours. They wanted support from their parents, but also wanted independence and to be allowed to make their own choices. In further studies children have expressed grievances about not being allowed to travel actively in their neighbours and to school without parental accompaniment (Mulvihill et al., 2000).

In summary, children from these studies spoke about a variety of ways in which their parents could facilitate and restrict their physically active play. These were presented in four general groups: ***P***laying or being active together; ***I***nstrumental support; ***E***ncouragement; ***S***upervision and allowing autonomy.

3.4. Factors that may impact on parent-child involvement in active play

In the previous section, different modes of parent-child involvement in physically active play were introduced. A variety of factors were identified from the literature that potentially impacted on these different modes. These have been arranged under ten headings.

- Concerns about safety
- Child's and parent's gender
- Child's age
- Socio-economic factors
- Health, disability, self-motivation and knowledge
- Ethnicity and related factors
- Season and weather
- Children's activity levels
- Electronic media activities
- Organised activities and clubs

Each of these themes are discussed in detail in the following sub-sections.

The section heading is "factors that may impact…" since this was an exploratory review which did not seek to meta-analyse findings or verify cause and effect which would be required to attempt to answer the question "what factors have an impact....?

Concerns about safety

> "My main concerns regarding park use by my child are strangers, syringes, and main roads on the way there (parent of boy aged 9) (Veitch et al., 2006, p386)

Parental concerns about conflict, violence, crime, stranger-danger and traffic are very real barriers to children's autonomy to play outside. Parents in several studies emphasised the importance of supervising their children when outside the home environment to make sure they did not come to harm (Irwin et al., 2005). In Holt et al.'s study (2009) safety fears, particularly those relating gangs and violence, were key issues was raised in relation to parental involvement: children referred to not being allowed to go to parks and other locations without

being accompanied by a parent. In two qualitative studies in Australia (Hesketh et al., 2005, Veitch et al., 2006), parents of primary school aged children expressed concerns about safety, and how this restricted opportunities for physical activities and active play.

Safety is an important issue for parents with regard to their children's opportunities for active travel, as highlighted in a systematic review of UK studies on attitudes to walking and cycling involving children and parents (Lorenc et al., 2008). In a study in the USA (Ahlport et al., 2008), parents of children aged 9 to 11 and their parents took part in focus groups to discuss issues relating to active travel. The majority of parents reported that they did not allow their children to walk or cycle to school unaccompanied because of safety fears relating to road accidents, abduction, and the presence of bullies. Barriers were also cited for children and parents travelling actively together including characteristics of the environment such as lack of pavements (US: sidewalks), long distances, and difficult terrains.

An area of concern that many children experience in their outdoor play is parents' fears of them taking risks which may lead to injuries. Children in Coster and Gleeve's study (2008) pointed out that parents often provided high levels of supervision and did not want them to do particular things such as climbing trees or high playground equipment because they might fall. Parents in the Brady et al.'s study (2008) realised that taking risks was an important and normal part of childhood, and used various strategies to facilitate these risks including closely supervising activities and assisting children, giving warnings and setting boundaries, and rationalising the level of risk. Parents reported being more wary about risks and minor injuries when they had their first-born child, but over time these concerns diminished.

Concerns about safety underlie many of the other impacts discussed in this section.

Child's and parent's gender

> "I wish they could cheer for me" (Boy)
> "I wish my Mom would not make me be active" (Girl)
> (children aged 10-14 in USA) (Wright et al., 2008, p6)

In Chapter 2, research was presented which suggested that boys tend to be more active than girls. In line with this, this review located research suggesting that parent-child involvement in physical activity may be patterned by gender.

In a systematic review of quantitative studies, Gustafson and Rhodes (2006) identified five studies that pointed towards boys receiving more encouragement or instrumental support for physical activity than girls, and a further three which did not did not show differences by child's gender. In a recent primary study, Wright et al. (2008) found that girls were generally more likely than boys to report incidences of positive encouragement from their parents, but were also more likely to receive what was described by the authors as negative support: that is being encouraged to be active when they did not want to.

Involvement from the same-sex parent as the child may be particularly important. In their systematic review, Gustafson and Rhodes (2006) suggested that mothers' and daughters' activity levels were more closely related than that of mothers and sons, and that fathers' and sons' activity levels were more closely related than that of fathers and daughters. The research indicated that mothers and fathers generally take contrasting approaches to their children's active play: fathers are generally more actively involved, whereas mothers tended more often to facilitate play without necessarily joining in.

Beets et al. (2007) found in their study in the USA that boys' activity levels at weekends were significantly related to activity with their fathers; and girls activity levels during the weekdays were significantly related to their mother's planning or encouraging weekday outdoor play, suggesting that children's activities may be most strongly influenced by the behaviours of a parent of the same sex as themselves.

Age of child

> "My mum doesn't kind of allow my brother to go on his own because he's a bit too young, and if I wanna go out on my own, she does have to come with me just in case anything happens." (Girl aged 11 or 12 in England)(Billings et al., 2008, p49)

Parental supervision of children's play may differ by child's age. Keeping children under closer supervision by keeping them inside rather than allowing them to go outdoors is a choice that parents often make for their young children. This was highlighted by the study involving parents of 5-7 year old children in Spain (Lopez-Dicastillo et al., 2010), who felt that their children were too young to safely go out alone. As children get older, it might be expected that they have increased independence to spend time away from the home without supervision, yet many children are still highly supervised as they enter adolescence. In a qualitative study in Kent, England some of the 11 to 15 year old girls reported that they were restricted from going outside alone, and referred to needing to be accompanied by parents (Billings et al., 2008).

Family structure and stage of parenthood

> "She [mother] tells me to go outside and play with my sister". (Child aged 10 to 14 in the USA) (Wright et al., 2008, p5)

> "My kids want to go outside a lot. And dealing with the baby, I can't get out and I won't let them out unless I'm there." (Parent of pre-school child in USA) (McGarvey et al., 2006, p277)

Very little evidence emerged from the literature on influences of being in one- or two-parent families on parent-child involvement in physical activities. In their systematic review, Gustafson and Rhodes (2006) suggested that having a lone parent who was a positive role-model for activity was better, with regard to children's overall activity levels, than having two parents who were inactive. When questioned about how family structure may influence children's

participation, some parents in Mulvihill et al.'s (2000) study were of the view that children in lone-parent families could be more restricted due to increased costs and finding time to chaperone to activities.

Siblings can play together and facilitate each other in active play, but this may have negative consequences with regard to parent-child opportunities. Parents of pre-school aged children in Irwin et al.'s (2005) expressed the view that there was little need for them to take part in active play with their children when their siblings were around. In a study in the USA involving focus groups with 10 to 14 year olds, children noted that they were encouraged by their parents to play with siblings, but that their parents did not often join in (Wright et al., 2008).

For some parents, having more than one child may lead to more difficulties in finding time to play or sorting out activities (Lopez-Dicastillo et al., 2010). In a study involving focus groups in the USA, a mother explained how she found it difficult to go out to play with her young children because of commitments to caring for her baby, and wouldn't allow them to play out without her (McGarvey et al., 2006). In a study based at play settings in England, parents reported that having more than one child put restrictions on getting to parks or playgrounds (Brady et al., 2008). Mothers in this study also discussed how being pregnant limited their participation in their preschool children's physically active play. A systematic review of quantitative literature has confirmed that physical activity for leisure is significantly reduced during pregnancy (Poudevigne and O'Connor, 2006).

Bellows-Riecken and Rhodes (2008) carried out a systematic review of qualitative research on physical activity among parents. Several studies indicated that commitment to caring for children was perceived as a barrier for many parents to take part in physical activity themselves. Those in early parenthood were particularly vulnerable to reductions in activity. These findings suggest that early childhood may be a time during which children are particularly likely to lack positive parental role-models for active behaviours. Even if parents become more active as their children get older, these factors may have long-lasting effects on children's attitudes to physically active play.

Socio-economic factors

> "I used to ride my bike every day until I got a puncture and my mum can't afford a new tyre" (Child aged 10 to 11 in Australia) (Hesketh et al., 2005, p23)

> "There's so little you can do as a family unit, so few places, I mean, there's the swimming pool, but when you tot it up for a low income family you're lucky if you can do one activity in the week...." (Single mother in England) (Sidebotham, 2001, p478)

In a qualitative study with children aged 7 to 11 in Australia, which used photography activities in focus groups, children discussed various aspects of physical activity and physically active play (Hesketh et al., 2005). Lack of money was cited by children as a barrier to their physical activity, for example because it meant they were unable to afford to buy toys and equipment. Financial restrictions were experienced by children and parents in Mulvihill et al.'s (2000) study in England. Most of parent respondents in this study did not regard financial costs as necessary for children to experience physical activity per se but realised that poorer families would not be able to afford transport and participation costs of certain types of activity. Literature has not been identified to suggest that parents who are more comfortable financially are any more likely to purchase toys which help to facilitate children's active play.

Taking part in activities together as a family can become very expensive, and for some families it can be difficult to afford opportunities. A qualitative component of the Avon Longitudinal Study of Parents and Children (ALSPAC) study involved semi-structured interviews with sixteen mothers and one father, which took place when the children were 8 years old (Sidebotham, 2001). Two mothers expressed how family activities such as going to the swimming pool had to be limited because of the expense. Quantitative analyses of data from over ten-thousand families from the ALSPAC study showed that 7 year old children of lower socio-economic status measured by occupation of the father (or mother if no father was present, measured at 32 weeks gestation) had lower average of number of visits to parks each week than those of higher economic status (Propper and Rigg, 2007).

Variations according to area deprivation were apparent in a quantitative study with children aged 5 to 10 years living in the USA (Weir et al., 2006). For a series of questions covering crime, road safety and general safety, parents living in low socio-economic inner-city neighbourhoods more frequently answered that their area was not safe for children to play outside compared to parents living in more affluent suburban neighbourhoods. Playing outside the house was less frequent among those in the inner-city neighbourhoods, but no difference was apparent for the child's frequency of going to neighbourhood parks or playgrounds with an adult.

The street that a child lives on is likely to have some impact on his or her play outside the home. In Veitch et al.'s (2006) study in Australia, parental perceptions on the acceptability of street play were often shaped by the type of street they lived on. Primary school aged children living in locations with low levels of traffic such as cul-de-sacs and courts were more likely to be allowed to play outside on the street unsupervised than children living in other locations. Also, some parents who had access to their own garden or court felt that this was sufficient outdoor play space for children, and did not think it was important to visit parks and larger open spaces.

Hart et al. (2003) carried out focus groups with parents of children aged 7 to 12 in England, and compared responses of those living in more and less advantaged areas, based on an area deprivation measure called the Jarman Index. The responses indicated that parents from the more advantaged areas were more likely to view physical activity as something requiring organisation and instrumental support, whereas those in less advantaged areas were more likely to see it as fitting in with everyday play and requiring less planning.

> ". . . if I want to play with my best friend . . . my mom has to drive me there . . ." (girl aged 10-11 in Australia)(O'Dea, 2003, p499)

Owning a car or motor vehicle may enable families to take part in a wide range of physical activity opportunities together, for example, getting to a play area, the swimming pool or to the beach. It is possible that parental insistence on

driving may however restrict their child's autonomy. The girl in O'Dea's (2003) study quoted above relied on her mother to drive her to her best friend's house to play, although it is not clear whether this was because the best friend lived too far away to walk there, or whether the mother would not permit her daughter to get there on her own though active travel.

> "We can get to parks but it's having the spare time to get there..." (parent of girl aged 7) (Veitch et al., 2006, p388)

Some parents find it difficult to make time to take part in physically active play with their children. Being in employment can mean parents have less time overall to spend with their children, and increased pressure to fulfil other duties rather than spending time playing when they are together. Children in Mulvihill et al.'s study (2000) reported that their activities as a family were restricted by their parents' work hours and other commitments such as cooking, housework, gardening, computing and even watching television. Low-income mothers in the USA reported employment as a barrier to not engaging with their children in physical activity (McGarvey et al., 2006). In another study, mothers of 9 to 12 year old children from low-income areas in Australia reported that being in employment could make it difficult to take part in activities with their children (Davies et al., 2008). Parents in Veitch et al.'s (2006) study reported that time was a barrier which impacted on them taking their children to parks or other play spaces.

Health, disability, motivation and knowledge

> "…what the child sees he is going to do more-so…. Like if parents are active, kids are going to be active. And if parents aren't the kids aren't either." (Parent of a pre-schooler in Canada) (Irwin et al., 2005, p302)

> "Planning, planning, planning. That's what it takes to get any family recreation activity going in our family - probably in any family with a kid with a disability." (Parent in the USA) (Mactavish et al., 1997, p41)

The amount and type of physical activity that parents exhibit may be central to the family's activity. Through demonstrating how they enjoy physical activity, parents may encourage their children's physically active play. Parents in Irwin et al.'s study (2005) emphasised the importance of modelling active behaviours so that their children were encouraged to be active too. Some parents used creative strategies to encourage physically active play: one parent described a making up a fun game of hopping and skipping around a shopping mall. The authors pointed out that parental enjoyment of physical activity may influence child's enjoyment, and child's enjoyment may also influence parental enjoyment.

Parents who are physically active may also be more likely to support their children's physical activity in other ways. Martin and Choi (2009) carried out questionnaires in the USA with 68 mothers and fathers of children with disabilities aged 5 to 13, and found that parents who enjoyed physical activity themselves and those who were active were more likely to report high encouragement of their children's physical activity.

Encouragement of children's physically activity is not regarded as necessary by all parents. Findings from the study in Spain suggested that a few of the parents believed that their children were usually physically active enough of their own accord, and so felt there was little requirement for them to be involved (Lopez-Dicastillo et al., 2010). High levels of activity were sometimes regarded as an indication of hyperactivity, and sedentary activities were preferred and

encouraged by these parents. Irwin et al. (2005) found that a small number of parents felt that by providing instrumental support for their pre-school children's physical activity, they were fulfilling their commitments and felt no need to participate with them.

Ahlport et al. (2008) found that knowledge on physical activity was reported by parents as a factor which motivated them to encourage active travel for their children. Other parents in this study said they could not find the energy, strength, or enthusiasm to walk with their children. In their systematic review of physical activity among parents, Bellows-Riecken and Rhodes (2008) identified various barriers to parents taking part in physical activity themselves, such as fatigue and health problems: those who are ill may be physically unable or lack motivation to take part.

In Chapter 2, research was presented on how children with disabilities can be particularly restricted in their opportunities for physical activity. Children with disabilities often have limited opportunities compared to their peers, partly a consequence of society not providing adequate facilities and support for their needs. A study was identified which involved questionnaires and interviews with the parents of children with a range of developmental disabilities (Mactavish et al., 1997). Patterns from basic quantitative data suggested that the children with disabilities generally had greater opportunities for recreation (not specifically physical activity) with a parent than their siblings without disabilities. One of the parents offered an explanation: that their children without disabilities had greater independence to play with friends, and so more effort was made with the child with a disability to ensure they did not miss out. Parents in this study also described how it could take a lot of time and effort to plan recreational activities for the children with disabilities – they felt it was exhausting with the commitments of childcare and work, but most expressed that it was worth the extra effort.

Ethnicity and related factors

As discussed briefly in Chapter 1, the term *ethnicity* is closely linked to a range of concepts, including country of origin, migration, acculturation, language-barriers, religion, and discrimination. A small amount of evidence was identified in the studies in this review to suggest that these concepts may impact on parent-child involvement in physical activity.

Research with the Millennium Cohort Study was identified in the study's published findings, which investigated ethnicity as having an impact of parent–child play (Dex and Ward, 2007, p72). Relationships between father's characteristics and frequency of playing with their three year old child were examined. Of 9207 fathers (including mother's partners), 78% reported that they played with the child daily, 21% weekly and 1% less often. Statistical analyses showed variation when comparing by fathers' ethnicity: Bangladeshi, Black Caribbean and Black African fathers were the least likely to play with their child every day.

Although the qualitative studies previously introduced in this review included children from a variety of backgrounds, few of these included any analyses on cultural factors or drew comparisons between different cultural groups with respect to involvement in physical activity. In their study in the USA, McGarvey et al. (2006) found that white, African-American and Hispanic mothers had similar attitudes to preventing children's obesity, which generally differed from those of Vietnamese mothers, but this mainly with reference to eating behaviours rather than physical activity. African-American mothers reported that lack of time and work commitments prevented them from joining in actively with their children; the other ethnicity groups did not, but inferences about ethnic differences cannot be drawn from this evidence.

One of the studies included in the review involved children from three countries: Newman et al. (2007) carried out the cross country comparison of 10 to 11 year old children in Bulgaria, Taiwan and the USA, involving self-report on activities (physically active and non-physically active) that they usually took part in.

Significant differences between the children's activities were identified between the countries for a variety of activity types, with children in the US spending more time in free play and sports. Children in Taiwan were less likely to have autonomy in their choices. These differences were reported as being partly attributable to differences in parents' expectations about completing academic study and homework. The authors suggested that these differences may be due to differences in parental perceptions about play, and expectations of children and how they should be brought up (Newman et al., 2007).

Season and weather

> "During the summer their activity behaviours are great. I love how active they are and how they want to be outside doing things but in the winter ….it's cold and I don't want to go outside and play with them anymore." (Parent of a preschooler in Canada) (Irwin et al., 2005, p4)

Children's outdoor play opportunities can be dependent on the sunlight. In British winters, it is getting dark by 4pm and outdoor play beyond the garden may be prohibited by parents after this time due to safety concerns . On weekdays, this can give children little time after school to play out. Parental concerns about rain, wind, the cold and other 'bad' weather conditions also mean that children can be confined to staying indoors. The weather was reported as a barrier to parent-child active play in a number of studies, for example by accessing parks (Brady et al., 2008) or going outside to play (Irwin et al., 2005). In their study Ahlport et al. (2008) found that parents mentioned different weather conditions (including heat, rain, and cold) as being barriers to them walking or cycling with their children to school.

Children's activity levels

One of the main factors likely to impact on, as well as being impacted by, parental involvement is amount of physical activity a child does: through being physically active, children may elicit greater involvement from their parents.

Quantitative data from Scotland's birth cohort study, Growing Up in Scotland, were analysed to investigate relationships between parental attitudes and their 4 year old children's activity levels (Marryat et al., 2009). Children who were considered highly active were more likely than those who were less active to take part in active play with their parents. Pugliese and Tinsley (2007) carried out a systematic review of quantitative studies published between 1997 and 2007 involving children and adolescents aged 3 to 18. In a series of meta-analyses, the authors found that children's activity levels were significantly associated with encouragement and instrumental support received from parents. It is important to emphasise that it is not possible to determine whether children are more highly active as a result of their parents' involvement, or whether the parents were more actively involved because they have highly active children. The most likely scenario is that the influences go in both directions.

Electronic media activities

> "...my mum usually says to me if I'm watching TV, she says, 'why don't you go and do something with your friends'" (Girl, aged 11 or 12) (Billings et al., 2008, p50)

> "I would give the cartoons to stop the commotion. I would prefer to see them play, but sometimes I just want them to sit and look." (parent of boy aged 6–7 years)(Jordan et al., 2006, p1307)

The term *electronic media* is used here to refer to television, computer, games console and other such activities. Quantitative research on the determinants of children's activity levels has been used to investigate the relationships between electronic media use and physical activity, showing mixed results. Marshall et al. (2004) carried out a meta-analyses on twenty-four studies investigating the relationship between electronic media use and physical activity among children aged under 18. The results showed that greater television viewing and greater video game/computer use were both associated with lower physical activity. In Billing's et al. (2008) study, parental strategies in relation to electronic media

use and physical activity were raised: there was report of parents discouraging television viewing, and encouraging outdoor activities instead. There is also evidence to suggest that some parents may show encouragement towards their children's use of electronic media equipment in order to discourage other activities. Jordan et al. (2006) carried out a study with parents and children aged 6 to 13 in the USA. In focus groups, some parents discussed how the television helped to calm their children and to subside arguments between siblings.

There is a general view in physical activity research that electronic media activities are unhealthy alternatives to physical activities. However, children in Hesketh's study (2005) pointed out that using a computer can be healthy for the brain and fingers. It is possible that electronic screen use may also help to facilitate physical activity among children. In Borra et al.'s study (2003), the internet was cited as a useful medium for children and parents to access information about health and physical activity. Online forums provided opportunities to communicate with others to exchange ideas and find solutions regarding physical activities. The popularity of sport in mass media was also thought to promote more positive attitudes towards physical activity: famous elite athletes were admired by children.

Organised activities and clubs

> "My mum says it's better to be in clubs than to be hanging round on street corners.'' (Child aged 7-14 in England) (Kapasi and Gleeve, 2009, p12)

Clubs and structured activities, although not always involving physical activity, may result in children having fewer opportunities for physically active free play. Although not a focus of the review, qualitative evidence identified within it pointed to socio-economic inequalities in parent's instrumental support for structured activities. For example, financial circumstances appeared to impact on families being able to afford sports clubs (Mulvihill et al., 2000) and school camps (Davies et al., 2008). There was also quantitative evidence of socio-economic differences: in a cross-sectional study of children aged 9 and 15 in

Norway, children whose parents had a higher level of education were more likely to report being involved structured physical activities and sport (Ommundsen et al., 2006). In Kapasi and Gleeve's recent study (2009), many of the children attended organised clubs, some of which involved physical activity, but these were generally regarded as being distinct from play. Some of the children expressed the view that they were too busy for play and had little time for themselves due to the number of clubs they attended. Some cited parental worries about safety as being the motivation for encouraging them to attend clubs.

In other studies parents gave reasons for not allowing their children to participate in structured activities. Mothers in Davies et al.'s (2008) study reported that they could not afford or lacked the time to transport their children to attend physical activity clubs. Some parents in Irwin et al.'s (2005) study suggested that organised sporting activities would increase competitive behaviours in their children, and they preferred to encourage physical activity through informal play.

3.5. Strengths and limitations of the literature review

Review Methods

With hindsight, it is clear that the literature review methods could have been improved. A broader selection of research databases could have been searched. As well as health and childhood databases, social science and education databases could have been used. The search strategy also allowed little scope for the identification of 'gray literature' – that is, those not obtained through usual publishing channels (Petticrew and Roberts, 2006). It could have been expanded to include databases of dissertations, theses and conference proceedings.

The approach to quality assessing, synthesising and presenting the findings evolved during the process of carrying out the review: it is likely that it would have benefited from the development of a more detailed protocol. This may have enabled greater understanding of appropriate methods relating to qualitative studies and mixed method reviews and ensured 'best practice' by being explicit about the process in advance.

While themes were identified from studies, a formal *thematic analysis* was beyond the scope of the thesis. Although thematic analysis is an approach most often associated with qualitative studies, authors of literature review guidance have noted that it is possible to use it in mixed-method literature reviews (Pope et al., 2007, p96). It is regarded as a suitable approach for organising and summarising findings which come from a diverse range of literature, which was evident in this review. With prior experience in this method or more time to learn the techniques, this might have been an option but for this MPhil research a simplified approach was taken. The matrices which were produced to analyse the data did not include investigation of interactions between themes, and the resulting narrative lacked complexity. The attempt to integrate qualitative and quantitative findings meant that it was not always obvious where gaps existed. With more resources, it could have been beneficial to use a qualitative synthesis program such as SUMARI or QARI (Pope et al., 2007, p135).

Children as Respondents

One of the main strengths of this review is the fact that children's own thoughts and opinions were presented. The majority of the studies included children as respondents, and creative approaches were used were used providing the children with different opportunities to be able to express their own views. Although children may experience more barriers than adults in reporting precise details of their physical activities (Pugliese and Tinsley, 2007), their perspectives and opinions were valuable for gaining understanding of their experiences.

Representativeness and Transferability

Several of the studies included in the review recruited from small geographic areas or particular locations. For example, in Martin and Choi's study (2009), the children were all enrolled on martial arts courses, and in two of the studies (Beets et al., 2007, Holt et al., 2009) the children attended the same school. Other studies sampled families from particular social groups, for example those in minority ethnic groups (Wright et al., 2008). These are all examples of purposive sampling. Self-selective sampling can also mean that those with particular characteristics are more likely to be in studies, for example, children and parents with high interest in physical activity (Pearce et al., 2009) or who were particularly 'keen' to take part in research (Irwin et al., 2005). A consequence relating to purposive and self-selective sampling, and also to the very nature of small scale in qualitative studies, is that the findings which emerge in the research may not be transferable to those in other settings or contexts (Ritchie and Lewis, 2003). Although Richie and Lewis suggest that readers can assess the transferability of a qualitative paper based on the detail presented, this is a complex task which relies on the reader's judgement, and was not untaken as part of this literature review. For any type of study, transferability of findings from one age group of child to another is a limitation to consider. Children's experiences vary across different ages, particularly their dependency on their parents. Parental involvement at age twelve will generally

be very different than at age four. Limiting the review to only include children aged 4 to 6 (the age of the sample in the main analyses) would however have left only one study eligible for inclusion.

Quantitative research included in the review used data from the MCS (Dex and Ward, 2007), and from other large cohort and cross-sectional studies in the UK (Propper and Rigg, 2007, Marryat et al., 2009) and Norway (Ommundsen et al., 2006). These studies all involved large sample sizes of over two-thousand participants, including families from a wide range of backgrounds, and were designed to allow findings to be generalisable to the wider population from which the sample is drawn. However, regardless of this, a study on five year old children from another country may not be generalisable to five year old children in the UK since the demographics of the populations may be so different.

Literature reviews presented results from several primary studies. Systematic approaches were adopted (as discussed previously) providing stronger evidence than each of the individual studies. An issue relating to literature reviews, in particular systematic reviews, is that they often contain only quantitative research, neglecting to include any qualitative studies. This was the case in five of the reviews presented (Marshall et al., 2004, Gustafson and Rhodes, 2006, Poudevigne and O'Connor, 2006, Pugliese and Tinsley, 2007, Bellows-Riecken and Rhodes, 2008), with only one including both types of research (Lorenc et al., 2008).

Causality and Association

Several of the quantitative studies in the review expressed caution regarding causal directions between parental/child characteristics and play-related activities. Pre-existing characteristics of the child and family such as child's and parent's gender, ages, disability status and ethnic group cannot be influenced but there are other factors identified for which the direction of influence can be less certain. For example, parent-child involvement in active play is likely to lead to changes in electronic screen use, and in organised activities. Previous

involvement in active play may impact on a parent's self-motivation to become involved in the future. Previous experiences may also impact on a parent's concerns about safety: those who are more actively involved may less fearful of safety concerns due to positive experiences of playing outside with their children.

Alongside these limitations, it is important to consider that few of the studies in the review tested whether associations between factors and outcomes relating to parent-child involvement in active play were 'independent associations', that is not explained by other factors. In order for this to be established, particular techniques in statistical analysis need to carried out.

Identifying Play

As discussed in Chapter 2, it was often difficult to determine from studies whether the physical activities under investigation were in the form of child self-motivated play. For some of the studies included in this review, it was not clear whether the findings genuinely referred to physically active play, since they only addressed physical activity in more general terms (Beets et al., 2007, Pugliese and Tinsley, 2007).

3.6. Summary and conclusions of the review

Summary of findings

This review identified a large body of evidence on parent-child involvement in physically active play. The types of involvement generally corresponded to at least one of four main categories: playing or being active together; instrumental support; encouragement; supervision and allowing autonomy. Research from different qualitative studies brought to light children's opinions on these types. In particular, children expressed that they enjoyed playing actively with their family and parents, and appreciated encouragement. Some important issues were raised in regard to children feeling that supervision by their parents restricted their autonomy to make their own choices about activities, and that instrumental support was sometimes resented.

Concerns regarding safety seemed to have an important impact, particularly on parental supervision and allowing autonomy. Factors such as violence, crime, stranger-danger and traffic, as well as fears about their children getting injured through play, were discussed in a number of studies. Evidence suggested that parents worries about safety were usually the main motivation for putting restrictions on their children's outdoor play and active travel, and also impacted on their participation in activities together. Safety concerns were also underlying factors for many of the other impacts discussed in this chapter.

Several studies suggested that gender patterns may exist: mothers seemed more likely to influence their children's physical activity levels through instrumental support and encouragement, and fathers through joining in actively, with possibly stronger links between boys and fathers, girls and mothers. Child's age was an aspect investigated in few of the studies: supervision may be greater for younger children but those entering adolescence also experience restrictions.

There was little evidence to suggest that being in a one- or two-parent family had any impact on the active involvement with parents. There was suggestion

that single parents may find it more difficult to provide instrumental support due to lack of economic resources, but the evidence tended to refer to organised activities rather than informal play. Several studies looked at the possible impacts of children having siblings: compared to only children, those with siblings appeared to be less likely to play actively with their parents and more likely to be granted outdoor autonomy.

In most studies, family financial circumstances were generally discussed in the context of clubs and organised activities, but there was also some indication that being poor could restrict informal active play within the family. Difficulties in affording swimming pool entry and buying a new tyre for a bike were examples cited. Living in poorer areas and on busier streets seemed to lead to greater restrictions on outdoor active play. Having access to motor vehicles was reported to have advantages in being able to get to places to take part in activity. Several studies indicated that parent's employment and other commitments appeared to have a negative impact on the time they had available to play actively with their children.

Parents expressed the view that children would be encouraged to enjoy physically active play if the parents exhibited healthy active behaviours themselves. There was indication that active parents may also be more likely to encourage their children's physical activity in other ways. A small number of parents from one study did not believe that their children needed any encouragement as they were already highly active, and others felt that by providing support in other ways there was no need for them to join in actively with their children. Health, motivation and knowledge about physical activity were all cited as factors which influenced parents' enthusiasm and ability to join in with physical activities. Although children with disabilities are often thought to miss out on play opportunities, there was indication that parents of children with disabilities made special effort to play actively with them.

There was evidence to suggest that ethnic differences may exist regarding parents' involvement in their children's play and their decisions regarding autonomy. There was only limited research which shed light on the experiences

of minority groups in England: analysis using data from the Millennium Cohort Study indicated that fathers of Bangladeshi, Black Caribbean and Black African ethnicity were less likely to play with their children than those from other ethnic groups.

Factors relating to sunlight and weather were discussed as factors which restricted parents permitting their children autonomy to play and travel actively outside, and also influenced their enthusiasm to join in actively with their children or take them to places to play.

Results from some studies suggested that being more active meant children were more likely to have parents who played actively with them, who gave them encouragement, and who provided instrumental support. Caution with assuming causality was discussed: it is likely that parental participation leads to more active children, and more active children also elicit greater participation from their parents.

There was evidence of parental concern about children watching too much television or playing on computer games, and of parents trying to encourage them to play actively. However, there was also evidence that parents can encourage the use of television in order to restrict physically active play. Quantitative evidence provided support for the commonly held belief that electronic screen use is associated with lower physical activity. There was also some, albeit limited, evidence to suggest that these activities may in fact have beneficial impacts on children's physical activity.

There was suggestive evidence that despite parent's good intentions, supportive actions for organised clubs and activities may in fact be hindering some children's opportunities for informal play. Children expressed how they had little time to just play due to the number of activities they attended. Reasons for parents enrolling their children in organised activities included there being a lack of siblings or friends to play with at home. Reasons for parents not using organised activities were not being able to afford fees and being concerned that organised sports were too competitive.

Conclusions

This review was an exploration of evidence, involving a variety of quantitative and qualitative studies and literature reviews. A rich amount of information was presented, particularly from qualitative studies involving children and parents as respondents. Different modes of parent-child involvement in physically active play were identified, but sometimes children's views conflicted with their parents' views. This is particularly evident regarding children's autonomy: parents wanted to ensure that their children were supervised, but children often reported that supervision restricted their play. Parental involvement through joining in actively was something that children appreciated and often wanted more opportunities for.

A variety of different factors which were likely to impact on parent-child involvement were discussed, but it was not possible to identify which of these factors had a 'statistically significant' impact due to a lack of quantitative evidence. Quantitative studies which were identified in the search for relevant papers tended to focus on children's activity levels in general, but not necessarily in the context of play, and rarely investigated parental involvement. It was also apparent that few of the studies in the review looked in detail at socio-economic inequalities, and the measures used for this were often based on the area a family lived in rather than their household circumstances. These are all issues which are addressed through the main quantitative analyses of the MCS.

As described briefly in Chapter 1, the MCS has involved several sweeps of interviews with mothers and fathers of young children, and has included questions related to parent-child involvement in physically active play, children's other activities and different aspects of socio-economic circumstance and background. It was chosen to be the source of the main quantitative analyses in this thesis, in order to investigate inequalities in parent-child involvement in children's physically active play. The findings from this literature review were used to inform this analysis. The study is described in the Chapter 4, together with the methods of analyses, and the findings are presented in Chapters 5.

Chapter 4.
Methods: MCS Study Design, Measures and Analyses

Chapter 4
Methods: MCS Study Design, Measures and Analyses

This chapter considers:

- *MCS Study Design:* the Millennium Cohort Study, a UK birth cohort study of children born around the year of the millennium (2000) is described.

- *Measures:* data from the MCS was used to form independent variables and outcomes to use in the analyses

- *Analyses:* a method of analysis called multinomial logistic regression was used for this thesis.

The purpose of this chapter is to inform readers of the process which was undertaken for the quantitative analyses. There are three main sections:

The methods of sampling, recruitment and data collection are described.

The formation of outcome variables and independent variables are described and justified through reference to evidence presented previously in the thesis.

The methods of analyses and reporting are described in detail, with examples of tables and figures.

4.1. Design of the Millennium Cohort Study

The description in this section used information from several publications (Shepherd et al., 2004, Dex and Joshi, 2005, Plewis, 2007a, Hansen and Joshi, 2008, Chaplin Gray et al., 2009).

The Millennium Cohort Study (MCS) is a large birth cohort study of children living in the UK. It is the fourth of Britain's large birth cohort studies: the previous studies began in 1946 (National Survey of Health and Development), 1958 (National Child Development Study) and 1970 (The British Cohort Study) (Dex and Joshi, 2005). Such studies are prospective longitudinal studies which aim to follow-up recruited children throughout their lifetime with observations, interviews and/or questionnaires taking place at various time points. During a cohort member's early childhood, surveys are completed by their parents or carers, and later the children become respondents.

The children of the MCS are currently (at time of print) of primary school age and so this study is an ideal source of contemporary data about children's lives. By January 2009, three 'sweeps' of data had been released from this study when each child was approximately aged nine months (first sweep), three years (second sweep), and five years old (third sweep) (Hansen and Joshi, 2008). Each sweep has included structured face-to-face interviews with the main respondent (usually the child's mother) of each cohort household and usually a partner respondent (partner living with the family). The interviews have covered many topics including the family's circumstances and their background, and specific questions about the child's health, care and development.

Sampling of Wards

The MCS was designed to allow investigations between subgroups of children, particularly those living in disadvantaged circumstances, in lower populated countries of the UK (Scotland, Wales and Northern Ireland) and from minority ethnic groups . To try to ensure there were sufficient numbers of participants for

analyses, greater proportions were recruited from these backgrounds than in the general UK population. The geography of UK electoral wards were used as a sampling frame for the study. Of 11090 electoral wards in the UK, 349 electoral wards and 49 areas termed superwards which were amalgamations of small electoral wards were selected for the study. A method was used to select these sample wards which took into account the population size within them, and how they were classified by the MCS study using a measure called the Indices of Multiple Deprivation (IMD) (Shepherd et al., 2004, p11). Wards with a high proportion of children in families receiving means tested benefits were 'disadvantaged', wards with a low proportion for this criteria were 'advantaged', and, for England only, those with a high proportion from ethnic minority groups were 'ethnic'. Overall, 188 of the sample wards were classified as 'advantaged', 191 as 'disadvantaged', and 19 as 'ethnic'. The sampling strategy meant that greater proportions of disadvantaged and high minority ethnic wards were included in the study than the true proportions. This was to try ensure that enough people from poorer backgrounds and minority ethnic groups to facilitate comparisons across these groups.

Eligibility and Recruitment of Families

Families living in the sample wards were identified by the Department for Work and Pensions (DWP) through the national Child Benefit register (Shepherd et al., 2004, p12). Child Benefit is a non-means tested payment which is available to most main carers of children under sixteen years living in the UK. Additional families living in the sample wards who were not registered to receive child benefit were sought and identified by Health Visitors: some of these families had recently migrated to the UK or migrated from another ward.

The cohort children were born between 1st September 2000 and 11th January 2002 (Shepherd et al., 2004, p19). Those who were resident in England and Wales were born in the academic year from September 2000 to August 2001. Recruitment in Scotland and Northern Ireland was delayed slightly due to overlap with an infant feeding study, and children recruited from these countries

were born between November 2000 to January 2002 (Shepherd et al., 2004, p8). Families with at least one child born in these periods were eligible for the study if they were living in a sample ward at age nine months, even if they had migrated in or out of that ward. Families of infants who had died before nine months of age were not recruited into the study. Families in which the child was cared for by adults other than natural parents were eligible for inclusion.

An opt-out method of recruitment was adopted: letters and information leaflets were sent to the families thought to be eligible which allowed them to inform the DWP by telephone or post if they did not want to take part in the study (Shepherd et al., 2004, p20). Leaflets and letters sent out to families were translated into several languages to aid understanding of the study for some minority groups. These languages were Begali, Gujerati, Kurdish, Punjabi, Somali, Turkish, Urdu and Welsh. This initial recruitment information was sent out when the infant was approximately seven months old.

A total of 27,257 families were identified for the selected wards from Child Benefit records and health visitor details. Following exclusions due to families being ineligible, moving out of wards, opting out of the study, eligibility not being established in time, not responding, and deciding not to participate, a sample of 18,552 families was included in the first sweep (Plewis, 2007a). In these families there were 18,819 cohort children as some included more than one due to multiple births or siblings born within the recruitment period. A reduction in the sample was inevitable in subsequent sweeps since in longitudinal studies families can move and become hard to trace, or decide they no longer wish to take part in the study. There were some new families who entered the study at the second sweep in order to help replenish the sample. There were 15,246 families in the third sweep and 13,234 of these families were included in all three sweeps (Hansen and Joshi, 2008, p20). Of these, 8314 were initially recruited in England, 2002 in Wales, 1596 in Scotland, and 1322 in Northern Ireland, although some migrated within these countries.

Data Collection

At each sweep, interviews took place throughout the year. For the third sweep most took place in 2006 (some in early 2007) and the timing was planned so that most of the cohort children were in their first year of schooling when the interviews took place (Chaplin Gray et al., 2009, p11). This was reception year in England and Wales, and primary one in Scotland and Northern Ireland. For this sweep, the children were aged between four years four months and six years two months (Ketende, 2008, p26).

Pilot studies were carried out prior to each sweep to ensure feasibility of content and length. Each sweep consisted of a structured face-to-face interview with the main respondent of each cohort household (usually the child's mother), and a shorter interview with a partner respondent if there was a partner living with the family willing to take part. Sometimes the main respondent answered some questions on behalf of the partner if absent (in proxy).

Computer assisted interviewing was used which involved the interviewer asking questions displayed on a laptop. For some questions the interviewee was asked to use the laptop themselves to read and self-complete questions. In the first sweep, the main interviews were designed to have a duration of approximately 105 minutes (Shepherd et al., 2004, p10), although they often lasted longer. The interviews in the second and third sweeps were of similar length. Some interviews were carried out with verbal translation by a family member or friend of the respondent, or by an employed translator.

The content of the interviews were divided into several modules to cover many aspects of the cohort child, respondent and family member's lives. For most questions, the respondent was required to choose an answer or answers from a pre-defined list which was either read out by the interviewer or read by the respondent on the laptop. For some questions, the respondent was required to give a free response which the interviewer either coded to a pre-defined list of answers or typed in as text.

Further data were collected using other methods. For most of the sample, at the first and second sweeps, the cohort child was observed by the interviewer and some cognitive assessments and physical measurements were carried out. Neighbourhood assessments were also completed by the interviewer in most cases. Further add-on projects have also been carried out by the MCS researchers including observations of some nurseries that the cohort children attended and analysis of children's Foundation Stage Profile from their first year at school.

Ethics and Security

Ethical approval for the MCS study was given by the South West and London Multi-Centre Research Ethics Committees. Those working directly with the data files containing participants names and identifiable details are required to comply with a data security policy which sets procedures for using an isolated computing environment. For this thesis, anonymised datasets were obtained through the Economic and Social Data Service (ESDS) Longitudinal, a web-based system for accessing longitudinal datasets.

Management and Funding of the MCS

The MCS study is managed by the Centre for Longitudinal Studies (CLS), and the datasets are co-ordinated by the ESDS. Principle funders are the Economic and Social Research Council (ESRC) a consortium of UK Government departments led by the Office for National Statistics (ONS) and the International Centre for Child Studies (ICCS)

4.2. Measures used in the analyses

Scoping the MCS questions

The MCS main questionnaires from the first, second and third sweeps were downloaded from the CLS website in PDF format. Any questions considered to be related to children's physically active play and potential impacts on these were visually identified by scrolling through the questionnaires. The questions that were selected for the analyses are presented in the following sections.

The datasets for the Millennium Cohort Study were accessed via the Economic and Social Data Service (ESDS) website. The data from the parent questionnaires for the first, second and third MCS sweeps were downloaded in a format compatible with the statistical software Stata. These three datasets were subsequently merged through matching family numbers to form a dataset of all the families (n=13,234) who completed the parent questionnaires in the three sweeps.

Eligibility

The eligibility criteria for families to be included in the **mother respondent sample** was that the main respondent reported that she was the birth mother of the cohort child and was interviewed as the main respondent in the first, second and third sweeps of the study to ensure any longitudinal data were consistent. She reported that the (cohort) child had started reception class at school in sweep 3. It should also be noted that families containing cohort twins and triplets were included, but only data for the first reported child were analysed. Although it is the norm in many health studies to include only singletons, this convention was not followed in the interests of inclusivity. Based on these eligibility criteria, the mother respondent sample contained 12,619 families.

The **father respondent sample** was a subset of the mother respondent sample described above: the same eligibility criteria for a mother main respondent were

applied to ensure consistency. The additional criteria were that there was a partner respondent who was the reported birth father of the cohort child, and who was interviewed as the partner respondent across all three sweeps. Since the households included in this dataset were all stable two-parent households, the findings on fathers' responses should not be generalised outside this group. The father respondent sample contained 8103 families.

Outcomes: Participation and Facilitation

As introduced in Chapter 1, the aim of the thesis was to investigate inequalities in parent-child involvement in physically active play. Two questions were selected in the dataset for the third sweep of the MCS which were considered to be suitable for investigating this topic.

Question 1: How often do you play sports or physically active games outdoors or indoors with [child's name]?

Question 2: How often do you take [child's name] to the park or to an outdoor playground?

These questions were included in both the main and partner interviews, so were included in the samples for mother respondents and father respondents. The questions relate to two different modes of involvement in physically active play which were discussed in Chapter 3: Question 1 was used as an indicator of the parent playing actively with the child; Question 2 was used as an indicator of an aspect of instrumental support, taking the child out to play, and also relates to the parent's supervision of outdoor play. The first suggests direct **participation** in physical activity, and the second suggests **facilitation** through going to the park or playground.

These questions were part of a set of seven questions in the interviews which all asked 'how often do you….' for different types of play or activity. The other questions were about reading, telling stories, doing musical activities, being

creative, and playing with toys or games indoors. The aim of the thesis was to look at involvement in physical activities, so these other questions were not analysed.

The choice of responses that mothers and fathers had for each of these questions followed an identical format: respondents had a choice of six frequency categories: ‘every day’, ‘several times a week’, ‘once or twice a week’, ‘once or twice a month’, ‘less often’, ‘not at all’. These were combined to form variables which consisted of three categories: *high-frequency* (‘every day’ or ‘several times a week’), *mid-frequency* (‘once or twice a week’), and *low-frequency* (‘once or twice a month’, ‘less often’ or “not at all’). The reasons for this are described in detail in Section 4.3.

These new variables were to be treated as *outcome variables* in this thesis, with other factors investigated as *independent variables*. The analyses involved examining whether the independent variables were statistically significant *predictors* of the outcome variables. The choice of independent variables are discussed in detail in the following section.

Independent variables to be investigated as predictors

Measures from the MCS datasets were sought to represent factors which emerged in the literature, particularly that presented in Chapters 2 and 3, as having possible impacts on parent-child involvement in active play. Some of these measures were used in the formation of variables to be investigated as predictors in the analyses. They were divided into eight domains:

A. Child’s Characteristics
B. Household Situation
C. Area and Season
D. Mother’s Background
E. Mother’s Situation
F. Father’s Background
G. Father’s Situation
H. Child’s Other Activities

These domains were chosen as a way of organising the variables, and corresponded to the literature introduced in Section 1.2 in Chapter 1 which pointed to three main levels of influence on health: characteristics relating to the individual child (domains A and H), their family (domains B and D-G), and the area they live in (domain C). The measures used in the variables for domains A to E, and H, were almost all taken from main respondent interviews with the mothers; those from domains F and G were from the father's interviews.

Prior to choosing the measures, it was necessary to consider the type of analyses which would be carried out. A method called multivariate logistic regression analyses was chosen. This method is described in more detail in Section 4.3.

As with all types of regression analysis it was important to ensure that the independent variables are conceptually distinct and are not considered alternative or highly similar measures of the same underlying concept (Vittinghoff, 2005, p144). For example, including more than one variable to represent parent's concern about safety in the local area would be inappropriate. Bland (2009) explains that when highly correlated independent variables are included in regression models, this may lead to poor estimates and large standard errors for the statistical relationships between them and the outcome variables.

In the following sub-sections, the measures used from the MCS surveys and the formation of the independent variables are described. Justification for using the various variables are given: this consists mainly of references to pages in Chapters 2 and 3 where the relevant literature is presented, as well as some discussion of additional literature which is of relevance. There are three main types of variable described:

- A *binary variable* has two categories. i.e. boy, girl.
- A *categorical variable* contains three or more categories. i.e. winter, spring, summer and autumn.
- A *numerical variable* is presented as number or value. i.e. a child's age

Domain A. Child's Characteristics

Several studies were identified which indicated inequalities between boys and girls in their involvement with parents in active play (page 80, Chapter 3). Using a data from the first MCS sweep, the binary variable **Child's Sex** showed whether the child was a *boy* or *girl*.

Several studies suggested that there is a decline in children's activity with age (page 50, Chapter 2) and so it seems likely that there may also be differences in parental facilitation and participation depending on their child's age. Based on date of birth, child's age in days at the date of the mother's third sweep interview was calculated by the MCS researchers. For this thesis, these were converted into years (including number of days as a decimal) to form the numerical variable **Child's Age**.

A small amount of qualitative evidence suggested that inequalities may exist between children with disabilities and those without in their involvement in active play with parents (page 87, Chapter 3). Mothers were asked about details of any disability that their child had in the third sweep. Children who were reported to have a disability which limited their activities in some way, were categorised as *has disability*, and others were *does not have disability*, in the binary variable **Child's Disability Status.**

There was little evidence on ethnicity identified in Chapter 3 (page 88). Studies presented in Chapter 2 did suggest that child's ethnicity may be associated with their active play (page 50). Minority ethnic families can be particularly vulnerable to disadvantage and poverty (Berthoud, 2002, Platt, 2007) which may be impact on their active play opportunities (page 83 in Chapter 3). Parenting practices such as discipline strategies and involvement in education may also differ between different ethnic groups (Hofferth, 2003, Barn et al., 2006, Phoenix and Husain, 2007), which may be related to involvement in physical activity. Based on mothers responses in the first and second sweeps, the MCS researchers created an eight category measure for child's ethnicity, which would allow for variations between the most populated ethnic groups to

be investigated. The categorical variable **Child's Ethnicity** consisted of the categories: *White; Mixed; Pakistani; Bangladeshi; Black Caribbean; Black African; Other.*

Background research suggested that children's enjoyment of physical activity may impact of their parent's involvement (page 86, Chapter 3). There was a measure in the third MCS sweep for how much the mother thought their child enjoyed or disliked physical activity. It was decided not to investigate this as a variable since it did not give the children's own opinion. An initial analysis revealed that over 95% of the mothers responded "very much" or "somewhat" so there was also little variation to investigate.

Domain B. Household Situation

Evidence suggested that inequalities may exist in parent-child involvement in active play according to the family's financial situation (page 83, in Chapter 3).

There were various income measures in the datasets, but these were found to have many missing values. There were also measures of means-tested benefits, but these were very basic binary measures which restricted analysis of patterns in the outcomes as wealth increased (socio-economic gradients). Living standards can be predicted by housing tenure and details about the home, but these measures do not necessarily represent the financial situation of the household.

A measure of self-report in the third sweep interviews on how the mother felt the family was managing financially was chosen as an alternative here. It enabled the mother to reflect on many factors including income, expenditure, and savings, and so was thought to be more encompassing than other measures. There were far fewer missing values is comparison with the specific finance measures. This was probably partly due to mothers being less apprehensive about revealing this information and partly because the question did not require precise knowledge which some may not have had. The

responses were combined to give three main categories for the variable **Managing Financially:** *Comfortable* (“Living comfortably”), *Stable* (“Doing alright”) and *Difficulties* (“Just about getting by", “Finding it quite difficult" or “Finding it very difficult").

There was a little research to suggest that the number of parents in a household may impact on their facilitation of active play (page 81, in Chapter 3). In the third wave interviews, mothers were asked who else lived in the household, allowing the MCS researchers to create a measure for the number of parents/carers. This was used to form the binary variable **Number of Parents/Carers** with categories *one* or *two.* This variable was only used in the analyses for mother-child involvement since in the analyses on father-child involvement, only two-parent families were included.

There was, in comparison to other factors, a large body of research to suggest that the number of siblings children live with may impact on parental involvement with them in physical activities (page 81, in Chapter 3). The number of children in the household (not necessarily natural siblings of the cohort child) was given by the mother in the third sweep interview: these ranged between one and thirteen children. This was used to form the categorical variable, **Number of Children,** with three categories: *one child; two children; three children or more.*

The was some evidence to suggest that having access to a motor vehicle may impact on parent-child involvement in active play (page 84 in Chapter 3). Vehicle ownership or the number of vehicles are often used as an measure of socio-economic circumstances in research, but the hypothesis here was related to vehicles being an enabler or disabler for physically active play opportunities. No data were collected on vehicle ownership in the third MCS sweep, and so the second sweep was referred to. The mother was asked whether she or her partner had regular use of motor vehicle as a passenger or driver, and this was used to form a binary variable **Access to Motor Vehicle(s)** with the categories *yes* or *no*.

Domain C. Area and Season

Research suggested that parent-child involvement in active play varied according the area a family lived in, particularly relating to concerns about safety, features of areas and area-based socio-economic factors (pages 78 and 83, Chapter 3).

Official area-based socio-economic measures are used in each of the four countries in the UK: the Indices of Multiple Deprivation (IMD) in England, the Scottish Index of Multiple Deprivation (SIMD), the Welsh Index of Multiple Deprivation (WIMD) and the Northern Ireland Multiple Deprivation Measure (Shaw et al., 2007). For each of these measures, areas[2] made up of groups of postcodes are scored using a set indicators. In England these indicators relate to income, employment, services, living environments, health, education and crime. The scores can then be ranked nationally from one to ten: those ranked one are considered the most affluent 10% of areas, and those ranked ten the most deprived 10% of areas. The MCS researchers used the postcodes of each of the families homes in the third sweep to assign them a deprivation decile based on the most recent data available for the corresponding country's deprivation index. This enabled the variable **Area Deprivation Level** to be included in the analyses, consisting of the *ten deciles*. This variable was treated as numerical since the levels were ordered one to ten.

Evidence was identified on how features of an area and how suitable it is considered for children can impact on aspects of parent-child involvement (page 83, Chapter 3). Several measures in the third sweep looked at the mother's opinion of the area the family lived in. There was a specific measure which asked the mother how good she regarded the area for children, which was the one used for the categorical variable **Mother's Opinion of Area for Children.** Responses ranged from excellent to very poor, and were combined into three categories: *excellent; good; average-poor.*

[2]In England, these are Lower Superoutput Areas, of which there are 32,482 in the country.

Seasonal variations in parent-child involvement in physical activity were noted in several studies (page 89, in Chapter 3). The month of the main interview was recorded in the third sweep, and from this a **Season of Interview** variable consisting of four categories: *winter* (December to February); *spring* (March to May), *summer* (June to August), *autumn* (September to November).

Domains D and F. Mother's/Father's Background

As discussed in the previous sub-sections, there was evidence to suggest that socio-economic circumstances are likely to have some impact on parent-child involvement in physical activity, but few of these studies investigated factors relating to the parent's past. Research on inequalities indicates that factors relating to a person's socio-economic circumstances during childhood usually has a long-lasting influence on their current circumstances and behaviours (Shaw et al., 2007). In order to investigate the mothers' and fathers' backgrounds, measures relating to social position prior to parenthood were sought.

In the second sweep interviews, the mothers and fathers were asked about their own father's job when they were fourteen years old. These were coded by the MCS researchers according to the Standard Occupational Classification 2000 (SOC2000). For this thesis, tables published by the Office of National Statistics (ONS) were used to convert the code each parent had been given to one from the more contemporary National Statistics Socio-economic Classification (NS-SEC) system. This enabled each parent to be assigned to one of the following five categories based on his/her father's occupation: *Managerial and Professional*; *Intermediate; Routine and Manual; Father Not Working; Unclassified* (Unknown/Father Had Died). These were used to form the categorical variables **Mother's Socio-economic Status at Age 14** and **Father's Socio-Economic Status at Age 14.**

Parental education is also an important socio-economic indicator since it is so strongly linked to other factors relating to a family's circumstances (Graham,

2007). It is a predictor of many subsequent socio-economic measures such as employment, income and age of having children. Measures of education have been identified as predictors of adult health behaviours, including exercise (Droomers et al., 2001, Grzywacz and Marks, 2001). In Chapter 3, a study suggested that children of parents with a higher level of formal education may have greater involvement in organised sport and structured exercise (Ommundsen et al., 2006), which may leave less time for direct involvement with their parents.

Two different measures of mother's and father's education were considered: NVQ level; and age of leaving full-time education. Questions on both of these were asked in the first sweep interviews, and also in subsequent sweeps if the information was to be updated. For the NVQ level measures, mothers and fathers reported their highest level of academic or vocational qualification. Most responses were categorised as NVQ levels from 1 to 5, but parents who reported that their highest qualification was achieved abroad and those who had qualifications which were not listed were put in an 'other' category. It was therefore unclear what level of education the parents in this group had achieved.

Age of leaving full-time education was a more straightforward question for respondents to answer, and the proportion who responded was higher. This measure did not take into account part-time education, but since this variable was to indicate an aspect of the respondent's background this was not thought to be a great limitation. It was a more comparable measure across cultures than NVQ level. Overall, the strengths of using the mother's and father's age at leaving education seemed to outweigh the strengths of NVQ level. The ages were given as integers (whole numbers, i.e. 1, 2, 3...) and used to form the numerical variables **Mother's Age at Leaving Full-time Education** and **Father's Age at Leaving Full-time Education**.

Although little background evidence was identified in the literature review on cultural impacts on parent-child involvement in physically active play (page 88, Chapter 3), evidence was identified to suggest that parents from different

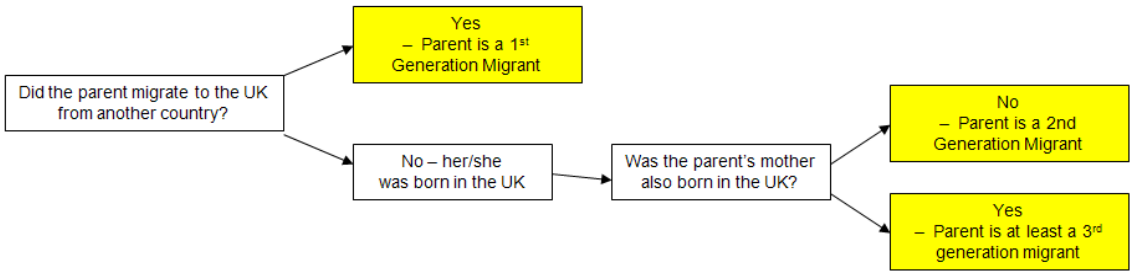
cultures do tend to differ in their parenting practices (Hofferth, 2003, Barn et al., 2006, Phoenix and Husain, 2007). Ethnicity of the child was included in Domain A: as expected this variable was found to be highly related to both mother's and father's ethnicity (see Table 4-1 below for distributions for mothers). Thus, it would have not been appropriate to also include these variables in the analyses (Vittinghoff, 2005, Bland, 2009).

4-1. Cross tabulation for mother's ethnicity and child's ethnicity in the mother respondent sample

		Ethnicity of Mother								
		White	Mixed	Indian	Pakastani	Bangladeshi	Black Carribe:	Black African	Other	Unknown
	Total n=12,619	*11,004*	*104*	*300*	*479*	*181*	*136*	*198*	*194*	*23*
Ethnicity of Child	White	10,784	21	1	1	3	4	2	26	0
	Mixed	184	65	13	10	1	20	4	32	0
	Indian	3	3	282	1	0	0	0	4	0
	Pakastani	4	3	2	465	1	0	0	4	0
	Bangladeshi	5	0	0	0	176	0	0	0	0
	Black Caribbean	11	5	1	0	0	108	3	0	0
	Black African	2	4	0	1	0	1	186	4	0
	Other	11	3	1	1	0	3	3	124	0
	Unknown	0	0	0	0	0	0	0	0	23

A related factor which may have an influence on active involvement is the migration history of the parents. Data from the second and third sweep interviews were combined to identify whether a parent was a first generation migrant (migrated to the UK), second generation migrant along the maternal line (they were born in UK, but their mother was not) or third generation or later (they and their mother were born in the UK). Figure 4-2 illustrates these categories. For a large proportion of the fathers, these data were unknown (n=783, 9.7% of father respondent sample). Ordinarily cases with missing values were excluded from the analyses, but due to the large proportion for this variable the missing values were coded as a separate category called *unclassified* to be included in the analyses. There are complex methods of dealing with missing data which involve prediction using the other data (O Rourke, 2003), but since for father respondent sample there were a greater proportion in this unclassified category than in the third generation category, this alterative strategy was used. The categorical variables **Mother's Family Migration History** and **Father's Family Migration History** therefore contained the categories: *First Generation Migrant; Second Generation Migrant; Third Generation Migrant or More;* and for fathers only, *Unclassified*.

4-2. Figure of categories for parent's family migration history.



The respondent's religion was also considered. Potential indicators of mother's and father's religious group were formed using data from across the three MCS sweeps, but since these both included very high proportions of unknown values for both the mothers (n=1281,10.2%) and fathers (n=804, 9.9%), it was decided not to investigate this factor in the analyses.

Domains E and G. Mother's / Father's Situation

A further measure relating to the socio-economic background of a family is the parent's age. No background research was identified in the literature review to suggest that parent's age may be important in regard to their involvement in physically active play with their children, but it was hypothesized that this factor is highly likely to impact on the experiences that are brought into parenthood. There may be cultural differences between parents of different ages, which could impact on their parenting practices and involvement in their children's play. The numerical variables **Mother's Age at Interview** and **Father's Age at Interview** for the third sweep consisted of integer values.

The amount of time that a parent spends playing active games with their child is likely to be influenced by the amount of time she/he has overall with the child. Being in employment was reported in several studies in the literature review as having an impact on parental involvement in their children's physically active play (page 85, Chapter 3). A recently published paper has been identified which looked at children's activities using data from a sample of 12,576 mothers and children from the third sweep of the MCS (Sherburne Hawkins et al., 2009). The authors reported that increased mother's employment hours were associated

with increased likelihood that the child were driven to school and had greater electronic media use. No association was found between mother's employment hours and child's sports club attendance. The authors did not investigate the participation and facilitation outcomes being used in this study.

Mothers and fathers were asked whether they were currently working and the approximate number of hours they usually worked. For the categorical variables **Mother's Employment Hours** and **Father's Employment Hours,** categories were formed: *not working; working fewer than thirty hours / unknown hours per week*; and *working thirty or more hours per week.* The number of hours were selected to approximately represent those working part-time and full-time.

Another factor for which little evidence was identified was the potential impact of parents' marital status on involvement in their child's active play. It was hypothesized that marital status could be an indicator of family stability, which could impact on parental time and involvement with children. Measures for mothers and fathers were taken from the third sweep: initial analysis revealed that it was not so highly correlated with the number of parents/carers to warrant exclusion on this basis. Thus **Mother's Marital Status** and **Father's Marital Status** were binary variables with the categories *married* and *not married.*

Research suggested that parental health behaviours and motivation to exercise may impact on their involvement with their children's physically active play (page 86, in Chapter 3). A question from the third sweep on the extent which the parent's physical or emotional health restricted their usual social activities with family and friends was used to form categorical variables **Mother's Health Restrictions** and **Father's Health Restrictions**. Responses were combined into three new categories: *No Restrictions* ("Not at all"); *Some Restrictions* ("Very little" or "Somewhat"); *High Restrictions* ("Quite a lot" or "Could not do").

Evidence presented in the literature review also indicated that parental activity levels are likely to impact on their active involvement with their children (page 86, in Chapter 3). No questions were identified, however, in the MCS surveys which could be used to form variables to represent this factor.

Domains H. Child's Other Activities

Background literature suggested that other activities that children do may impact on their opportunities for physically active play. Evidence on two broad types of activity were identified: electronic media use (page 90, Chapter 3); and organised activities and clubs (page 91, Chapter 3).

Two measures of the child's electronic media use were identified in the mother's interviews for the third sweep. The first asked the mother to identify the duration in hours of television viewing, and the second the duration in hours of computer use; both for a normal term-time weekday. Three categories for the variables were formed according to the distributions of the responses. For **Child's Television Viewing,** the new categories were *low-duration* (under 1 hour), *mid-duration* (at least 1 hour, under 3 hours), and *high-duration* (3 or more hours). For **Child's Computer Use,** the new categories were *no-duration* (not at all), *low-duration* (under 1 hour), and *high-duration* (1 hour or more).

Children's sports club attendance was investigated in the third sweep. Mother's were asked how many days of the week the child usually attended a sports club or class. For the categorical variable **Sports Club Attendance,** the new categories were *high-frequency* (three or more days per week), *mid-frequency* (one or two days per week) and *low-frequency* (less often).

Several studies were identified which included reference to children's enjoyment of playing with pets, particularly dogs (page 48, Chapter 2). Evidence also suggested that having a dog may be a facilitator for going on walks and to parks (Mulvihill et al., 2000, Veitch et al., 2006, Cutt et al., 2007, DCSF, 2008a). Questions about pets were included in the first and second sweep interviews with the mother so the responses from these were used in proxy to indicate whether the family may have had a dog in the third sweep. The binary variable was **Dog Ownership** with categories *dog* and *no dog*.

Which variables are included in which section of Chapter 5?

Chapter 5 consists of four main sections which present the analyses. Table 4-3 shows which variables were included in the analyses for each section.

4-3. Table indicating which variables are included in which section for analyses in Chapter 5.

	Section of Chapter 5 in which variables were used			
Domain	5.1. Findings on predictors of mother-child involvement in active play	5.2. Findings on predictors of father-child involvement in active play	5.3. Comparison of the predictors of mother-child and father-chiled involvement in active play	5.4. Relationships between children's other activities and parent-child involvement in active play
A. Child's Characteristics	√	√	√	√
B. Household Situation	√	√ (except no. of parents/carers)	√	√
C. Area and Season	√	√	√	√
D. Mother's Background	√		√	√
E. Mother's Situation	√		√	√
F. Father's Background		√	√	√
G. Father's Situation		√	√	√
H. Child's Other Activities				√

It was decided that the variables which were specific to mothers (domains D and E) would not be included in the analyses for fathers, and the variables which were specific to fathers (domains F and G) would not be included in the analyses for mothers. The main reason for this was that there was no background evidence to support this approach. It also was thought that the equivalent mother and father variables would be likely to confound each other, as discussed in the following section. Further to this, it would not have been possible in the main analyses of mother-child involvement since the dataset included families without a father respondent. The methods of analyses for each of the four sections is described in the following section.

4.3. Methods of analysis and reporting

Statistical analysis was performed using Stata (Version 10 for Windows) (Stata Corp, 2009). Microsoft Excel was used to produce tables and create the original diagrams which have been used to present data, with some editing carried out using Microsoft Paint to improve the designs (Microsoft Corp., 2009).

Background Characteristics of the Samples

Prior to the main analyses, background characteristics of the samples were examined. For each of the mother (Section 5.1) and father (Section 5.2) respondent samples, this involved using Stata to calculate numbers and proportions of families who were in the different categories for each of the variables.

A **background characteristics table** was designed for each of the samples. These can be found in Chapter 5 on page 149 for the mother respondent sample and page 165 for the father respondent sample. A copy of part of one of the tables is shown alongside (4-4). This presents the data for **independent variables** within the Mother's Situation and Health domain, for the mother respondent sample of 12,619 families.

4-4. Example of a section from a background characteristic table

DOMAINS Variables Categories	Children & Mothers n = 12,619 n	 Weighted %
E. MOTHER'S SITUATION		
E1. Mother's Age		
18-24	785	6.17
25-29	2083	15.60
30-34	3440	27.54
35-39	4011	32.02
40-66	2300	18.66
E2. Mother's Employment Hours		
No	5255	40.58
Yes,<30 hours per week / unknown hours	4957	41.46
Yes, 30+ hours per week	2406	17.96
Unknown	1	0.00
E3. Mother's Marital Status		
Married	8454	66.74
Not married	4164	33.25
Unknown	1	0.01
E4. Mother has Health Restrictions		
No restrictions	8169	64.59
Some restrictions	3573	28.49
High restrictions	866	6.83
Unknown	11	0.08

For all numerical variables, categories were formed for the presentation of these data: in this example the numerical variable mother's age at interview is presented in age bands. The number of unknown values for each variable is also presented. The number of families for each category is given in the frequency column. Rather than showing the percentages of families in the sample in each category, a function in the software was used that took account

of how the sampling strategy recruited more families from disadvantaged areas to calculate 'weighted percentages'. This represents the likely distribution across the categories for the general population of the UK. The purpose of the background characteristics tables is to provide background information on overall patterns, in addition to indicating the number of unknown values.

Response Re-categorisation Summaries

As previously discussed, the following two types of mother-child involvement were selected as **outcomes** based on questions in the main interview of the third MCS sweep:

Participation:	*How often mother and child play sports or physically active games together.*
Facilitation:	*How often mother and child go to park or outdoor playground together.*

Equivalent questions were investigated for father-child involvement based on data from the partner interviews in the third sweep:

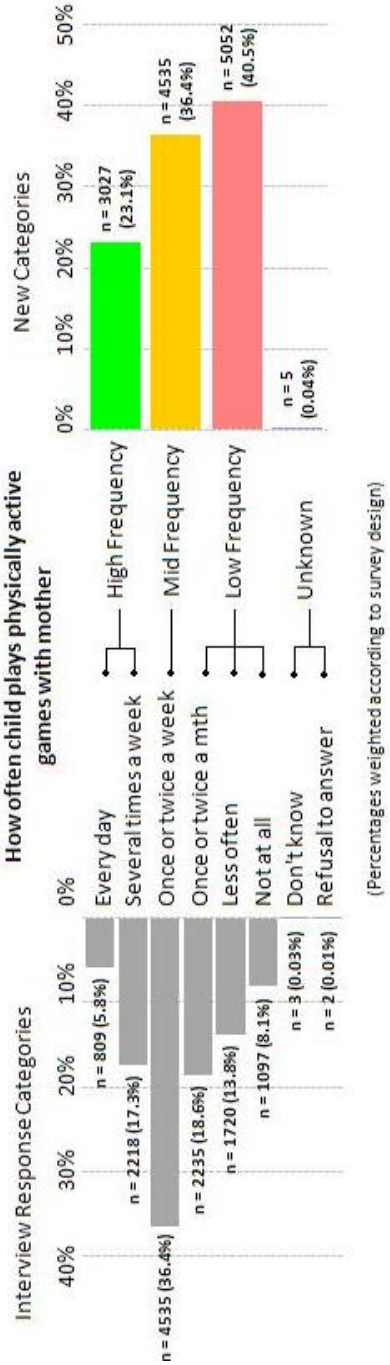
Participation:	*How often father and child play sports or physically active games together.*
Facilitation:	*How often father and child go to park or outdoor playground together.*

For each of the questions, respondents had a choice of six frequency categories ranging from 'every day' to 'not at all', plus a 'don't know' and 'refusal to answer' categories. Using Stata, for each question the response categories were combined to form three new categories. "Once or twice a week", which was the most common (modal) response for all four questions, was retained as a category and referred to as **mid-frequency participation/facilitation**; "Every day' and 'several times a week' were combined to form a **high-frequency participation/facilitation** category; "once or twice a month", "less often" and

"not at all" were combined to form a **low-frequency participation/facilitation** category. The responses "don't know", "refusal to answer" and "not applicable" were referred to as unknown.

In order to present data on these re-categorisations, **response re-categorisation charts** were designed using Microsoft Excel, with some editing using Microsoft Paint. These can be found in Chapter 5 on pages 150-151 for mothers and pages 166-167 for fathers. A copy of one of the diagrams is shown in 4-5 to illustrate the design. This particular example illustrates the data on how often the mother plays physically active games with their child.

4-5. Example of an response re-categorisation chart



The original categories for the responses to the question are shown on the vertical axis in the grey (left-hand) bar-chart. The values on the horizontal axis are the weighted percentages (as referred to in the previous section). The number of families in each group is also shown as the value n alongside each bar. The coloured (right-hand) bar-chart shows the data using the new categorisation, with colour-coding to show high-frequency participation in green, mid-frequency participation in orange, and low-frequency participation in pink. In-between the two graphs, the format for re-categorizing the responses is shown.

The purpose of the response re-categorisation charts is to show the distributions across the new categories of participation/facilitation, and how these relate to the original responses.

Analyses of Weighted Proportions

Some basic analyses were carried out to investigate the varying patterns in the support outcomes according to each of the variables. These are presented for the mother-child participation and facilitation in the main sample and can be found in the appendices (pages A/14 to A/16). For each variable, data were analysed using Stata to find weighted percentages and chi squared test p values across the high-frequency, mid-frequency and low-frequency categories for each of the outcomes. Chi squared tests are used to test whether distributions have statistical significance in their variation, and are a simple way of identifying whether a variable may be related to an outcome, and therefore whether it may be a variable. **Analyses of Weighted Proportions Charts** were designed using Microsoft Excel. An example is shown in Chart 4-6 below. This is for the variables in the household situation domain, with the outcome frequency of mother taking the child to parks or playground.

4-6. Example of an analyses of weighted proportions chart

Analysis of weighted proportions: frequency of mother-child facilitation through going to parks/playgrounds by household situation variables

	low	mid	high	low	mid	mid	high
ALL CHILDREN	39.6	43.2	17.3	47.8	52.2	71.4	28.6
HOUSEHOLD SITUATION							
(B1) MANAGING FINANCALLY	0.0041 (chi2 p values)			0.0444		0.0003	
Comfortable	39.3	44.9	15.9	46.7	53.3	73.9	26.1
Stable	38.8	44.5	16.7	46.6	53.4	72.6	27.4
Difficulties	40.5	40.7	18.8	49.9	50.1	68.4	31.6
(B2) NUMBER OF PARENTS	0.0000			0.1837		0.0000	
Two	40.3	43.4	16.3	48.2	51.8	72.7	27.3
One	36.0	42.3	21.8	46.0	54.0	66.0	34.0
(B3) NUMBER OF CHILDREN	0.0000			0.0000		0.5588	
1	34.4	47.5	18.1	42.1	58.0	72.4	27.6
2	38.6	44.0	17.4	46.7	53.3	71.7	28.3
3 or more	43.2	40.1	16.7	51.8	48.2	70.6	29.4
(B4) ACCESS TO MOTOR VEHICLE(S)	0.0000			0.9733		0.0000	
Yes	40.0	43.6	16.4	47.8	52.2	72.7	27.3
No	36.8	40.2	23.1	47.8	52.3	63.6	36.4

On the left of Chart 4-6 are the variable names and the categories. The diagram is made up of a series of bars. The left hand set of bars illustrate the weighted distributions for each variable across all three outcome categories. In this example for mother-child park or playground visits, low-frequency facilitation is shown in pink, mid-frequency facilitation in orange, and high-frequency facilitation in green. For families who reported that they were financially comfortable, 39.3% were in the low-frequency group, 44.9% in the mid frequency group, and 15.9% in the high-frequency group. The set of bars in the

centre show the distributions of the weighted percentages for low- and mid-frequency facilitation only, the bars on the right-hand side show the distributions for mid- and high-frequency facilitation. The differences in the patterns between the categories for each variable can be observed. Above each bar chart is its chi squared p-value: a value of less than 0.1 indicates that there is significant difference at the 90% level in the distributions between the categories, indicating with reasonable certainty that there is a relationship between the variable and participation or facilitation outcome. The purpose of these graphs is to provide a preliminary indication of which variables may predict the outcomes, in preparation for the main analysis.

These preliminary analyses were also carried out for the father-child participation and facilitation outcomes, but are not described in this thesis.

Main Analyses: Identification of Predictors using Multinomial Logistic Regression Analyses

After researching some different techniques in analysis, it was decided that an appropriate method for the main analyses of this study was multinomial logistic regression analysis. This method can be used to test whether variables have a statistically significant impact on particular outcomes, and can therefore be referred to as predictors of those outcomes (Foster et al., 2006). It involves a process of building statistical models, which can contain several binary, categorical and numerical variables, allowing the associations between each variable and the outcome to be tested, while taking into account or 'adjusting' for other variables (referred to as confounders). Putting variables together in a model reduces what is termed the 'standard errors' of the estimates (Bland, 2009). A particular advantage of using multinomial logistic regression it that it is well suited to use with large overall sample size, as was the case with this study.

Logistic regression involves prediction of one particular outcome compared to another. The strength of multinomial logistic regression is that it allows more than two or more outcomes to be compared to another. For each mode of

parent-child involvement there were three main levels to be investigated as outcomes: high-frequency. mid-frequency and low-frequency. It was thought that an advantage of this approach was that by comparing both extremes to the mid-frequency group, this would provide a comprehensive picture of potentially important factors related to parent-child participation and facilitation. It enabled investigation of which factors predict whether a child is more likely to be missing out on involvement in physically active play with their mothers or fathers (low-frequency participation or facilitation), and which factors predict whether a child is likely to have more involvement (high-frequency participation or facilitation) as compared to the modal groups. It was possible to see where the predictors of high and low frequency participation and facilitation differed.

Following consultation with Play England, it was decided that this would be an illuminating approach. Evidence presented in Chapter 3 suggests that higher levels of parental involvement with their children through providing access to outdoor environments and perhaps actively joining in may facilitate physically active play; lower levels of these modes of involvement may lead to the child not having enough opportunities for play and becoming disinterested in physical activity. For policy-making, it may also be useful for targeting initiatives to encourage and support families in 'moving up' to the next level of participation or facilitation, i.e. from low-frequency to mid-frequency, and from mid-frequency to high-frequency.

In Chapter 5, there were eight main models to investigate, shown in illustration 4-7.

4-7. Illustration of the eight models to be examined through multinomial logistic regression analyses

MOTHER-CHILD INVOLVEMENT		
Participation: Playing Actively Together		
low-frequency	compared to	mid-frequency
high-frequency	compared to	mid-frequency
Facilitation: Going to Parks/Playgrounds		
low-frequency	compared to	mid-frequency
high-frequency	compared to	mid-frequency

FATHER-CHILD INVOLVEMENT		
Participation: Playing Actively Together		
low-frequency	compared to	mid-frequency
high-frequency	compared to	mid-frequency
Facilitation: Going to Parks/Playgrounds		
low-frequency	compared to	mid-frequency
high-frequency	compared to	mid-frequency

Many of the variables to be tested as predictors were based on measures taken from the third sweep of the study which was the same sweep as the participation and facilitation outcomes. Therefore the analyses were regarded as **cross-sectional.** The longitudinal design of the study was also utilised since several of the variables used measures from the first two sweeps

Unadjusted Analyses

The first stage of multinomial logistic regression analysis for each of the eight models was to investigate the 'unadjusted' relationships between each of the variables of interest and a particular outcome. Unadjusted meant that nothing else was included the model: just one independent variable and the outcome variable. These analyses were carried out using Stata, which calculated a range of statistics: the odds ratios and Wald test p-values were entered into tables in Excel. An odds ratio is an estimate for the strength of association between a variable and outcome. The p-value indicates how certain we can be that there is a relationship between variable and outcome. For the categorical variables, several odds ratios and p values were calculated, each representing a different category. These analyses were carried out using a function which took into account the sample weights in the MCS study.

These statistics are presented within tables in the appendices: on pages A/22 to A/31 for mother-child involvement and pages A/35 to A/44 for father-child involvement. An example of a section of one of these tables is shown on the following page (Table 4-8). The table is the high-frequency and mid-frequency comparison for mother-child facilitation through going to parks or playgrounds, and this section shows the unadjusted logistic regression analyses for the variable *child's ethnicity.* The eight categories for this variable are shown on the left (unknown category is always omitted from the analysis): *White* is the reference category which means there are no statistics presented for it except the number of families (n); the other seven categories are each compared to this reference category.

4-8. Example of a section of a logistic regression results table showing unadjusted regression statistics

Mother-child facilitation through going to parks/playgrounds				
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic	
Variables	n = 5416	n = 2245	Unadjusted	
Categories	n	n	OR	P
A. CHILD'S CHARACTERISTICS				
A4. Child's Ethnicity				
White	4662	1921	1.00	
Mixed	155	63	1.00	0.992
Indian	121	36	0.67	0.041
Pakistani	210	92	1.19	0.282
Bangladeshi	73	33	1.05	0.822
BlackCaribbean	41	34	1.74	0.051
BlackAfrican	82	42	1.03	0.889
Other	72	24	0.88	0.575

- For five of the categories, the p-values are greater than 0.1, and so these comparisons are not significant at a 90% level.

- For the *Black Caribbean* and for the *Indian* categories, the p-values are lower than 0.1, so significant at a 90% level.

Where a p-value showed statistical significance at a 90% level in the unadjusted analysis, this variable was included in the next stage. This level of significance was used at this stage, rather than the more conventional 95% level, to allow for variables on the 'borderline' to at least be considered for the adjusted models.

Adjusted Analyses

Often in regression analyses, researchers choose a primary variable which they are interested in as the potential predictor of interest and investigate the relationship between this and an outcome while adjusting for other variables in the model (Vittinghoff, 2005). For this research, a different approach was taken since the findings from the literature review suggested that there were several different factors which could impact on parent-child involvement in physical activity, and the research aimed to provide a preliminary overview.

Significant variables in the unadjusted analysis for a particular model were all entered together into an 'adjusted' logistic regression model, and the new odds ratios and p-values were observed. These differed from the values in the unadjusted analyses due to the relationships with the other variables. A backwards regression technique was used which involved removing variables if they were not significant, in an order determined by the p-values. For this stage, a 95% level was used rather than a 90% level to determine the exclusion of factors to ensure a more stringent approach. The process eventually led to a model in which all the variables contained at least one category that was significant at a 95% level. The variables in this final adjusted model were regarded as significant predictors of the outcome. These analyses were carried out manually rather than using an automatic function in the Stata software, which was not possible when using the weighting function.

Tables were produced in Excel to show the number of families for each variable from each outcome group which was being examined, the statistics for unadjusted analyses (discussed above), alongside the statistics for the adjusted analyses. For the unadjusted analyses, these statistics were displayed for all variables of interest. For the adjusted analyses, only statistics for the predictors in the adjusted model were shown. As well as odds ratios and p-values, the 95% confidence intervals for the adjusted analyses were presented. These indicate the range of values which the true strength of association is likely to take, and the percentage indicates the level of significance.

Table 4-9 is the example of the results for three variables, in the table comparing mother-child high-frequency to mid-frequency facilitation through going to parks or playgrounds. All three of these variables (child's ethnicity, household access to motor vehicle(s), and mother's health restrictions) were significant in unadjusted analyses at the 90% level shown by at least one p-value which is less than 0.1, thus eligible for inclusion in the adjusted model. Mother's health restrictions was dropped from the adjusted model as it was no longer significant at a 95% level, indicating that the association seen in the unadjusted analyses was explained by other factors in the model.

4-9. Example of a section of a logistic regression results table, with categorical variables

Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 5416	n = 2245	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A4. Child's Ethnicity							
White	4662	1921	1.00		1.00		
Mixed	155	63	1.00	0.992	0.88	0.526	0.60 to 1.30
Indian	121	36	0.67	0.041	0.58	0.012	0.39 to 0.89
Pakistani	210	92	1.19	0.282	0.85	0.414	0.57 to 1.26
Bangladeshi	73	33	1.05	0.822	0.74	0.207	0.47 to 1.18
BlackCaribbean	41	34	1.74	0.051	1.27	0.439	0.69 to 2.32
BlackAfrican	82	42	1.03	0.889	0.81	0.349	0.53 to 1.25
Other	72	24	0.88	0.575	0.75	0.263	0.45 to 1.24
B. HOUSEHOLD SITUATION							
B4. Access to Motor Vehicle(s)							
Yes	4736	1817	1.00		1.00		
No	680	428	1.53	<0.0005	1.29	0.002	1.09 to 1.51
E. MOTHER'S SITUATION							
E4. Mother's Health Restrictions							
No restrictions	3588	1499	1.00				
Some restrictions	1513	585	0.93	0.221			
High restrictions	315	161	1.27	0.041			

Both child's ethnicity and household access to motor vehicle(s) were retained in the adjusted model, thus regarded as significant predictors of high-frequency facilitation through park or playground visits.

Interpretation of the results involved looking at the odds ratios and p-values in the adjusted model. The interpretations relating to Table 4-9 are given here as examples.

- For the *Access to Motor Vehicle(s)* variable, the adjusted analysis statistics for the *no* category show a p-value which are less than 0.05 and odds ratios which is more than 1. This tells us that children and mothers in households without access to motor vehicle(s) are statistically more likely than those with motor vehicle access reference to experience high-frequency park or playground visits together.

- For the *Child's Ethnicity* variable, the adjusted analysis statistics for the *Indian* category show a p-value which is less than 0.05 and an odds ratio which is less than 1. This tells us that Indian children are statistically less likely than white children to have high-frequency park or playground visits with their mothers.

- For the other categories in the *Child's Ethnicity* variable, each p-value is greater than 0.05 indicating that the other comparisons are not statistically significant.

The 95% confidence intervals represent the range of values which the odds ratio is likely to be within, with 95% certainty. If the confidence interval includes the value 1 (i.e. for the *Pakistani* group in Table above, 0.57-1.26) it is not statistically significant; if it does not include the value 1 (i.e. *Indian* group 0.39-0.89) it is statistically significant. These represent the same finding as the p-value but are useful because they provide an illustration of the range of values which the true effect size is likely to take.

The statistics are presented slightly differently for the numerical variables (these were *child's age, area deprivation level, mother's/father's age left full-time education and mother's/father's age*). Table 4-10 is another section of the table for the high-frequency and mid-frequency comparison for mother's facilitation through going with her child to a park or outdoor playground. This section shows the statistics for the variable *area deprivation level.*

4-10. Example of a section of a logistic regression results table, with a numerical variable

Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 5416	n = 2245	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
C. AREA AND SEASON							
C2. Area Deprivation Deciles							
Continuous:1 decile increase	5416	2245	0.96	<0.0005	0.96	0.001	0.93 to 0.98

The numerical variables were analysed as continuous variables to give odds ratios representing the change in effect size for each increase of one decile or one year in age. For the example in Table 4-10, the odds ratio per one decile increase in affluence of area is shown as 0.96, and can be converted simply to an odds ratio per five-year increase by calculating its value to the power of five: 0.96^5 = 0.82. It is only appropriate to do this conversion if the range of values is at least five, so not for child's age.

It should also be noted here that the value of the odds ratios provides an indication of how much more or less likely a group is to have a particular outcome. So for example, in Table 4-9 the odds ratio for not having a motor vehicle in the adjusted analysis is 1.29 meaning children and mothers living in households without access to motor vehicle(s) are 29% more likely than those with motor vehicle access to have high-frequency visits to parks or playgrounds together.

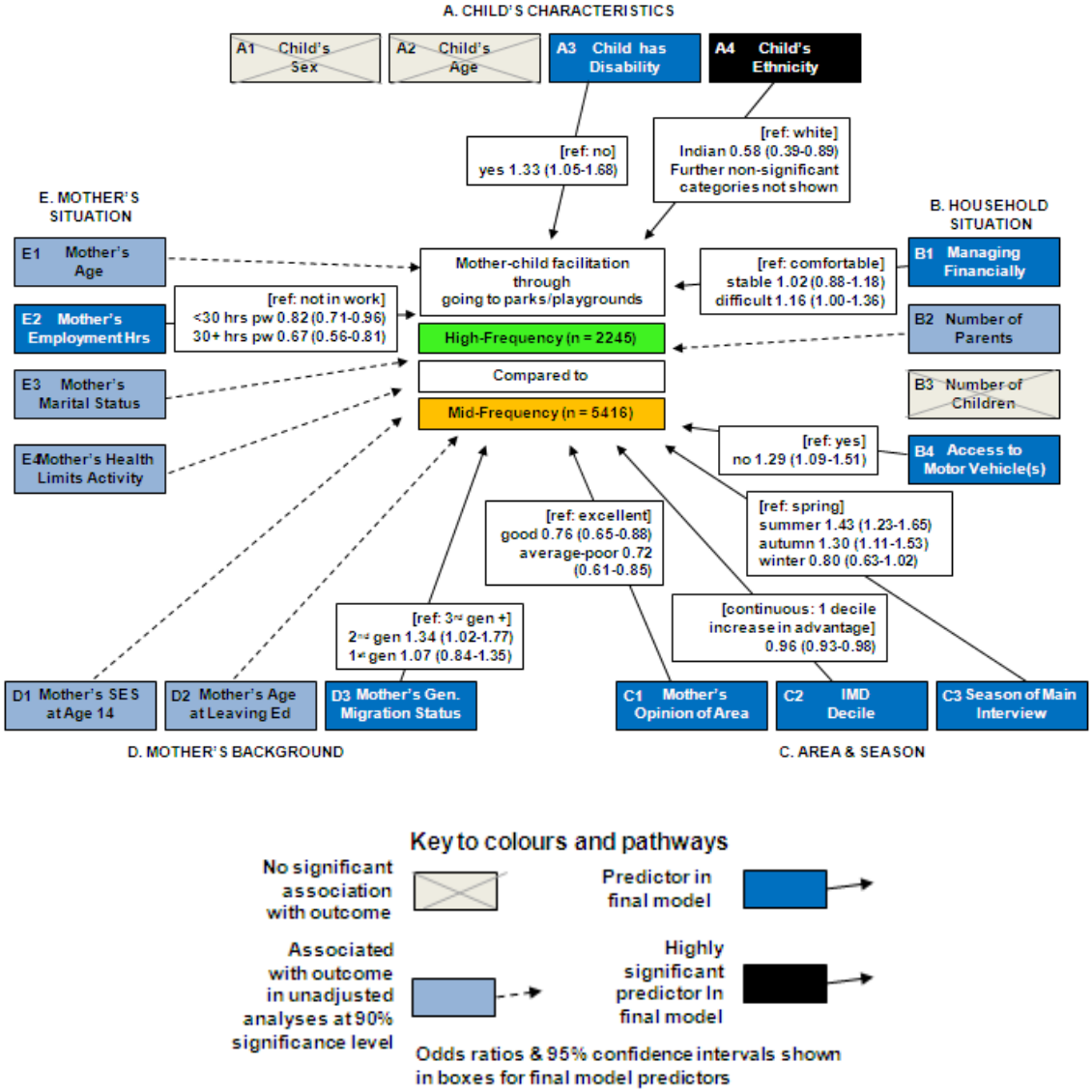
Where odds ratios are lower than 1, the inverse [3] of the odds ratio is taken to calculate how much less likely the group is to have the outcome. So referring back to Table 4-9 again, Indian children are 72% less likely than white children to be in the high-frequency group (calculation: 1/0.58 = 1.72).

As well as presenting the data in these results tables in the appendices, an illustrated **logistic regression model flow diagram** was created using Microsoft Powerpoint for each model, and these are presented within Chapter 5. These diagrams do not show a complex analysis of the flow between variables: this is deemed unnecessary to meet the aims of this thesis. They were designed to show details of the predictors in the final model and to show which variables which were significant at a 90% level in unadjusted analysis but not retained in the model. Figure 4-11 is an example of one of these flow diagrams, for mother's high- compared to mid-frequency facilitation through going with her child to parks or playgrounds.

The dark blue boxes are the predictors which remained in the adjusted model. The light blue boxes are the variables which were significant in the unadjusted analyses but not found to be predictors in the adjusted model, and the pale boxes with the cross through them are those which were not significant in unadjusted analyses.

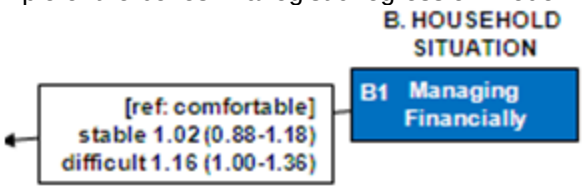
[3] 1 divided by the odds ratio.

4-11. Example of a logistic regression model flow diagram



The black boxes were an additional feature to highlight any predictors in the adjusted model for which the odds ratios were at least 1.5 (or less than the inverse 0.67) with at least 99% significance ($p<0.01$). These predictors were considered 'statistically strong', and the reasons for highlighting these is discussed in the following sub-section called *Assessing the level of statistical importance of variables*. For the variables which were significant only in unadjusted analyses, there are dashed lines leading to the outcome, to show that an association exists, but it is explained by other factors. For the predictors in the adjusted model, the lines leading to the outcome are solid, and on top of each of these lines is a box showing the odds ratios and confidence intervals. The p-values are not shown here. Figure 4-12 is a close-up of two of these boxes:

4-12. Example of the boxes in a logistic regression model flow diagram



The managing financially variable is a significant predictor of mother's high frequency facilitation in the final model, as it is a dark blue box. The categories *stable* and *difficult* are compared to the reference category *comfortable.* The 95% confidence interval for *stable* includes the value of 1, showing that this comparison is not statistically significant at a 95% level. The confidence interval for *difficult* does not include 1, and so this comparison is statistically significant: the value of the odds ratio is 1.18, meaning mothers reporting that the household has financial difficulties are 19% more likely than those reporting that that they are financially comfortable to facilitate active play through high-frequency park/playground visits.

Assessing the level of statistical importance of variables

Since there were a large number of predictors which emerged as significant across the various models, it was realised that in order to present an informative and interesting commentary on the results, it would be useful to find a way of presenting the relative importance of these predictors. Established statistical techniques were sought (Johnson and LeBreton, 2004) but no appropriate technique was found which could be learned and carried out on the data within the time constraints of this research project. A technique called dominance analysis was identified which has been adapted for logistic regression (Azen and Traxel, 2009), but would have required re-running the analyses, and also, this could not be used to take into account the importance across models. A simple approach was therefore devised to assess the statistical importance of the variables. For each of the adjusted models, the variables which had been investigated was tested by the following criteria.

Statistically Strong Predictor

The value of each predictor's odds ratios in the adjusted models were observed identify particularly large effect sizes. Many of the categorical predictors had odds ratios of around 1.3 to 1.4 (or their inverses 0.77 to 0.71), so an odds ratio of around 1.5 (inverse 0.67) was considered to be high. Except for child's age, this was adapted to 1.09 (inverse 0.92) per unit increase for assessing the continuous variables.[4] Following this, the levels of significance (p values and confidence intervals) of the large odds ratios were observed to check whether they were also strongly significant. The levels of significance for inclusion in the model was 95% ($p<0.05$), but stricter level of 99% ($p<0.01$) was applied here. The purpose of using this approach is that greater odds ratios indicate a larger effect, suggesting that the inequalities in parent-child involvement in physically active play will be greater. The stricter significant level reduces the likelihood that finding occurred only by chance. Predictors thought of as important based on these criteria were referred to as *Statistically Strong Predictors.*

Single or Multiple Models

A second approach was taken to identify whether predictors seemed particularly important, by looking at the number of adjusted models which they were in. Presence in at least two of the models was considered to indicate that the factor is likely to have a wider impact on inequalities, and it was unlikely likely that these findings both occurred by chance. Predictors which fulfilled these criteria, were referred to as being in *Multiple Models.*

These criteria were used to allocate each variable to one of the following five levels of importance:

- **Level 1.** Statistically strong predictor in at least one model **and** in multiple models
- **Level 2.** Statistically strong predictor in a single model **or** predictor in multiple models
- **Level 3.** Predictor in one model, but not a statistically strong

[4] Odds ratio of 1.09 per unit increase translates as 1.5 per 5-unit increase.

- **Level 4.** Variable significant in at least one unadjusted analyses, but in none of the adjusted models.
- **Level 5.** Variable not significant in any unadjusted analyses.

At the end of each analysis section, a summary table showing a summary of the results for all four models was presented. An example of a section of one of these tables for mother-child involvement is shown in Table 4-13 below.

4-13. Example of part of a summary table of the predictors of mother-child involvement in physically active play

Mother-Child Involvement in Active Play	Participation ('active games')		Facilitation ('park/playground visits')		Key to coloured rings. Variable has..... no significant association with outcome; unadjusted association (at 90% significance); adjusted association (at 95% sig.); statistically strong adjusted assoc. (OR ≥1.5 or ≤0.67, 99% sig.)	
	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Importance	Short description of adjusted model findings
B. Household Situation						
B1. Managing financially					Level 2	Children in families with financial difficulties more likely to have low-freq active games & high-freq park/playground visits.
B2. Number of parents/carers					Level 4	n/a
B3. Number of children					Level 1	Children with siblings more likely than only-children to have low-freq active games & low-freq park/playground visits.
B4. Access to vehicle(s)					Level 3	Children in families with no vehicle access more likely than those with vehicle to have high-freq park/playground visits.

Level 1: Statistically strong predictor & in multiple adjusted models
Level 2: Statistically strong predictor or in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

On the left are the variable names, sorted by domain. This example shows the four variables for the domain Household Situation. The next four columns represent each of the four models for mother-child involvement in active play, and the colour of the rings indicates the degree to which the variable was associated with the outcome.

A pale grey ring signifies that the variable had no association with the outcome at all.

A light blue rings signifies an unadjusted association at least a 90% significance level, but that the variable was not in the adjusted model.

A dark blue ring signifies that a variable was found to be a predictor in the adjusted model.

A black ring shows that a predictor was a statistically strong predictor in the adjusted model.

From these rings it is possible to identify which of the levels of statistical importance (described above) a variable was in, and the level is presented in sixth column. In the last column is a brief description of the findings from the adjusted models.

In Chapter 5, these tables were used to summarise the results for mother-child involvement (Section 5.1) and father-child involvement (Section 5.2), and were accompanied by descriptions of the findings arranged by level of statistical importance.

Comparison of findings on mother-child and father-child involvement (Section 5.3)

In order to make comparisons between the predictors of mother-child and father-child involvement in physically active play, further logistic regression analyses were carried out to produce four new models for mothers and children in the two-parent family sub-set in order to have a comparable group. The analysis tables are found in the appendices (from page A/47).

Summary tables were created to show the results for these analyses, alongside those for fathers in two parent families. Observations were then made on the differences between the predictors of mother-child and father-child involvement in the two-parent family sample.

Further analyses in this section involved investigation of the outcomes as predictors of other outcomes. These were:

- *Mother-child park/playground visits as a predictor of mother-child playing active games*

- *Father-child park/playground visits as a predictor of father-child playing active games*

- *Mother-child playing active games as a predictor of father-child playing active games*

- *Mother-child park/playground visits as a predictor of father-child park/playground visits*

This involved using the models built in Section 5.1 for mothers and their children, and Section 5.2 for fathers and their children, taking account of the other predictors in the models.

First unadjusted logistic regression was carried out, followed by adjusted analyses using the corresponding models in Section 5.1. or Section 5.2. The analyses were presented in the appendices, and a summary of the findings in Section 5.3.

Relationships between children's other activities and parent-child involvement in physically active play (Section 5.4)

Section 5.4 includes the additional analyses on children's other's activities in Domain H: television viewing, computer use, sports club attendance and dog ownership.

Firstly, response re-categorisation charts were created for three of the four variables (not dog ownership). Analyses of weighted proportions charts were then used to investigate the relationships between these activity variables and the variables in domains A to E for the mother's sample and domains F and G for the father respondent sample. These are presented in the appendices from page A/63. This was followed by analyses of the child's other activity variables as potential predictors of each of the mother-child and father-child participation and facilitation outcomes, using unadjusted multinomial logistic regression. As with the methods described previously, variables were eligible for the next stage if they were significant in unadjusted analyses at a 90% significance level. The adjusted analyses were carried out by entering those child's activity variables into the corresponding model in Section 5.1. or 5.2. Backwards regression was then carried out on only the activity variables. The tables for these analyses are presented on pages A/71 to A/78 in the appendices. Logistic regression flow diagrams and summary tables for mother-child and father-child involvement are presented in Section 5.4.

Reporting Style

In the process of reporting of the results, it became evident that choices would have to be made as to whether to use language that gave the child's perspective or the parent's perspective. For example

> Child's perspective: "Children with disabilities were more likely than children without disabilities to have high-frequency participation with their mothers through playing physically active games."

> Parent's perspective: "Mothers whose child had a disability were more likely than those whose child did not have a disability to have high-frequency participation through playing physically active games."

The initial preference of the author was to use the child's perspective throughout in order to give a child-orientated approach, focusing on their lives and opportunities. However, the MCS data are based on parental report rather than child report, and it was important to signal this so as to not mislead readers about the source of the information. Using the child's perspective, yet ensuring reference to parental report, led to very word-heavy and sometimes ambiguous sentences. For example:

> Child's perspective: "Children whose fathers reported that they had high health restrictions were more likely than those whose fathers had no health restrictions to have low-frequency facilitation through going to parks or playgrounds with their fathers."

This finding was clearer when presented from the father's perspective:

> Parent's perspective: "Fathers who reported that they had high health restrictions were more likely than those with no health restrictions to report low-frequency facilitation through going to parks or playgrounds with their child."

After experimenting with the different perspectives, it was decided that, in order to provide a concise as well as family-oriented viewpoint of the findings, it was

most appropriate to use:

- the child's perspective for the variables related to the child's characteristics and their activities.

- the mother's perspective for the variables related to the mother's background and situation.

- the father's perspective for the variables related to the father's background and situation.

- Selection of the perspective that sounded most appropriate for the variables related to the environments which they shared.

These are summarised in Table 4-14.

4-14. Summary table of reporting style perspectives

	Reporting Style - perspectives			
Domain	Child's perspective	Mother's perspective	Father's perspective	Most appropriate-sounding perspective
A. Child's Characteristics	√			
B. Household Situation				√
C. Area and Season				√
D. Mother's Background		√		
E. Mother's Situation		√		
F. Father's Background			√	
G. Father's Situation			√	
H. Child's Other Activities	√			

This concludes the explanation of the analyses which are presented in Chapter 5. Readers should refer back to this chapter for details of the methods if required.

Chapter 5.
Results: Parent-Child Involvement in Active Play

Chapter 5
Results: Parent-Child Involvement in Active Play

This Chapter presents the analyses using the UK's Millennium Cohort Study. Two modes of parent-child involvement , frequency of playing active games with her/his child (participation) and frequency of taking her/his child to parks or outdoor playgrounds visits (facilitation) are investigated as outcomes. The methods for these analyses were described in Chapter 4.. The chapter consists of five sections.

A description of the characteristics of the mother respondent sample is followed by patterns in their responses for the outcomes relating to participation and facilitation. Four models are presented, which used multinomial logistic regression, to investigate associations between eighteen variables and the outcomes. A summary table is presented, and the main findings are discussed.

This section follows a similar format as the previous section for father-child involvement in active play among those in two-parent families.

Additional analyses are carried out in order to compare predictors of mother-child and father-child involvement among two parent families. Relationships between participation and facilitation outcomes are also investigated.

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5.4. Relationships between children's other activities and parent-child involvement in active play p186

Four variables representing children's other activities are investigated as predictors.

5.5. Chapter Summary p201

The main findings from the chapter are summarised

5.1. Findings on predictors of mother-child involvement in active play

The methods for this section were explained in Chapter 4 (section 4.3).

Characteristics of the sample of mother respondents and their children

This section looks at a sample of children aged four to six years from the third wave of the MCS, and their mothers. These were the self-reported birth mothers who were living with the child, and who were the main respondents of the first three waves of the MCS survey. The sample excluded a minority of children (n=163) who had not started school (either part- or full-time) or for whom this information was not available to try to ensure some consistency in the amount of time the children potentially had to spend with their mothers. Overall there were 12,619 families eligible for inclusion in the analyses presented in this chapter.

As discussed in Chapter 4, variables from five domains were included in the analyses: there were eighteen variables altogether. Table 5-1 on page 149 shows the number of families and weighted percentages for each of these, and the patterns for these factors are described below.

Child's Characteristics

After adjusting for the sample weights, just over half (50.85%) of the children were boys. At the time of the mother's interview in the third wave, their ages ranged from 4 years and 4 months to 6 years and 1 month: just under half (48.72%) were aged from 5 years to 5 years and 3 months. Around one in twenty (5.41%) were reported by their mothers as having a disability which limited their activities. About nine in ten (88.35%) were reported as being of white ethnicity and the most populous minority ethnic groups were Mixed (2.95%) and Indian (1.68%).

Household Situation

A quarter (25%) of the children were living with mothers who considered the household to be in a comfortable financial situation. Greater proportions were categorized as stable (38.25%) or having difficulties (36.64%). 17.61% of the children lived in a one-parent family with their mother. About half had one other sibling in the household (49.2%) and about a third had two or more household siblings (35.17%). A high proportion were living (86.97%) in households where there was at least one car or other type of motor vehicle.

Area and Season

In terms of quality for children, around three quarters of the mothers thought the area in which they lived was excellent (32.84%) or good (40.98%), and about a quarter that it was average, poor or very poor (26.04%).The raw frequencies for the five categories of deprivation indicated that the highest number were recruited from the most disadvantaged areas: but with the sample weighting considered, the proportions were similar across the categories. The greatest proportion of interviews took place in the spring (56.5%), followed by summer (26.29%), autumn (11.44%) and winter (5.77%).

Mother's Background

For mother's socio-economic circumstances when she was a child (at age 14) based on the information she gave about her father's job, just over a third (34.82%) were in the routine and manual socio-economic group, about a quarter (26.32%) in the managerial or professional group and about a fifth (21.3%) in the intermediate group. 6.72% of the mothers reported that her father was not working and 10.85% were unclassified. Almost half (49.62%) of the mothers left full-time education when they were aged 16 or 17 years and 8.98% when they were aged under 16. Approximately two fifths left at 18 to 19 (21.56%) and another two fifths when they were older than this (19.81%). About one in ten (9.62%) were migrants to the UK (termed first generation migrants). A lower proportion (6.78%) were both born in the UK and the daughters of mothers who migrated to the UK (termed second generation migrants).

Mother's Situation

The mothers were aged between 18 and 66: about a third (32.02%) were aged 35 to 39 which was the highest frequency age band: 30 to 35 was the second largest group (27.54%). Over two fifths (40.58%) of the mothers reported that they were not working, and approximately the same proportion (41.46%) were working fewer than 30 hours per week or an unknown number of hours. 17.96% were working at least 30 hours per week. Around two thirds (66.74%) of the mothers were married. The majority of mothers (64.59%) reported that their physical or emotional health did not limit their usual social activities with friends and family at all. 28.49% reported some restrictions and 6.83% reported high restrictions.

5-1. Background characteristic table for the sample of mothers respondents and their children - frequencies and weighted percentages.

DOMAINS Variables Categories	Children & Mothers n = 12,619 n	 Weighted %
A. CHILD'S CHARACTERSTICS		
A1. Child's Sex		
Boy	6424	49.15
Girl	6195	50.85
A2. Child's Age		
4y4-4y11	2356	19.35
5y0-5y3	6077	48.72
5y4-6y1	4186	31.92
A3. Child has Disability		
No	11874	94.49
Yes	733	5.41
Unknown	12	0.10
A4. Child's Ethnicity		
White	10842	88.35
Mixed	329	2.95
Indian	293	1.68
Pakastani	479	2.63
Bangladeshi	181	0.83
BlackCaribbean	128	0.95
BlackAfrican	198	1.36
Other	146	1.05
Unknown	23	0.23
B. HOUSEHOLD SITUATION		
B1. Managing Financially		
Comfortable	3057	25.00
Stable	4908	38.25
Difficulties	4640	36.64
Unknown	14	0.11
B2. Number of Parents/Carers		
Two	10368	82.39
One	2251	17.61
B3. Number of Children		
1	1989	15.64
2	6000	49.20
3 or more	4630	35.17
B4. Access to Motor Vehicle(s)		
Yes	10849	86.97
No	1770	13.03
C. AREA AND SEASON		
C1. Mother's Opinion of Area for Children		
Excellent	3956	32.84
Good	5114	40.98
Average-Very Poor	3527	26.04
Unknown	22	0.15
C2. Area Deprivation		
Deciles 9-10: most advantaged	3135	19.17
Deciles 7-8	2672	18.54
Deciles 5-6	2263	19.77
Deciles 3-4	2094	19.71
Deciles 1-2: most disadvantaged	2455	22.81
C3. Season of Main Interview		
Spring	6367	56.50
Summer	3402	26.29
Autumn	2150	11.44
Winter	700	5.77

DOMAINS Variables Categories	Children & Mothers n = 12,619 n	 Weighted %
D. MOTHER'S BACKGROUND		
D1. Mother's SES at Age 14		
Managerial & professional	3062	26.32
Intermediate	2698	21.30
Routine & manual	4483	34.82
Father was not working	990	6.72
Unknown/father had died	1386	10.85
D2. Mother's Age Left Full-time Education		
20+	2486	19.81
18-19	2668	21.56
16-17	6346	49.62
<16	1114	8.98
Unknown	5	0.03
D3. Mother's Generation Migriation History		
Third Generation or more	10170	82.85
Second Generation	910	6.78
First Generation	1440	9.62
Unknown	99	0.75
E. MOTHER'S SITUATION		
E1. Mother's Age		
18-24	785	6.17
25-29	2083	15.60
30-34	3440	27.54
35-39	4011	32.02
40-66	2300	18.66
E2. Mother's Employment Hours		
Not working	5255	40.58
Working <30 hours per week / unknown hr	4957	41.46
Working 30+ hours per week	2406	17.96
Unknown	1	0.00
E3. Mother's Marital Status		
Married	8454	66.74
Not married	4164	33.25
Unknown	1	0.01
E4. Mother has Health Restrictions		
No restrictions	8169	64.59
Some restrictions	3573	28.49
High restrictions	866	6.83
Unknown	11	0.08

Response re-categorisation: mother-child participation through playing active games

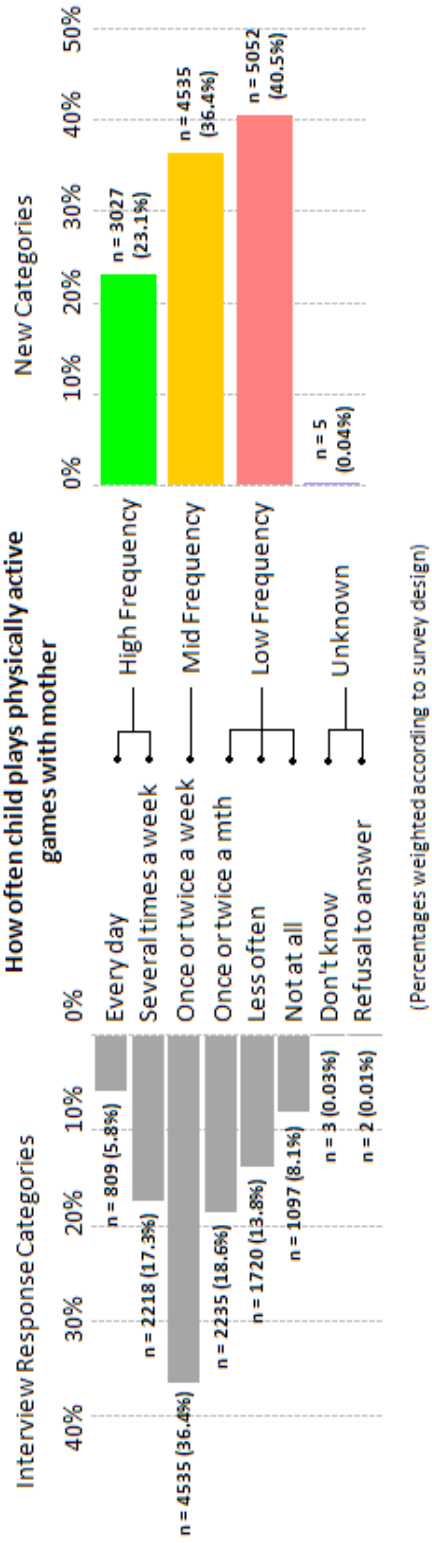
In the third sweep of the MCS the following question was included in the main interview:

"How often do you play sports or physically active games outdoors or indoors with [child]?"

The original responses were re-categorised as shown in Chart 5-2. Low-frequency referred to mothers who reported to playing physically active games with their children less than once a week. Mid-frequency corresponded to the modal response category, once or twice a week. High-frequency referred to mothers who reported playing actively with their children at least twice a week.

Among the mother respondent sample (n=12,619), 5052 were in the low-frequency participation category, 4535 in the mid-frequency participation category and 3027 in the high-frequency participation category. The Unknown category contained 5 children.

5-2. Response re-categorisation chart mother-child playing active games.



Response re-categorisation: mother-child facilitation through going to parks or playgrounds

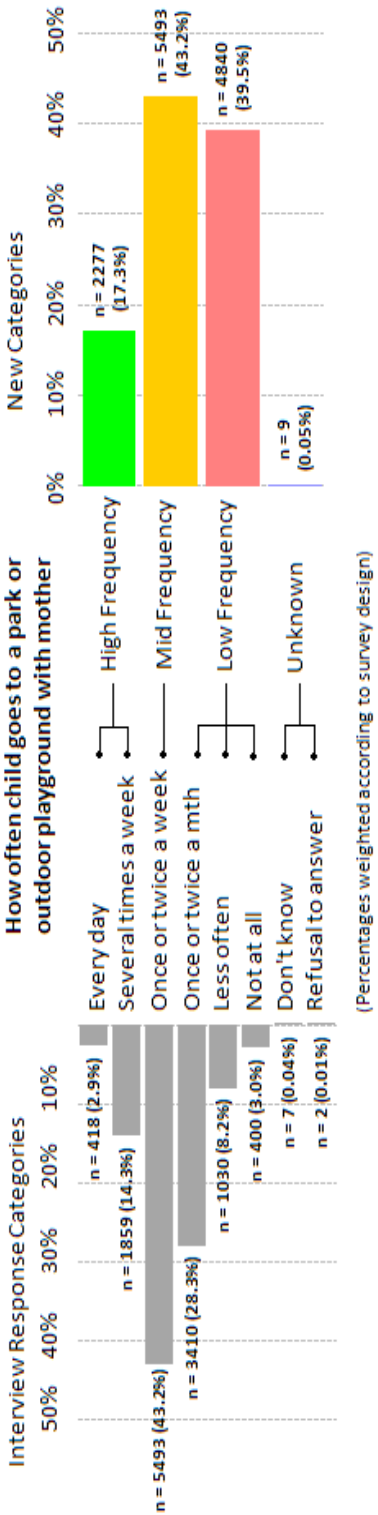
In the third sweep of the MCS the following question was included in the main interview:

"How often do you take [child] to the park or to an outdoor playground?"

The original responses were re-categorised as shown in Chart 5-3. Low-frequency referred to mothers who reported taking their children to parks or playground less than once a week. Mid-frequency corresponded to the modal response category, once or twice a week. High-frequency referred to mothers who reported taking their children to playgrounds at least twice a week.

Among the mother respondent sample (n=12,619), 4840 were in the low-frequency facilitation category, 5493 in the mid-frequency participation category and 2277 in the high-frequency participation category. The Unknown category contained 9 children.

5-3. Response re-categorisation chart for mother-child going to parks/playgrounds.



Preliminary analyses of weighted proportions for mother-child involvement

Preliminary analyses are presented on pages A/13 to A/20 of the appendices which look at patterns for each variable in relation to the modes of involvement outcomes. The percentages of children, weighted to be representative of the children in the UK population, are presented as bar-charts to show the distributions for the categories within each variable across the three frequency groups. P-values for chi-squared tests are used to identify significant variations in the distributions.

Findings from logistic regression analyses for mother-child involvement

The main results from four models for mother-child involvement in active play are presented in this sub-section.

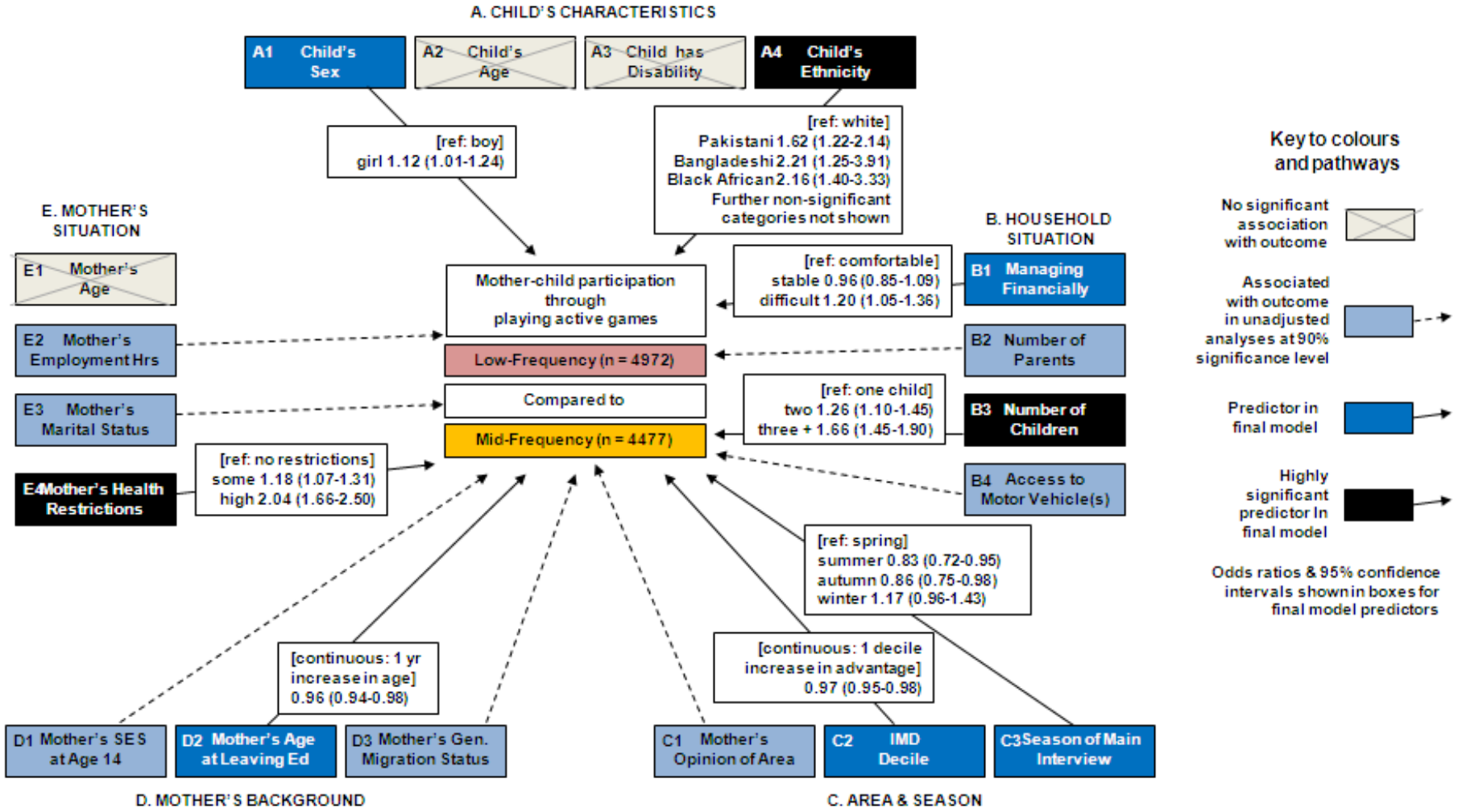
5-4. List of the four models of mother-child involvement in active play

MOTHER-CHILD INVOLVEMENT		
Participation: Playing Actively Together		
low-frequency	compared to	mid-frequency
high-frequency	compared to	mid-frequency
Facilitation: Going to Parks/Playgrounds		
low-frequency	compared to	mid-frequency
high-frequency	compared to	mid-frequency

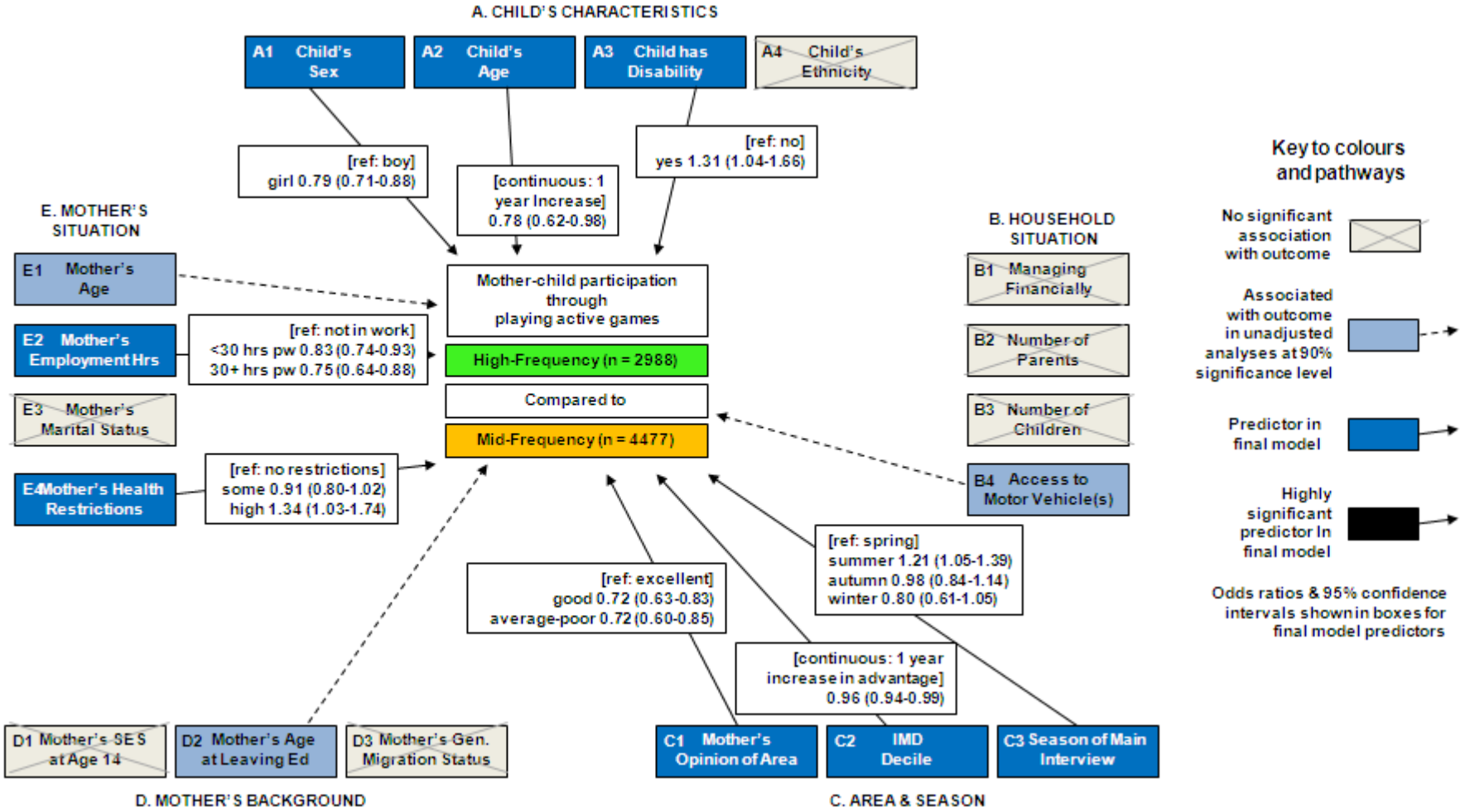
Families were not included in the analyses if data were not complete for all eighteen independent variables, as well as for both the active games and park/playground outcomes. The full sample of n=12,619 was reduced to n=12,437. The purpose of doing this was to ensure adjusted and unadjusted analyses were comparable.

From page A/21 in the appendices, tables displaying full results from unadjusted and adjusted logistic regression analyses for the four models can be found, together with written descriptions. Model flow diagram diagrams and a summary table of the models are on the following pages, followed by a summary of the main findings on mother-child involvement.

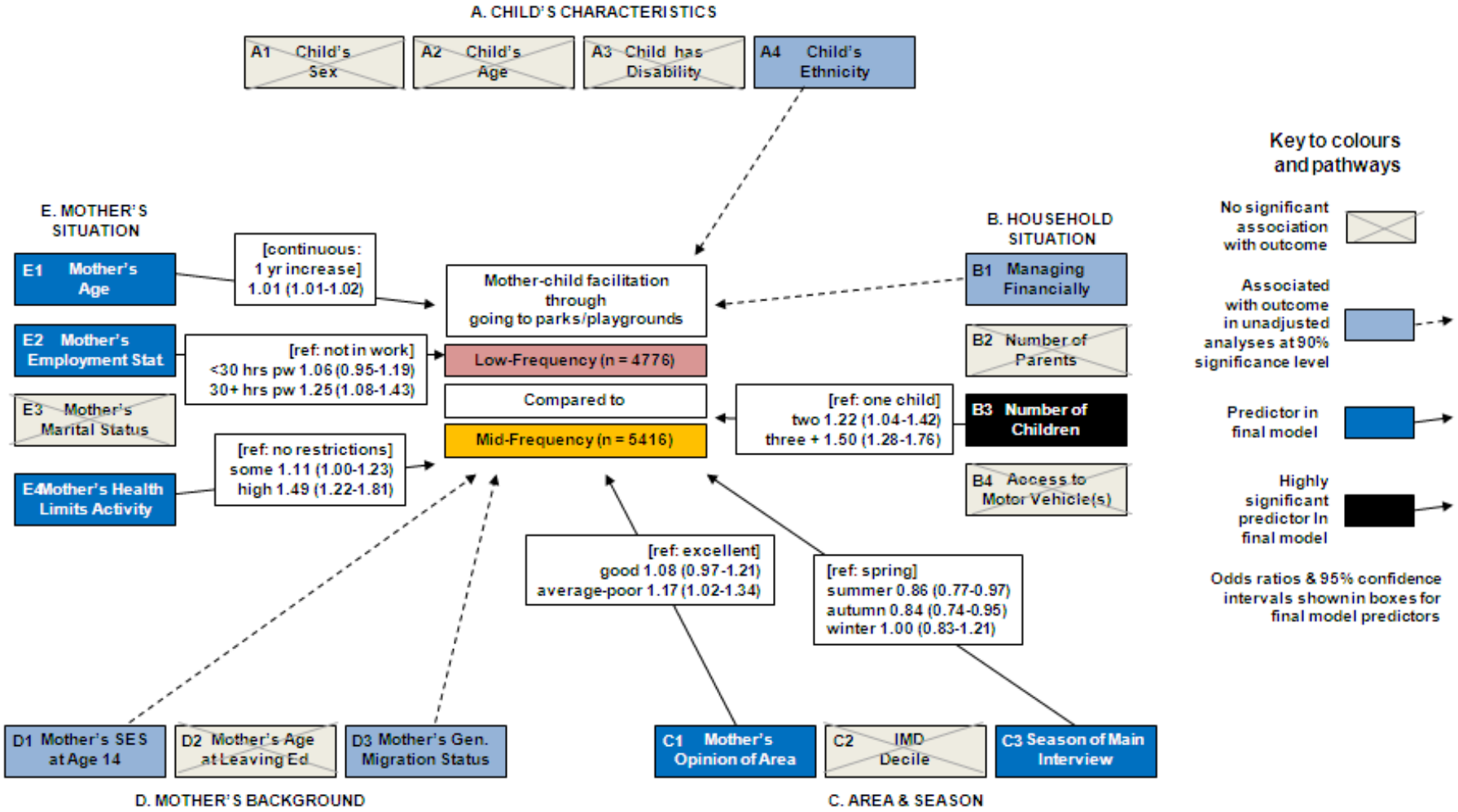
5-5. Logistic regression model flow diagram for mother-child low-frequency compared to mid-frequency participation through playing active games. Constructed from results from Table A 11 on page A/22.



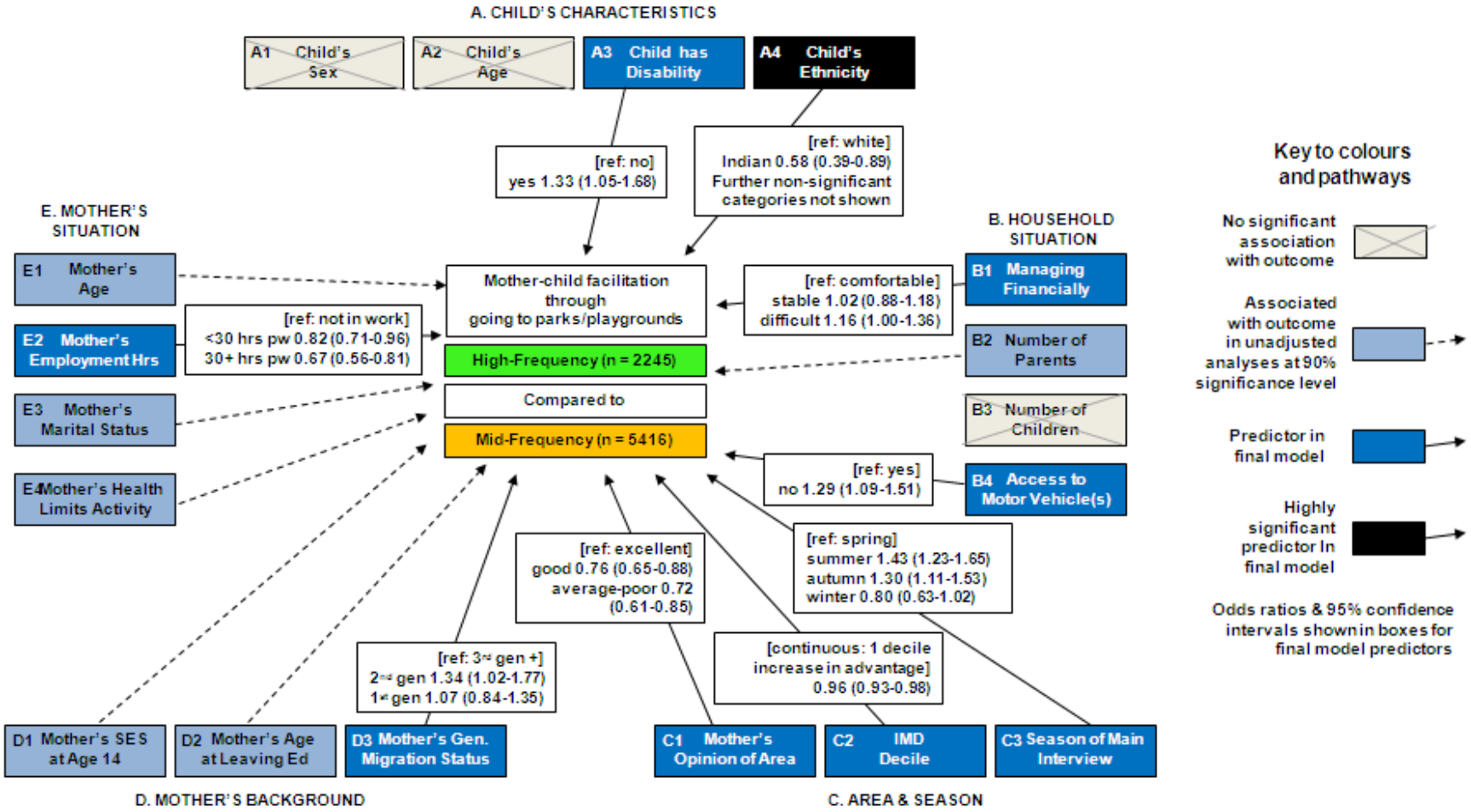
5-6. Logistic regression model flow diagram for mother-child high-frequency compared to mid-frequency participation through playing active games
Constructed from results from Table A 12 on page A/25.



5-7. Logistic regression model flow diagram for mother-child low-frequency compared to mid-frequency facilitation through going to parks/playgrounds Constructed from results from Table A 13 on page A/28.



5-8. Logistic regression model flow diagram for mother-child high-frequency compared to mid-frequency facilitation through going to parks/playgrounds Constructed from results from Table A 14 on page A/31.



5-9. Summary table of predictors of mother-child involvement in active play

Mother-Child Involvement in Active Play	Participation ('active games')		Facilitation ('park/playground visits')		Key to coloured rings. Variable has.....	
	Low-freq compared to	High-freq compared to	Low-freq compared to	High-freq compared to	no significant association with outcome; unadjusted association (at 90% significance); adjusted association (at 95% sig.); statistically strong adjusted assoc. (OR ≥1.5 or ≤0.67, 99% sig.)	
	Mid-frequency				Importance	Short description of adjusted model findings
A. Child's Characteristics						
A1. Child's sex	●	●	○	○	Level 2	Boys more likely than girls to have higher freq active games.
A2. Child's age	○	●	○	○	Level 3	Younger children more likely to have high-freq active games.
A3. Child has disability	○	●	○	●	Level 2	Children with disabilities more likely than those without disabilities to have high-freq active games & high-freq park/playground visits.
A4. Child's ethnicity	●	○	●	●	Level 1	Pakistani, Bangladeshi & Black African children more likely than White children to have low-freq active games. Indian children less likely than White children to have high-freq park/playground visits.
B. Household Situation						
B1. Managing financially	●	○	●	●	Level 2	Children in families with financial difficulties more likely to have low-freq active games & high-freq park/playground visits.
B2. Number of parents/carers	●	○	○	●	Level 4	n/a
B3. Number of children	●	○	●	○	Level 1	Children with siblings more likely than only-children to have low-freq active games & low-freq park/playground visits.
B4. Access to vehicle(s)	●	●	○	●	Level 3	Children in families with no vehicle access more likely than those with vehicle to have high-freq park/playground visits.
C. Area and Season						
C1. Mother's opinion of area	●	●	●	●	Level 2	Children whose mothers have better opinion of area more likely to have high-freq active games & high-freq park visits, & less likely to have low-freq park/playground visits.
C2. Area deprivation score	●	●	○	●	Level 2	Children in more deprived areas more likely to have low-freq active games, high-freq active games & high-freq park/playground visits.
C3. Season of main interview	●	●	●	●	Level 2	Interviews in warmer summer/autumn more likely to have higher freq active games and park/playground visits.

Level 1: Statistically strong predictor **&** in multiple adjusted models
Level 2: Statistically strong predictor **or** in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

Continued on following page

5-9. Summary table of predictors of mother-child involvement in active play **(continued)**

Mother-Child Involvement in Active Play	Participation ('active games')		Facilitation ('park/playground visits')		Key to coloured rings. Variable has.....	
	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Importance	Short description of adjusted model findings
D. Mother's Background						
D1. SES at 14	○	○	○	○	Level 4	n/a
D2. Age left full-time education	●	○	○	○	Level 3	Mothers who left education earlier more likely to have low-freq active games.
D3. Family Migration History	○	○	○	●	Level 3	Mothers who are second generation migrants more likely than third generation to have high-freq park/playground visits.
E. Mother's Situation						
E1, Age	○	○	●	○	Level 4	Older mothers more likely to have low-freq park/playgorund visits.
E2. Employment status	○	●	●	●	Level 2	Non-working mothers more likely to have high-freq active games than those working. Non-working mothers more likely to have high-freq park/playground visits and less likely to have low-freq park/playground visits than those working 30+ hours.
E3. Marital status	○	○	○	○	Level 4	n/a
E4. Health Restrictions	●	●	●	○	Level 1	Mothers with some high health restrictions more likely than those without restrictions to have low-freq active active games & low-freq park/playground visits. Mothers with high restrictions more likely to have high-freq active games.

Key to coloured rings. Variable has.....
○ no significant association with outcome ○ unadjusted association (at 90% significance)
● adjusted association (at 95% sig.) ● statistically strong adjusted assoc. (OR ≥1.5 or ≤0.67, 99% sig.)

Level 1: Statistically strong predictor **&** in multiple adjusted models
Level 2: Statistically strong predictor **or** in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

The findings on the potential predictors of mother-child involvement in physically active play have been sorted into five levels of statistical importance. The criteria for these levels were set out in Chapter 4 (pages 136 to 139).

Level 1: Predictors which were both statistically strong in a final model and in multiple final models (mother-child)

Three of the predictors fulfilled the criteria for being level 1 statistical importance. These predictors were strong according to the size of the odds ratios and p-values, as well as being in multiple models.

- Child's ethnicity
- Number of children in the household
- Mother's health restrictions

Compared to children of white ethnicity, those from some minority ethnic groups were more likely to be in the low-frequency groups for active games with their mothers: groups which were significant in this analysis were Pakistani (62% more likely) Bangladeshi (121%, over twice as likely), and Black African (116%, over twice as likely). For park and playground visits, Indian children were 72% less likely to be in the high-frequency group than white children.

Children with more siblings in the household, particularly those with at least two siblings, were more likely to be having low-frequency involvement in active play with their mothers. For active games, children with one sibling were 26% more likely and those with two or more siblings were 66% more likely than those without siblings to be in the low-frequency group. For parks or playground visits, children with one sibling were 22% more likely and those with two or more siblings were 50% more likely than those without siblings to be in the low-frequency group.

Mothers who reported having restrictions in their usual social activities because of their health had increased likelihood of low-frequency involvement with their children through playing active games and park/playground visits together:

those with high restrictions were over twice (104%) as likely than those without restrictions to have low-frequency participation through playing active games and 49% more likely to have low-frequency facilitation through park or playground visits. There was also a seemingly contradictory finding: those with high health restrictions were 34% more likely to have high-frequency participation through active games.

Level 2: Predictors which were either statistically strong in one final model or in multiple final models (mother-child)

Seven predictors were identified as being of level 2 statistical importance. These were all in at least one of the models.

- Child's sex
- Child's disability status
- Managing financially
- Mother's opinion of the area
- Area deprivation level
- Season of main interview
- Mother's employment status

Boys were 27% more likely than girls to experience high-frequency and 12% less likely to experience low-frequency active games with their mothers. There were no significant differences by child's gender when it came to going to parks or outdoor playgrounds however.

Children with disabilities were 31% more likely than other children to experience high-frequency active games with their mothers, and 33% more likely to have high-frequency park or playground visits.

Children and mothers from families experiencing financial difficulties were 16% more likely to have high-frequency visits to parks/playgrounds together, but were 20% more likely to have low-frequency active games together.

Children whose mothers thought the local area was excellent for children compared to those who considered it good or average-poor were more likely (good 39%, average-poor 39%) to have high-frequency participation through

active games and more likely (32%, 39%) to have high-frequency facilitation through visits to parks or playgrounds. Those whose mothers thought it was average-poor were 17% more likely to have low-frequency facilitation through going to parks or playgrounds together.

Children living in poorer areas based on the area deprivation level were more likely to have high-frequency active play, (4% increase in likelihood per one decile increase in deprivation) and high-frequency park/playground visits (4% increase) but also more likely to have low-frequency active play with their mothers (3% increase).

Compared to mothers who were interviewed in spring, those interviewed in summer were more likely to report higher frequency outcomes in all four models, with odds ratios ranging from 20% to 43%. Those interviewed in autumn were more also more likely to report greater frequency of park/playground visits and less likely to report low-frequency active games.

Mother's employment status was a significant factor in three out of four of the final models. Compared to mothers who were not working, those who were working thirty or more hours a week were 20% less likely to be in the high frequency group for active play, 25% more likely to be in the low-frequency group for park/playground visits and 49% less likely to be in the high frequency group for park/playground visits. Those whose mothers were working fewer than 30 hours a week also had decreased likelihoods of being in the high-frequency groups for active games (by 20%) and for park/playground visits (21%).

Level 3: Predictors which were in one of the single final models, but were not statistically strong (mother-child)

Four predictors were identified as being of level 3 statistical importance. These were all in just one of the final models.

- .Child's age
- Access to a motor vehicle
- Mother's age left full-time education
- Mother's family migration history

Younger children were more likely to be in the high-frequency group for active games with mother, with a 28% increase in likelihood with one year decrease in age.

Having no access to motor vehicle(s) was associated with a 29% increase in likelihood of being in the high-frequency group for park/playground visits.

Children whose mothers left full-time education earlier were more likely to be in the low-frequency group for active games: for each year's reduction, there was a 4% increase in likelihood.

Mothers whose mothers had migrated to the UK were 34% more likely than those who were at least third generation migrants to have high-frequency facilitation through park/playground visits.

Level 4: Variables which were significantly associated with an outcome in unadjusted analyses, but in none of the final models (mother-child)

There were four factors which were not in any of the final models.

- Number of parents/carers
- Mother's socio-economic circumstances at age 14
- Mother's age
- Mother's marital status.

All of these were found to be significantly associated with the outcomes in some of the unadjusted analyses, but the relationships were explained by predictors in the final models.

Level 5: Variables which were not associated with any of the outcomes in adjusted analyses (mother-child)

No variables were considered to be of level 5 statistical importance.

5.2. Findings on predictors of father-child involvement in active play

The methods for this section were explained in Chapter 4 (Section 4.3)

Characteristics of the sample of father respondents and their children

This section looks at a sample of children from the third wave of the Millennium Cohort Study. This was a subset of those included in the sample in Section 5.1. Those included were living with their birth mothers and birth fathers, who were the main respondents and partner respondents respectively of the first three waves of the survey. Overall there were 8103 children and their father respondents.

Child's Characteristics

After adjusting for the sample weights, just over half (weighted: 50.56%) were boys and just under half (49.16%) were aged 5 to 5 years three months. Around one in twenty (4.8%) were reported by their mothers as having a disability which limited their activities. About nine in ten (90.67%) were reported as being of white ethnicity and the most populous minority ethnic groups were Pakistani (2.25%) and Mixed (weighted: 2.95%).

Household Situation

All of the children lived in two-parent families in this sample. According to the mother's opinion, the greatest proportion of the children were living in households considered to be financially stable (38.25%). Lower proportions were categorized as comfortable (30.3%) or having difficulties (29.85%). About nine in ten of the children had siblings in the household, with over a third having two or more (34.77%). Just one in twenty (4.85%) of the households did not have access to at least one motor vehicle.

Area and Season

The majority of the children lived in areas which their mothers considered excellent (36.78%) or good (44.50%) for children, and the rest in areas considered average, poor or very poor (19.63%). Low weighted proportions lived in the most disadvantaged areas, levels 1 to 2 (12.53%) and levels 3 to 4 (16.65%). The greatest proportion of interviews took place in the spring (58.02%).

Father's Background

For the measure of the father's socio-economic circumstances when he was aged 14, based on the information he gave about his father's job just over a third (34.73%) were in the routine and manual socio-economic group, about a quarter (23.05%) in the managerial or professional socio-economic group and about a fifth (19.99%) in the intermediate socio-economic. 3.91% of reported that his father was not working and a large proportion 18.32% were unclassified. Just over half (51.36%) of the fathers left full-time education when they were aged 16 or 17 years and nearly a quarter (23.65) stayed on until age 20 or older. 9.65% discontinued full-time education when they were younger than age 16. 7.79% of the fathers reported that they were first generation migrants to the UK and 5.61% were both born in the UK and the sons of mothers who migrated to the UK (second generation migrants along the maternal line). For almost one in ten (9.94%), this information was unknown.

Father's Situation

The fathers in this sample were aged between 18 and 77 at the time of the third wave interview. The highest frequency age-band was 35-39 years (36.11%), followed by 40-44 years (25.91%). The youngest age group, 18-24 years, contained just 24 fathers (0.36%). Almost nine in ten (89.84%) reported that they were working 30 or more hours a week. Low proportions were working fewer than this number of hours/working but unknown hours (3.98%) or not working at all (6.16%). 83.4% were married, although it was not specified whether they were married to the main mother respondent in the survey. The

majority (71.94%) of the fathers had no restrictions on their usual social activities with friends and family because of health. Almost a quarter (23.31) reported having some restrictions and one in twenty (4.72%) having high restrictions.

5-10. Background characteristics table for the sample of father respondents and their children - frequencies and weighted percentages.

DOMAINS Variables Categories	Children & Fathers n = 8103 n	 Weighted %
A1. Child's Sex		
Boy	4107	50.56
Girl	3996	49.44
A2. Child's Age		
4y4-4y11	1533	19.69
5y0-5y3	3961	49.16
5y4-6y1	2609	31.15
A3. Child has Disability		
No	7682	95.13
Yes	414	4.80
Unknown	7	0.07
A4. Child's Ethnicity		
White	7149	90.67
Mixed	147	2.09
Indian	219	1.96
Pakastani	280	2.25
Bangladeshi	106	0.72
BlackCaribbean	36	0.42
BlackAfrican	58	0.66
Other	91	0.97
Unknown	17	0.28
B. HOUSEHOLD SITUATION		
B1. Managing Financially		
Comfortable	2375	30.30
Stable	3292	39.83
Difficulties	2433	29.85
Unknown	3	0.02
B2. Number of Parents/Carers		
Two	8103	100.00
One	0	0.00
B3. Number of Children		
1	943	11.45
2	4217	53.78
3 or more	2943	34.77
B4. Access to Motor Vehicle(s)		
Yes	7653	95.15
No	450	4.85
C. AREA AND SEASON		
C1. Mother's Opinion of Area for Children		
Excellent	2898	36.78
Good	3439	43.50
Average-Very Poor	1756	19.63
Unknown	10	0.10
C2. Area Deprivation		
Deciles 9-10: most advantaged	1975	27.96
Deciles 7-8	1544	22.42
Deciles 5-6	1548	20.45
Deciles 3-4	1617	16.65
Deciles 1-2: most disadvantaged	1419	12.53
C3. Season of Main Interview		
Spring	4224	58.02
Summer	2112	25.79
Autumn	1317	10.45
Winter	450	5.74

DOMAINS Variables Categories	Children & Fathers n = 8103 n	 Weighted %
F. FATHER'S BACKGROUND		
F1. Father's SES at Age 14		
Managerial & professional	1715	23.05
Intermediate	1611	19.99
Routine & manual	2826	34.73
Father was not working	387	3.909
Unknown/father had died	1564	18.32
F2. Father's Age Left Full-time Education		
20+	1915	23.65
18-19	1211	15.36
16-17	4226	51.36
<16	747	9.561
Unknown	4	0.0684
F3 Father's Generation Migriation History		
Third Generation or more	5961	77.74
Second Generation	445	5.791
First Generation	739	7.785
Unclassified	774	8.687
G. FATHER'S SITUATION		
G1. Father's Age		
18-24	24	0.3643
25-29	542	6.397
30-34	1685	19.76
35-39	2896	36.11
40-44	2022	25.91
44-77	920	11.32
Unknown	14	0.1374
G2. Father's Employment Hours		
Not working	554	6.16
Working <30 hours per week / unknown hr	371	3.975
Working 30+ hours per week	7176	89.84
Unknown	2	0.0266
G3. Father's Marital Status		
Married	6804	83.4
Not married	1299	16.6
G4. Father's Health Restrictions		
No restrictions	5856	71.94
Some restrictions	1865	23.31
High restrictions	376	4.72
Unknown	6	0.0264

Response re-categorisation: father-child participation through playing active games

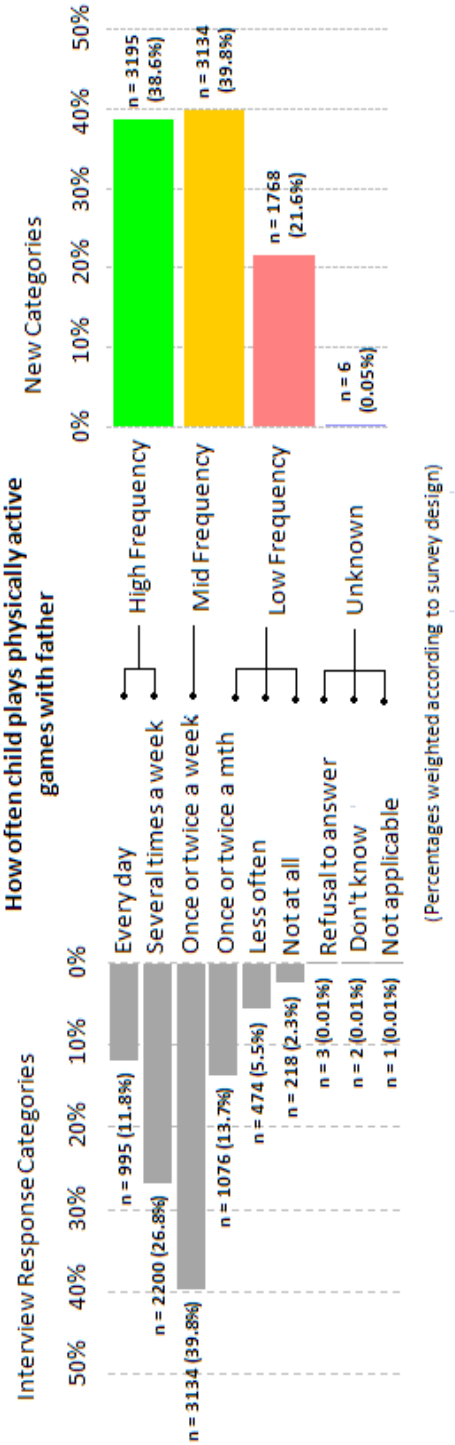
In the third sweep of the MCS the following question was included in the partner interview:

"How often do you play sports or physically active games outdoors or indoors with [child]?"

The original responses were re-categorised as shown in Chart 5-11. Low-frequency referred to fathers who reported to playing active games with their children less than once a week. Mid-frequency corresponded to the modal response category, once or twice a week. High-frequency referred to fathers who reported playing actively with their children at least twice a week.

Among the father respondent sample (n=8103), 1768 were in the low-frequency participation category, 3134 in the mid-frequency participation category and 3195 in the high-frequency participation category. The Unknown category contained 6 children.

5-11. Response re-categorisation chart for father-child playing active games.



Response re-categorisation: father-child facilitation through going to parks or playgrounds

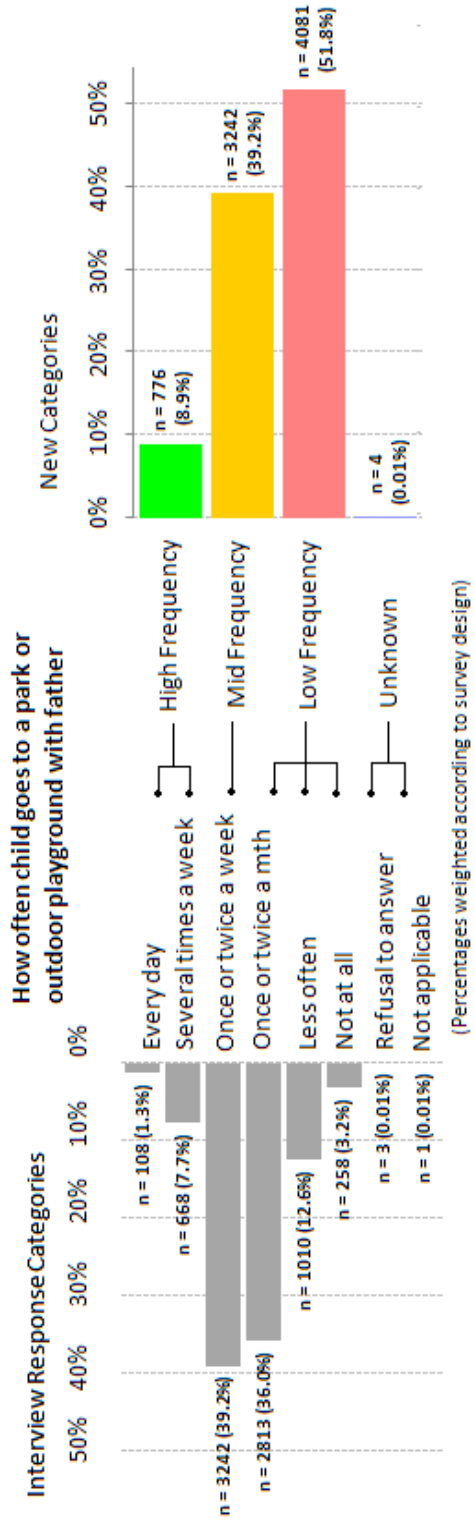
In the third sweep of the MCS the following question was included in the partner interview:

"How often do you take [child] to the park or to an outdoor playground?"

The original responses were re-categorised as shown in Chart 5-12. Low-frequency referred to fathers who reported taking their children to parks or playground less than once a week. Mid-frequency corresponded to the modal response category, once or twice a week. High-frequency referred to fathers who reported taking their children to playgrounds at least twice a week.

Among the father respondent sample (n=8103), 4081 were in the low-frequency facilitation category, 3242 in the mid-frequency facilitation category and 776 in the high-frequency facilitation category. The Unknown category contained 4 children.

5-12. Response re-categorisation chart for father-child going to parks/playgrounds.



Findings from logistic regression analyses for father-child involvement in active play

Results from the four models for father-child involvement in active play are presented in this section:

5-13. List of the four models of father-child involvement in active play

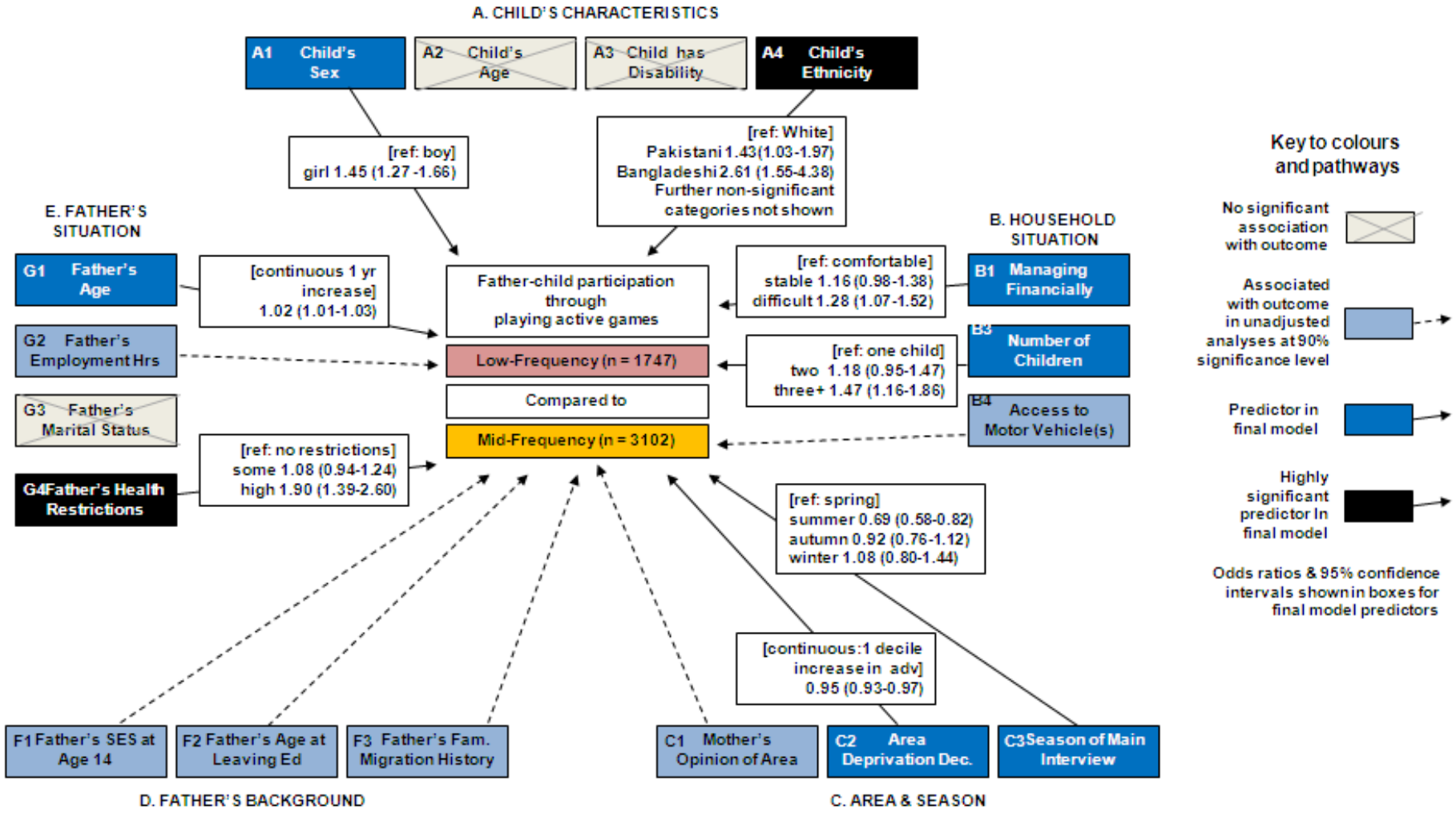
FATHER-CHILD INVOLVEMENT		
Participation: Playing Actively Together		
low-frequency	compared to	mid-frequency
high-frequency	compared to	mid-frequency
Facilitation: Going to Parks/Playgrounds		
low-frequency	compared to	mid-frequency
high-frequency	compared to	mid-frequency

Families were not included in the analyses if data were not complete for all seventeen of the variables and for the outcomes for child's active games and park/playground visits with mother and for father. This reduced the full dataset from n=8103 as shown in the previous characteristics of the sample, to n=7997. As with the analyses for children and mothers, the purpose of doing this was to ensure adjusted and unadjusted analyses were comparable.

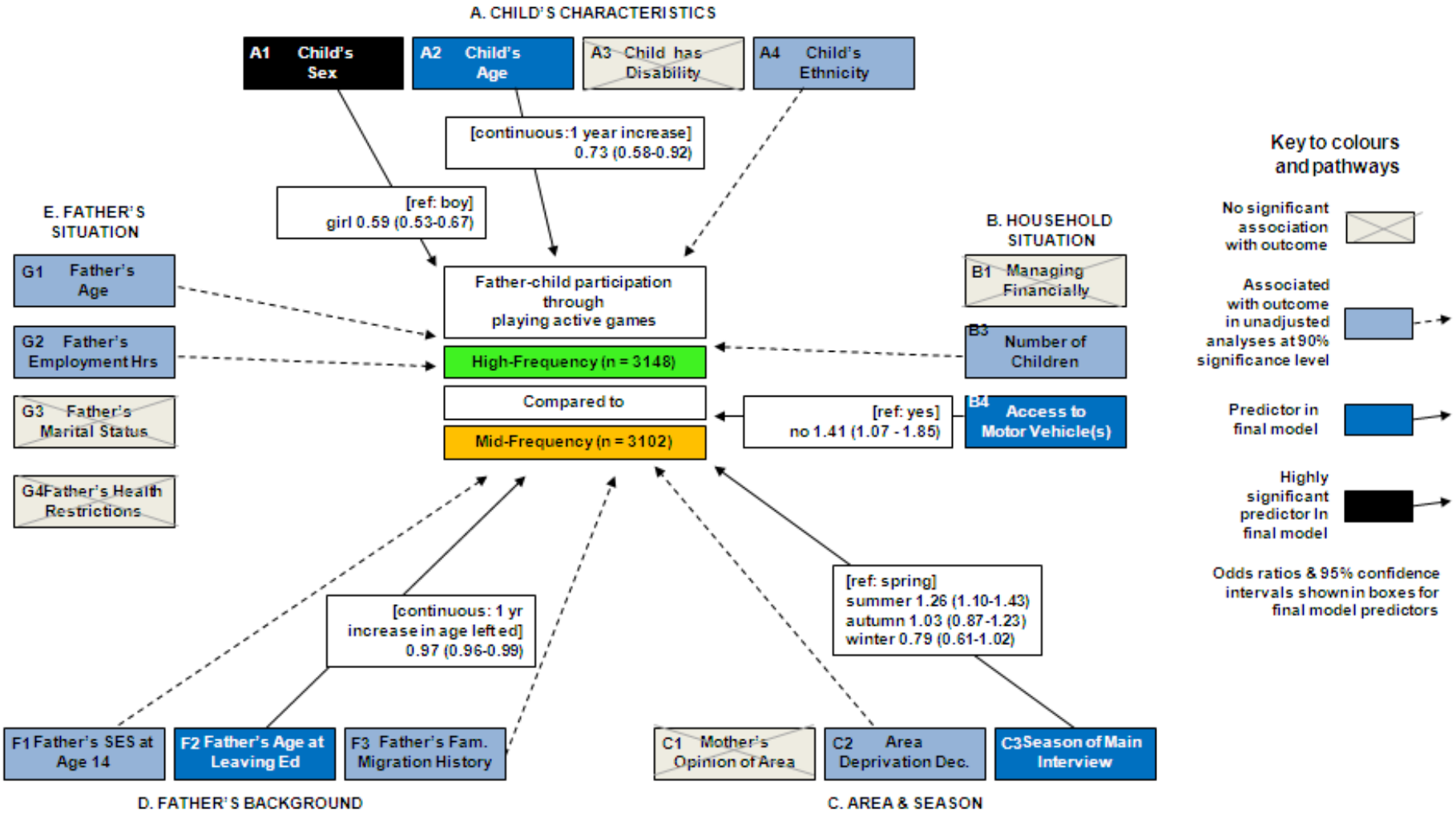
From page A/35 in the appendices, the tables displaying the full results from unadjusted and adjusted logistic regression analyses for each of the four models for father-child involvement can be found, together with written descriptions.

Model flow diagram diagrams and a summary table the four models are on the following pages, and this is followed by a summary of the main findings on father-child involvement.

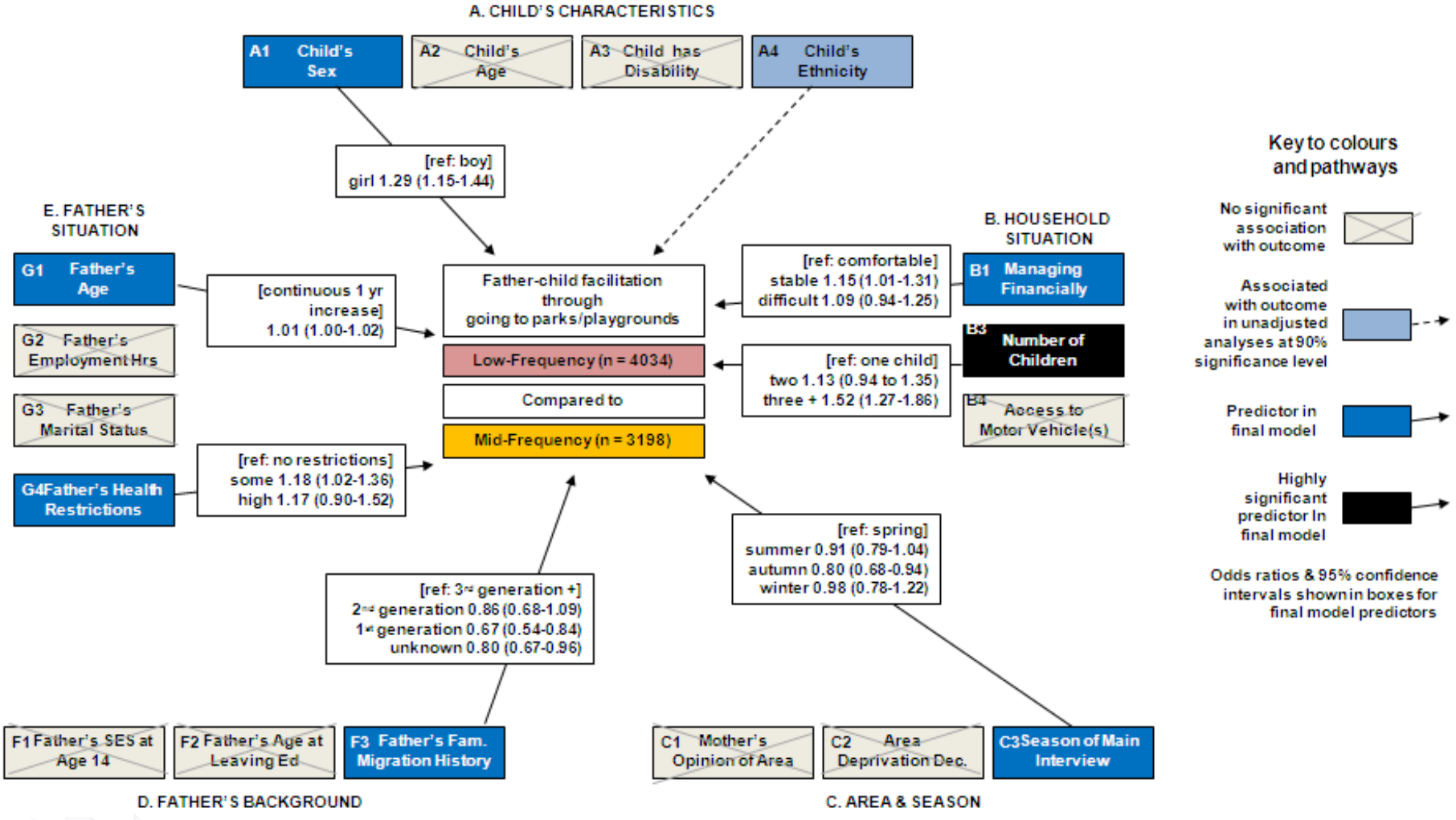
5-14. Logistic regression model flow diagram for father-child low-frequency compared to mid-frequency participation through playing active games Constructed from results from Table A 15 on page A/35.



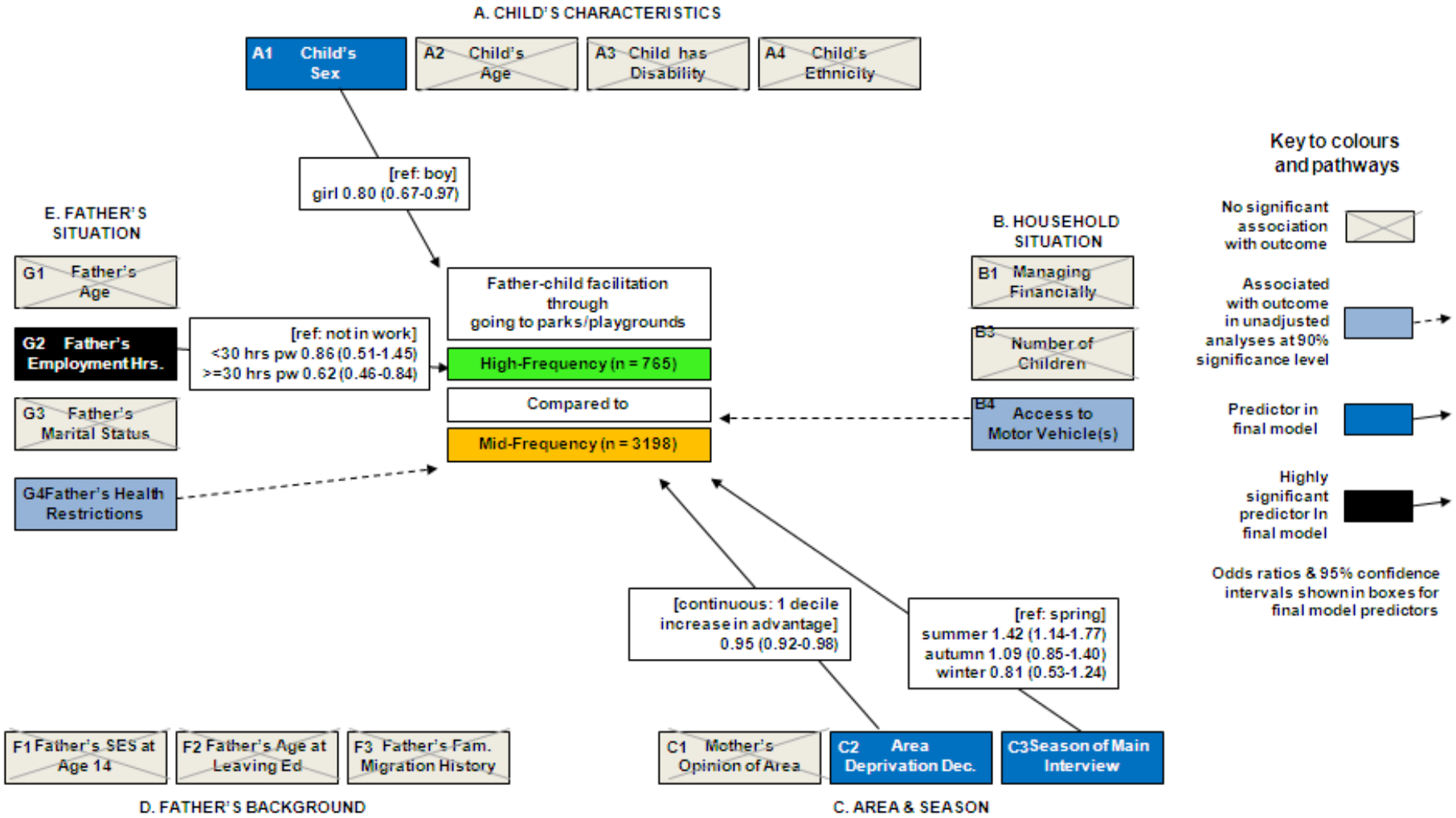
5-15. Logistic regression model flow diagram for father'-child high-frequency compared to mid-frequency participation through playing active games Constructed from results from Table A 16 on page A/38.



5-16. Logistic regression model flow diagram for father-child low-frequency compared to mid-frequency facilitation through going to parks/playgrounds Constructed from results from Table A 17 on page A/41.



5-17. Logistic regression model flow diagram for father-child high-frequency compared to mid-frequency facilitation through going to parks/playgrounds Constructed from results from Table A 18 on page A/44.



5-18. Summary table of predictors of father-child involvement in active play.

Father-Child Involvement in Active Play (Two parent families)	Participation ('active games')		Facilitation ('park/playground visits')		Key to coloured rings. Variable has..... no significant association with outcome; unadjusted association (at 90% significance); adjusted association (at 95% sig.); statistically strong adjusted assoc. (OR ≥1.5 or ≤0.67, 99% sig.)	
	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Importance	Short description of adjusted model findings
A. Child's Characteristics						
A1. Child's sex	●	●	●	●	Level 1	Boys more likely than girls to have higher freq active games & park/playground visits.
A2. Child's age	○	●	○	○	Level 3	Younger children more likely to have high-freq active games.
A3. Child has disability	○	○	○	○	Level 5	n/a
A4. Child's ethnicity	●	◐	◐	○	Level 2	Pakistani & Bangladeshi children more likely than White children to have low-freq active games.
B. Household Situation						
B1. Managing financially	●	○	●	◐	Level 2	Children in families with financial difficulties more likely than those who are financially comfortable to have low-freq active games & children in families which are stable more likely to have low-freq park/playground visits.
B3. Number of children	●	◐	●	○	Level 2	Children with two or more siblings more likely than only-children to have low-freq active games & low-freq park/playground visits.
B4. Access to vehicle(s)	◐	●	○	◐	Level 3	Children in families with no vehicle access more likely than those with vehicle access to have high-freq active games.
C. Area and Season						
C1. Mother's opinion of area	◐	○	○	○	Level 4	n/a
C2. Area deprivation score	●	◐	○	●	Level 2	Children in more deprived areas more likely to have low-freq active games & high-freq park/playground visits.
C3. Season of main interview	●	●	●	●	Level 2	Main interviews in warmer season more likely to have higher freq active games & park/playground visits.

Level 1: Statistically strong predictor **&** in multiple adjusted models
Level 2: Statistically strong predictor **or** in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

Continued on following page

5-18. Summary table of predictors of father-child involvement in active play **(Continued)**

Father-Child Involvement in Active Play (Two parent families)	Participation ('active games')		Facilitation ('park/playground visits')		Key to coloured rings. Variable has..... no significant association with outcome; unadjusted association (at 90% significance); adjusted association (at 95% sig.); statistically strong adjusted assoc. (OR ≥1.5 or ≤0.67, 99% sig.)	
	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Importance	Short description of adjusted model findings
F. Father's Background						
F1. SES at 14	○	○	○	○	Level 4	n/a
F2. Age left full-time education	○	●	○	○	Level 3	Fathers who left education earlier more likely to have high-freq active games.
F3. Family Migration History	○	○	●	○	Level 3	Third generation migrants more likely than second generation & unclassifieds to have low-freq park/playground visits.
G. Father's Situation						
G1, Age	●	○	●	○	Level 2	Older fathers more likely to have low-freq active games & low-freq park/playground visits.
G2. Employment status	○	○	○	●	Level 2	Non-working fathers more likely to have high-freq park/playground visits.
G3. Marital status	○	○	○	○	Level 5	n/a
G4. Health Restrictions	●	○	●	○	Level 1	Fathers with high health restrictions more likely than those without to have low-freq active games. Fathers with some restrictions more likely to have low-freq park/playground visits.

Level 1: Statistically strong predictor **&** in multiple adjusted models
Level 2: Statistically strong predictor **or** in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

The findings on the potential predictors of father-child involvement in active play have been sorted into five levels of importance. The criteria for these levels were set out in Chapter 4 (pages 136 to 139).

Level 1: Predictors that were both statistically strong in a final model and in multiple final models (father-child)

Three of the predictors fulfilled the criteria for being level 1 statistical importance. These were strongly predictive, as measured by the odds ratios and p-values, as well as by being in more than one model.

- Child's sex
- Number of children in household
- Father's health restrictions

Boys were 69% more likely than girls to experience high-frequency participation and 45% less likely than girls to experience low-frequency participation with their fathers through active games. Similarly, boys were 25% more likely to have high-frequency facilitation through going to parks or playgrounds with their fathers, and 29% less like likely to have low-frequency facilitation of this type.

Children with two or more siblings in their household were 47% more likely to be in the low-frequency group for active games and 52% more likely to have be in the low-frequency group for park/playground visits with their fathers.

Children whose fathers reported having high restrictions in their usual social activities because of their health had 90% increased likelihood of low-frequency participation through active play together compared to those reporting no health restrictions. Those with some restrictions were 18% more likely to have low-frequency park or playground visits.

Level 2: Predictors that were either statistically strong in one final model or in multiple final models (father-child)

Six predictors were identified as being of level 2 statistical importance. Two of these, child's ethnicity and father's employment status, were regarded as being statistically strong but were in only one final model, and the remaining four were in multiple models.

- Child's ethnicity
- Father's employment status
- Managing financially
- Area deprivation level
- Father's age
- Season of main interview

Compared to children of white ethnicity, those from two minority ethnic groups were particularly likely to having low-frequency active games with their fathers: Pakistani children were 43% more likely to be in the low-frequency group, and Bangladeshi children were over twice as likely (161%).

Children with fathers who were working at least 30 hours per week had 61% lower likelihood than those who were not working of being in the high-frequency group for park and playground visits.

Children and fathers from families that were experiencing financial difficulties were 28% more likely than those who were financially comfortable to have low-frequency of active games together, and those who were financially stable were 15% more likely to have low-frequency park or playground visits than those who were financially comfortable.

Children and fathers living in poorer areas were more likely (5% increase in likelihood per one decile decrease in deprivation) to have low-frequency active games together but were also more likely (again, 5% per decile increase) to be in the high-frequency category for going to park or playgrounds.

Father's age at the time of interview was also important: for every 5-year increase in age, they were approximately 10% more likely to be in the low-

frequency group for active games and 5% more likely to be in the low-frequency group for park/playground visits.

Seasonal differences were apparent in all four of the final analysis models. Comparing main interviews which took place in summer to spring, fathers were 45% less likely to report low-frequency and 26% more likely to report high-frequency participation through active games; and 42% more likely to report high-frequency facilitation through visits to parks or playgrounds. Interviews in the autumn were also associated with an 25% decrease in likelihood of being in the low-frequency group for visits to parks or playgrounds.

Level 3: Predictors that were in one of the single final models, but were not statistically strong (father-child)

Four predictors were all in just one of the final models, and did not fulfil the criteria as being statistically strong.

- Child's age
- Access to a motor vehicle
- Father's age left full-time education
- Father's family migration history

The age of the child was associated with high-frequency of playing active games with the father: older children were less likely to be in the high-frequency group, with a 37% decrease in the likelihood per one year increase in age.

Not having access to a motor vehicle was associated with a 41% increase in likelihood of having high-frequency active games together.

Fathers who left full-time education at a later age were less likely to be high-frequency players of active games with their children: for every 5-year increase in age, there was an 16% decrease in likelihood.

Children whose fathers had migrated to the UK (first generation) were 49% less likely to have low-frequency visits to parks or playgrounds than those who were at least third generation migrants.

Level 4: Variables that were significantly associated with an outcome in unadjusted analyses, but in none of the final models (father-child)

There were two factors that were not in any of the final models but were found to be significantly associated with at least one of the outcomes in the unadjusted analyses. The relationships were explained by predictors in the final models.

- Mother's opinion of area
- Father's socio-economic circumstances at age 14

Level 5: Variables which were not associated with any of the outcomes in unadjusted analyses (father-child)

There were two factors which were not found to be associated with the participation or facilitation outcomes at all.

- Child's disability status
- Father's marital status

5.3. Comparison of the predictors of mothers-child and father-child involvement in active play

The methods for this section were explained in Chapter 4 (Section 4.3, from page 139)

It would be desirable to make comparisons between children's opportunities with their mothers and fathers in order to further investigate inequalities. However, direct comparisons are not possible since the analyses of father–child involvement were on a subset of the main sample which included only those in two-parent households with the birth mother and birth father living together.

Compared to the main sample of children living with their birth mothers (Table 5-1, page 149), the sub-set of those who were also living with their birth fathers (Table 5-10, page 165) contained the following.

A lower proportion of

- Children with disabilities
- Children in minoirty ethnic groups
- Mothers who considered that they lived in an average-poor area for children

A greater proportion of

- Financially comfortable households
- Households with access to motor vehicle(s)
- Households in advantaged areas

These socio-economic differences between the samples confirmed that it would not be appropriate to compare the models for mother-child and father-child involvement in active play. Therefore, logistic regression was used to build additional models for mother-child involvement in the two-parent families. The tables for unadjusted and adjusted regression analyses are presented from page A/47 of the appendices, but are not described.

The following sub-section is a comparison of the findings for mother-child involvement and father-child involvement for the two-parent family subset.

How do the predictors of mother-child and father-child involvement in active play compare for the two-parent households?

The analyses for mother-child and father-child involvement in the same two-parent families were compared. The same variables for the first three domains were used in the analyses (child's characteristics; household situation; area and season). There were equivalent variables in the mother's and father's background domains, and the mother's and father's situation domains. For example, mother's family migration history could be compared to father's family migration history. Therefore the findings could be compared alongside each other by looking at the differences for each variable. Table 5-19 on page 182 is a summary showing the findings for mother's and father's support in the two-parent families.

Generally the overall findings were very similar for the mother-child and father-child involvement. There were however four variables for which there were notable differences. These are described below.

Child's Sex

Boys were more likely than girls to have higher frequency involvement in active play with mothers and fathers, but this factor appeared to be of greater statistical importance for involvement with fathers. For mother-child involvement, child's sex was of level 3 importance since it was in one of the models. For father-child involvement, this factor was of level 1 importance: it was in multiple models and strongly significant.

Child's Disability Status

This factor was of level two statistical importance for mother-child involvement since it was in multiple models, but of level 5 importance for father-child involvement since there was no association between child having a disability and the participation or facilitation outcomes.

Parent's Family Migration History

Although this factor was of level three statistical importance for both mother-child and father-child involvement, the direction of the association was different between the two for park/playground visits. Among mothers, second generation migrants were more likely than third (or more) generation to have low-frequency park/playground visits with their children whereas among fathers, third (or more) generation migrants more likely than second generation to have low-frequency park/playground visits.

Parent's age

This factor was assessed as level 2 importance for both mother-child and for father-child involvement, but the direction of association was different between them for active games. Low-frequency active games were most likely among older fathers and among younger mothers.

5-19. Summary table of the predictors of parent-child involvement in active play, comparing mothers and fathers in two parent families

	Sample of Two-Parent Families			
	Mother-Child Involvement		Father-Child Involvement	
A. Child's characteristics				
A1. Child's sex	Level 3	Boys more likely than girls to have high-freq active games.	Level 1	Boys more likely than girls to have higher freq active games & park/playground visits
A2. Child's age	Level 4	n/a	Level 3	Younger children more likely to have high-freq park/playground visits.
A3. Child has disability	Level 2	Children with disabilities more likely than those without disabilities to have high-freq park/playground visits & high-freq park/playground visits.	Level 5	n/a
A4. Child's ethnicity	Level 2	Pakistani, Bangladeshi, Black Caribbean & Black African children more likely than white children to have low-freq active games.	Level 2	Pakistani & Bangladeshi children more likely than white children to have low-freq active games
B. Household situation				
B1. Managing financially	Level 3	Children in families with financial difficulties more likely than those who are financially comfortable to have low-freq active games.	Level 2	Children in families with financial difficulties more likely than those who are financially comfortable to have low-freq active games & children in families which are financially stable more likely to have low-freq park/playground visits.
B3. Number of children	Level 1	Children with siblings more likely than only-children to have low-freq active games.	Level 2	Children with two or more siblings more likely than only-children to have low-freq active games & low-freq park/playground visits.
B4. Access to vehicle(s)	Level 3	Children in families with no vehicle access more likely than those with vehicle access to have high-freq park/playground visits.	Level 3	Children in families with no vehicle access more likely than those with vehicle access to have high-freq active games.
C. Area and Season				
C1. Mother's opinion of area	Level 3	Children whose mothers have better opinion of area more likely to have high-freq active games.	Level 4	n/a
C2. Area deprivation score	Level 2	Children in more deprived areas more likely to have low-freq active games, low-freq park/playground visits & high-freq park/playground visits.	Level 2	Children in more deprived areas more likely to have low-freq active games & high-freq park/playground visits.
C3. Season of main interview	Level 2	Interviews in warmer season more likely to have higher freq active games and park/playground visits.	Level 2	Main interviews in warmer season more likely to have higher freq active games & park/playground visits.

Level 1: Statistically strong predictor **&** in multiple adjusted models
Level 2: Statistically strong predictor **or** in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

5-19. Summary table of the predictors of parent-child involvement in active play, comparing mothers and fathers in two parent families **(continued)**

	Sample of Two-Parent Families			
	Mother-Child Involvement		Father-Child Involvement	
D/F. Parent's Background				
E1/F1. SES at 14	Level 4	n/a	Level 4	n/a
E2/F2. Age left full-time education	Level 2	Mothers who left education earlier more likely to have low-freq and high-freq active games.	Level 3	Fathers who left education earlier more likely to have high-freq active games.
E3/F3. Family Migration History	Level 3	Second generation migrants more likely than third generation to have low-freq park/playground visits.	Level 3	Third generation migrants more likely than second generation & unclassifieds to have low-freq park/playground visits
E/G. Parent's situation				
E1/G1, Age	Level 2	Younger mothers more likely to have low-freq active games. Older mothers more likely to have low-freq park/playground visits.	Level 2	Older fathers more likely to have low-freq active games & low-freq park/playground visits.
E2/G2. Employment hours	Level 2	Non-working mothers more likely to have high-freq active games than those working & park visits than those working 30+ hours	Level 2	Non-working fathers more likely to have high-freq park/playground visits.
E3/G3. Marital status	Level 4	n/a	Level 5	n/a
E4/G4. Health Restrictions	Level 1	Mothers with some or high health restrictions more likely than those without to have low-freq active games. Mothers with high restrictions more likely to have low-freq park/playground visits.	Level 1	Fathers with high health restrictions more likely than those without to have low-freq active games. Fathers with some restrictions more likely to have low-freq park/playground visits.

Level 1: Statistically strong predictor **&** in multiple adjusted models
Level 2: Statistically strong predictor **or** in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

Relationships between the participation and facilitation outcomes

Further analyses were carried out the assess the relationships between the participation and facilitation outcomes. The results can be found in the tables from page A/55 in the appendices for Section 5.3., and a brief summary of the findings are given below. Four main relationships were investigated.

- *Mother-child facilitation as a predictor of mother-child participation?*

Mother-child facilitation through park/playground visits was a strong predictor of mother-child participation through playing active games. For example, those reporting low-frequency park/playground visits were over twice as likely as those reporting mid-frequency visits to also report low-frequency active games.

- *Father-child facilitation as a predictor of father-child participation?*

Among two-parent families, father-child facilitation through park/playground visits was a strong predictor of father-child participation through playing active games. For example, those reporting low-frequency park/playground visits were over three times as likely as those reporting mid-frequency visits to also report low-frequency active games. Comparing this to the findings for mothers above, there was indication that the two modes of involvement were more closely related for fathers than mothers.

- *Mother-child participation as a predictor of father-child participation?*

Mother-child and father-child participation through playing active games were highly related among two-parent families. Children who experienced low-frequency participation with their mothers were over 50% more likely than those who had mid-frequency participation with their mothers to experience low-frequency participation with their fathers.

- *Mother-child facilitation as a predictor of father-child facilitation?*

Strong relationships could be seen between mother's and father's facilitation through park/playground visits in the two-parent family sub-set. Children who experienced low-frequency park/playground visits with their mothers were over two and a half times more likely than those who had mid-frequency visits with their mothers to experience low-frequency park/playground visits with their fathers. Comparing this to the findings for active games above, there was indication that frequency of mother-child and father-child facilitation through playground visits were more closely related than frequency of mother-child and father-child participation through active games.

5.4. Relationships between children's other activities and parent-child involvement in active play

In this section four factors related to children's activities are investigated. These are:

- Duration of child's television viewing on term-time weekdays
- Duration of child's computer use on term-time weekdays
- Frequency of child's sports club attendance each week
- Household dog ownership

Background evidence presented in Chapters 2 and 3 suggested that each of these factors may be related to children's physically active play, and with involvement in active play with their parents. Although not a measure of activity like the others, it seems likely that dog ownership in a family will be important for children's active play opportunities.

On the following page are the response re-categorisation charts for television viewing, computer use and sports club attendance, to show the distribution of responses for the interview questions for these factors, and the new categories which were created. For dog ownership, there is no chart due to the different format of the question and responses, but the variable is described.

Child's Television Viewing

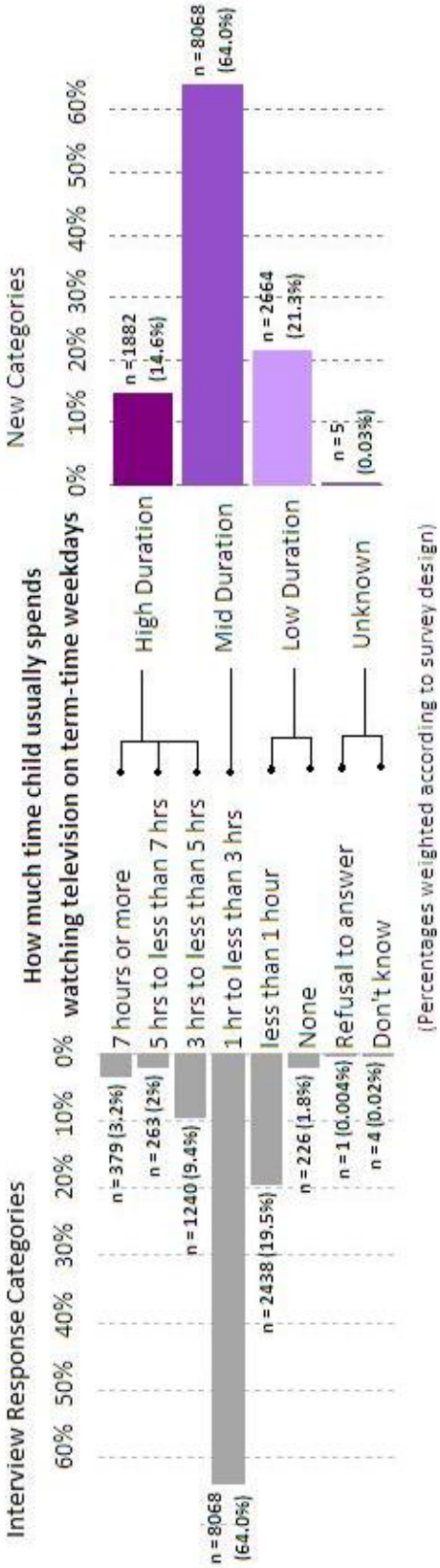
In the third sweep of the MCS the following question was included in the main interview:

"On a normal week day during term time, how many hours does [child] spend watching television, videos or DVDs?"

The original responses were re-categorised as shown in Chart 5-20. Low-duration referred to those children who were reported to watch television for less than hour or not at all on typical term-time weekdays. Mid-duration corresponded to the model response category, at least one hour to fewer than three hours. High-duration referred to children who were reported to watch three or more hours. Among the children in the main mother respondent sample (n=12,619), 2664 were in the low- duration group, 8068 in the mid-duration group and 1182 in the high-duration group. The data was unknown for 5 children.

In the appendices (pages A/63 to A/64) are the initial analyses to investigate the relationships between children's duration of television viewing and the variables of interest in this study.

5-20. Response re-categorisation chart for how much child usually spends watching television on term-time weekdays.



Child's Computer Use

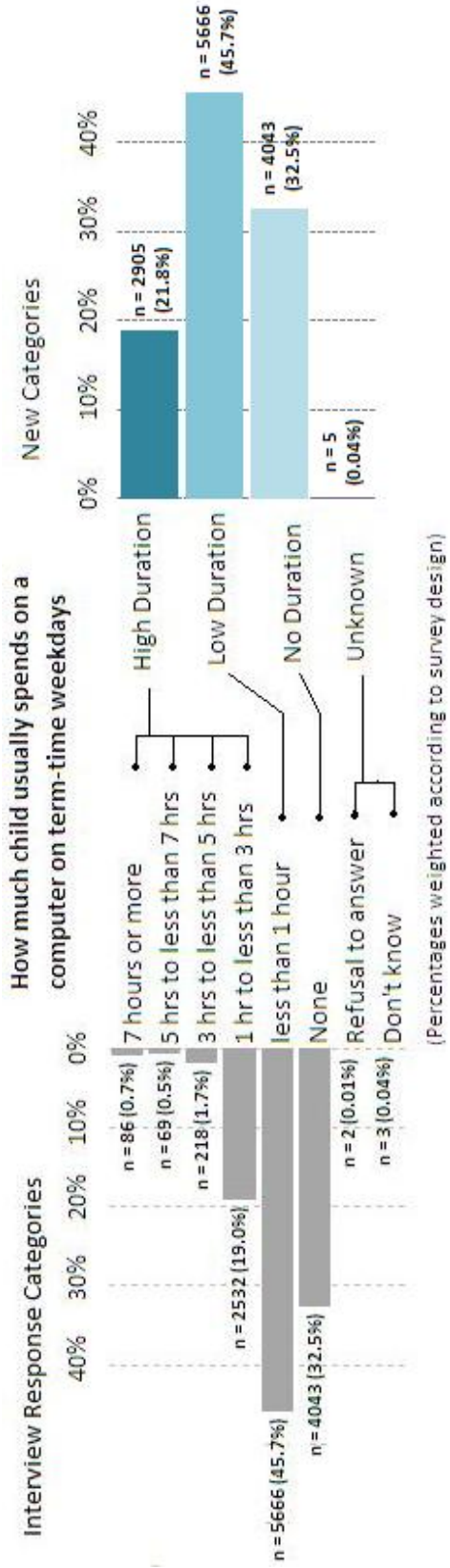
In the third sweep of the MCS the following question was included in the main interview:

"On a normal weekday during term time, how many hours does [child] spend using a computer or playing electronic games outside school lessons?"

The original responses were re-categorised as shown in Chart 5-21. No-duration referred to those children who were reported not to use a computer at all on typical term-time weekdays. Low-duration corresponded to the modal response category, less than one hour. High-duration referred to children who were reported to use the computer for at least one hour. Among the children in the main mother respondent sample(n=12,619), 4043 were in the no-duration group, 5666 in the mid-duration group and 2905 in the high-duration group. The data were unknown for 5 children.

In the appendices (pages A/66 to A/67) are the initial analyses to investigate the relationships between children's duration of computer use and the variables of interest in this study.

5-21. Response re-categorisation chart for how much child usually spends using a computer on term-time weekdays.



Child's Sports Club Attendance

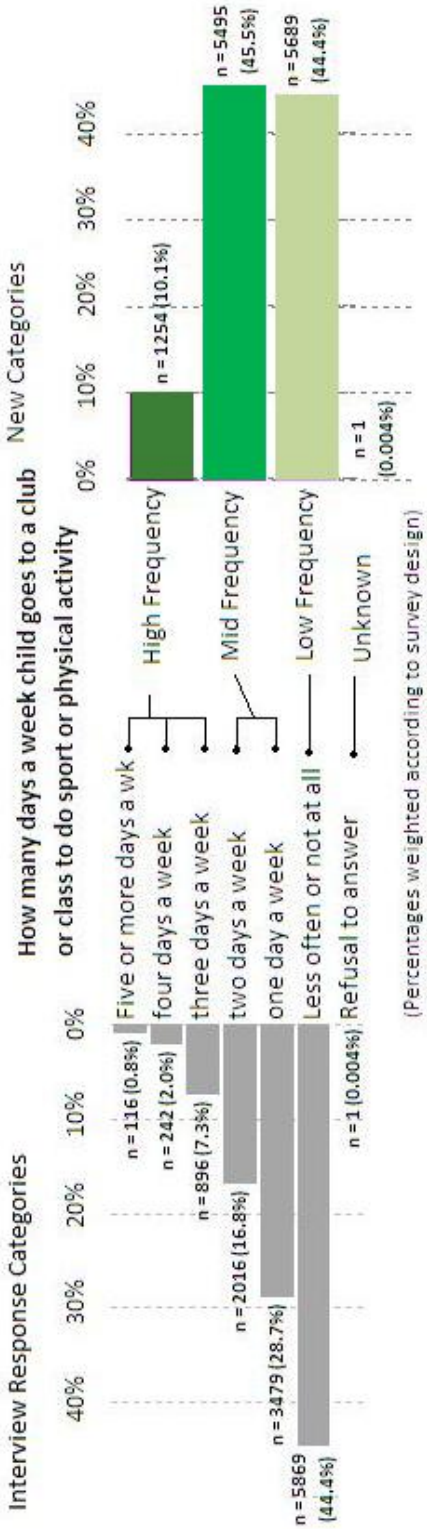
In the third sweep of the MCS, the following question was included in the main interview:

"On average how many days a week does [child's name] go to a club or class to do sport or any other physical activity like swimming, gymnastics, football, dancing etc?"

The original responses were re-categorised as shown in Chart 5-22. Low-frequency referred to those children who were reported to attend sports clubs on less than one day a week or not at all. Mid-frequency were those who attended on one or two days each week. High-duration referred to children who were reported to attend sports clubs on three or more days each week. Among the children in the main mother respondent sample (n=12,619), 5689 were in the low-frequency group, 5495 in the mid-frequency group and 1254 in the high- frequency group. The data was unknown for 1 child.

In the appendices (pages A/69 to A/70) are the initial analyses to investigate the relationships between children's attendance at sports clubs and the variables of interest in this study.

5-22. Response re-categorisation chart for how frequently child goes to sports clubs.



Household Dog Ownership

The mothers in the sample were asked what pets the family owned. There were up to five types of pet which could be selected: *dog, cat, some other furry pet, bird, and some other pet.* For those with no pets there was the option *none of these.* In these analyses we are only interested in ownership of dogs, since they are the most popular pet, and generally require more 'active' attention by taking them out for walks. It is possible that other pets may also be associated with physically active play in the home, but these were not investigated. Among the main mother respondent sample (n=12,619), 2663 responded that they had dogs, 9944 responded that they either only had other pets or had no pets at all. For 12 mothers, the response was unknown (refusal, don't know or not applicable).

Associations between children's other activities and frequency of mother-child involvement in active play

The analyses of weighted proportions in the previous sub-sections have demonstrated how television viewing, computer use, and sports club attendance are associated were with socio-economic background and characteristics of the children and their families. Inequalities in dog ownership were also investigated briefly, and some inequalities were evident.

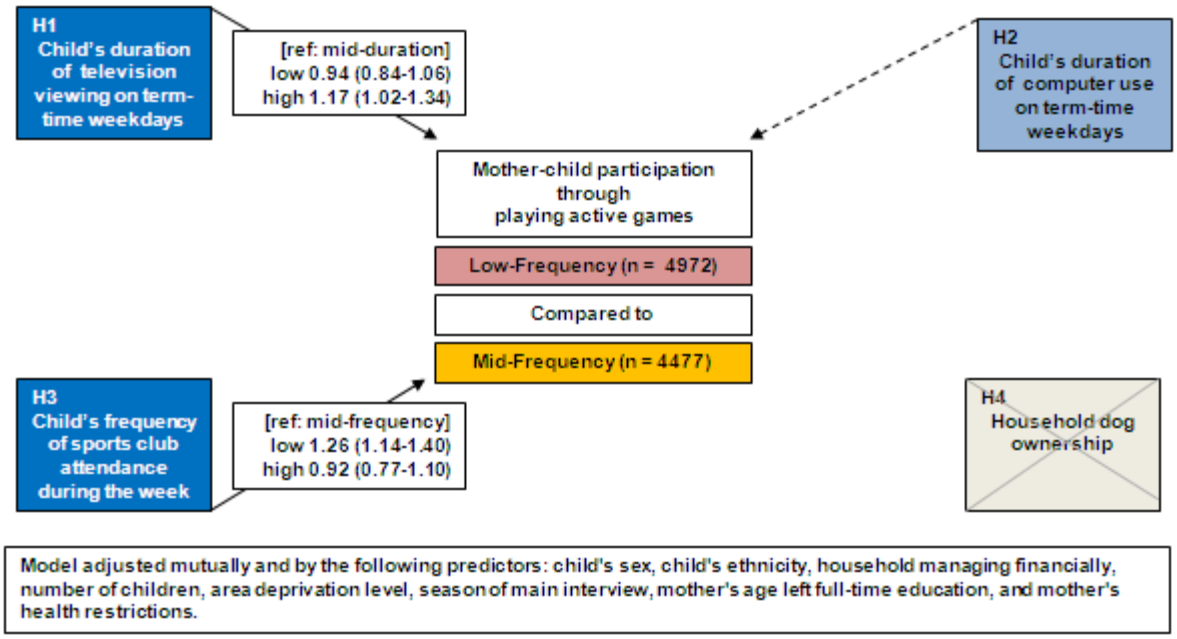
In this sub-section, the relationships between these activity variables and the outcomes for mother's support outcomes are investigated. Multinomial logistic regression analyses were carried out to investigate the four modes of support outcomes, using the adjusted models presented in Chapter 5.

Firstly the variables were tested in unadjusted logistic regression to see if they were significantly related to each of the mode of support outcome. As in previous analyses, a 90% significant level was used at this stage. If significant, variables were entered into the corresponding final models constructed in Chapter 5, and backwards regression was carried on only the four new variables (no predictors from the original models were removed) to assess whether they were significantly associated with the outcome at a 95% level.

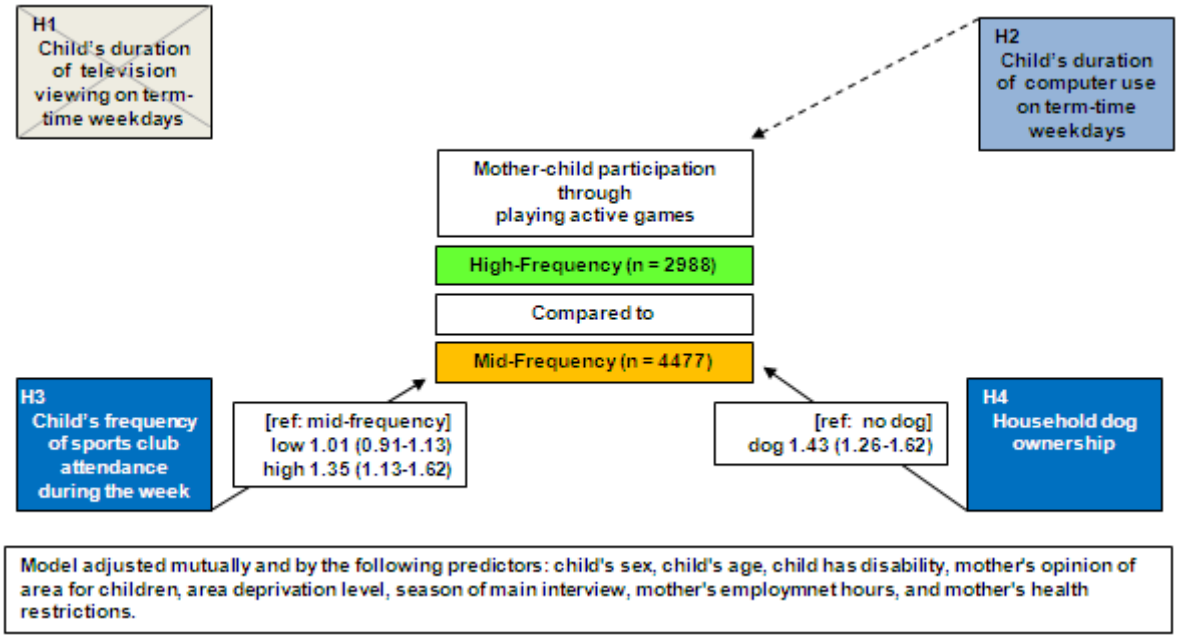
Tables showing the results from the four sets of analyses are presented on the following pages, together with descriptions. Although the term 'predictor' is used to refer to the variables which are in the adjusted models, since the direction of causality is particularly uncertain for these factors (i.e. parent-child involvement in physical activity is likely to have an impact on children's sports club attendance, as well as vice-versa).

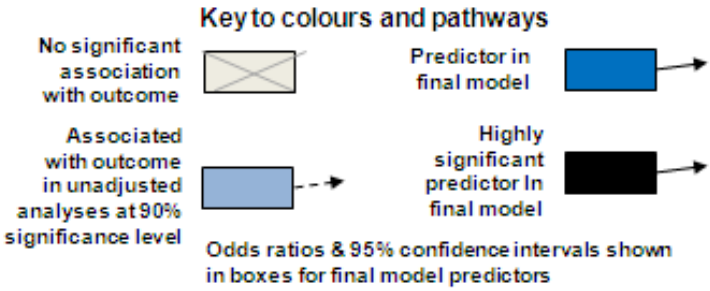
Table 5-27 on page 194 provides a summary of the four sets of analyses.

5-23. Logistic regression model flow diagram for other activities in the model for mother-child low-frequency compared to mid-frequency participation through playing active games. Constructed from results from Table A 42 on page A/71.

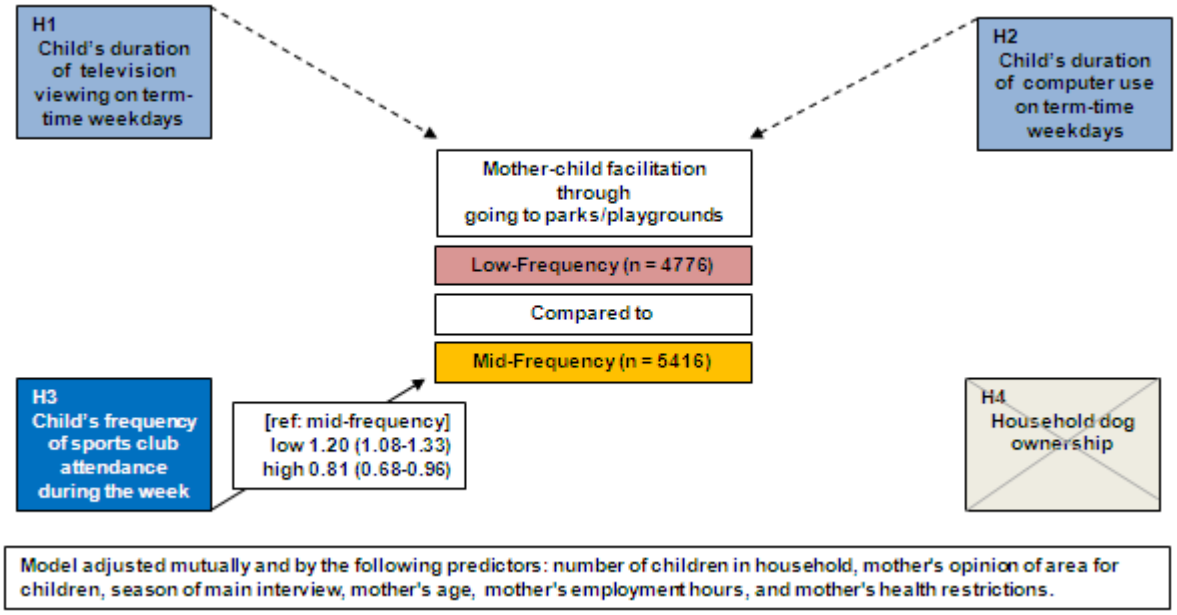


5-24. Logistic regression model flow diagram for other activities in the model for mother-child high-frequency compared to mid-frequency participation through playing active games. Constructed from results from Table A 43 on page A/72.

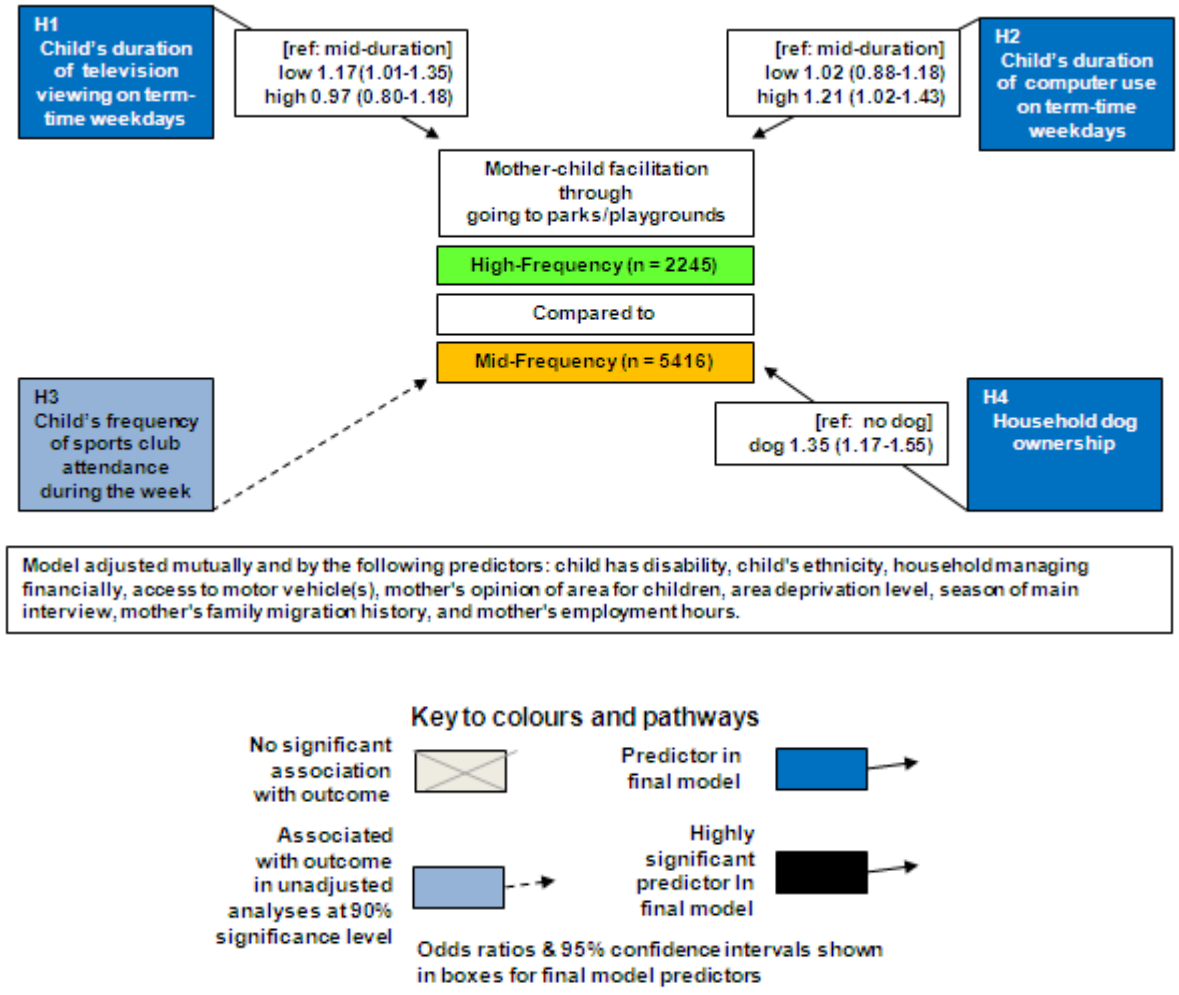




5-25. Logistic regression model flow diagram for other activities in the model for mother-child low-frequency compared to mid-frequency facilitation through going to parks/playgrounds. Constructed from results from Table A 44 on page A/73.



5-26. Logistic regression model flow diagram for other activities in the model for mother-child high-frequency compared to mid-frequency facilitation through going to parks/playgrounds. Constructed from results from Table A 45 on page A/74.



5-27. Summary table of the predictors of mother-child involvement in active play, for child's other activities variables

Mother-Child Involvement in Active Play	Participation ('active games')		Facilitation ('park/playground visits')		Key to coloured rings. Variable has..... no significant association with outcome; unadjusted association (at 90% significance); adjusted association (at 95% sig.); statistically strong adjusted assoc. (OR ≥1.5 or ≤0.67, 99% sig.)	
	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Importance	Short description of adjusted model findings
H. Other Activities						
H1. Child's television viewing on term-time weekdays	●	○	○	●	Level 2	High-duration television viewing associated with increased likelihood of low-frequency active games. Low duration television viewing associated with increased likelihood of high-frequency park/playground visits.
H2. Child's computer use on term-time weekdays	○	○	○	●	Level 3	High-duration computer use associated with increased likelihood of high-frequency park visits.
H3. Child's sports club attendance each week	●	●	●	○	Level 2	Low-frequency sports club attendance associated with increased likelihood of low-frequency active games & park/playground visits. High-frequency sports club attendance associated with increased likelihood of high-frequency active games and decreased likelihood of low-freq park/playground visits.
H4. Household dog ownership	○	●	○	●	Level 2	Dog ownership associated with increased likelihood of high-freq active games and park/playground visits.

Level 1: Statistically strong predictor **&** in multiple adjusted models
Level 2: Statistically strong predictor **or** in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

The findings on the four activity variables have been sorted into two levels of importance, from the criteria set out in Chapter 4 (from page 136): None of the variables were found to be at level 1, 4, or 5 importance.

Level 2: Child's other activity predictors which were either statistically strong in one final model or in multiple final models (mother-child)

Child's Television Viewing

Children whose mothers reported that they watched television for at least three hours on term-time weekdays were 17% more likely than those who watched between one and three hours to have low-frequency active games with their mothers. Children who watched television for less than an hour or not at all were 17% more likely to have high-frequency park or playground visits with their mothers.

Child's Sports Club Attendance

Compared to children whose mothers reported that they went to sports clubs on one or two days per week, children who went less than one day per week were 26% more likely to have low-frequency active games and 20% more likely to have low-frequency park or playground visits with mothers. Children who went to sports clubs at least three times per week were 35% more likely to have high-frequency participation with mothers through active games and 23% less likely to have low-frequency facilitation through park or playground visits.

Dog Ownership

Children and mothers who had a dog were 43% more likely to have high-frequency active games together, and 35% more likely to have high-frequency park or playground visits together, compared to those without a dog.

Level 3: Child's other activity predictors which were in one of the single final models, but were not statistically strong (mother-child)

Child's Computer Use

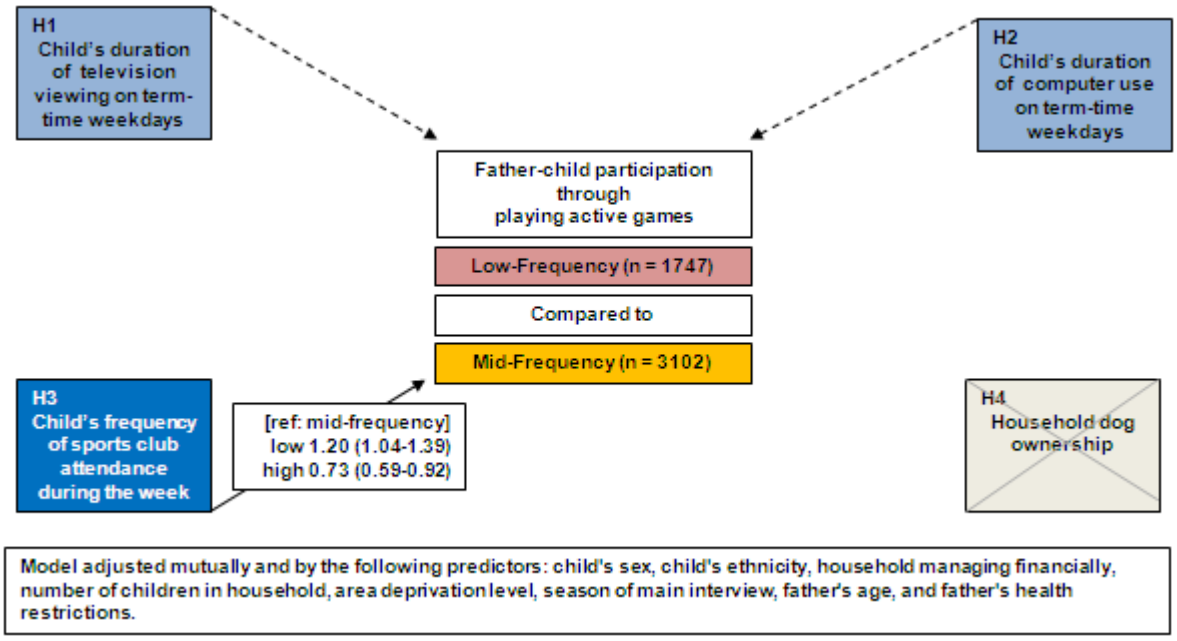
Children whose mothers reported that they used a computer for at least one hour on term-time weekdays were 21% more likely than those who used a computer for less than a hour to have high-frequency park or playground visits with their mothers.

Associations between children's other activities and frequency of father-child involvement in active play

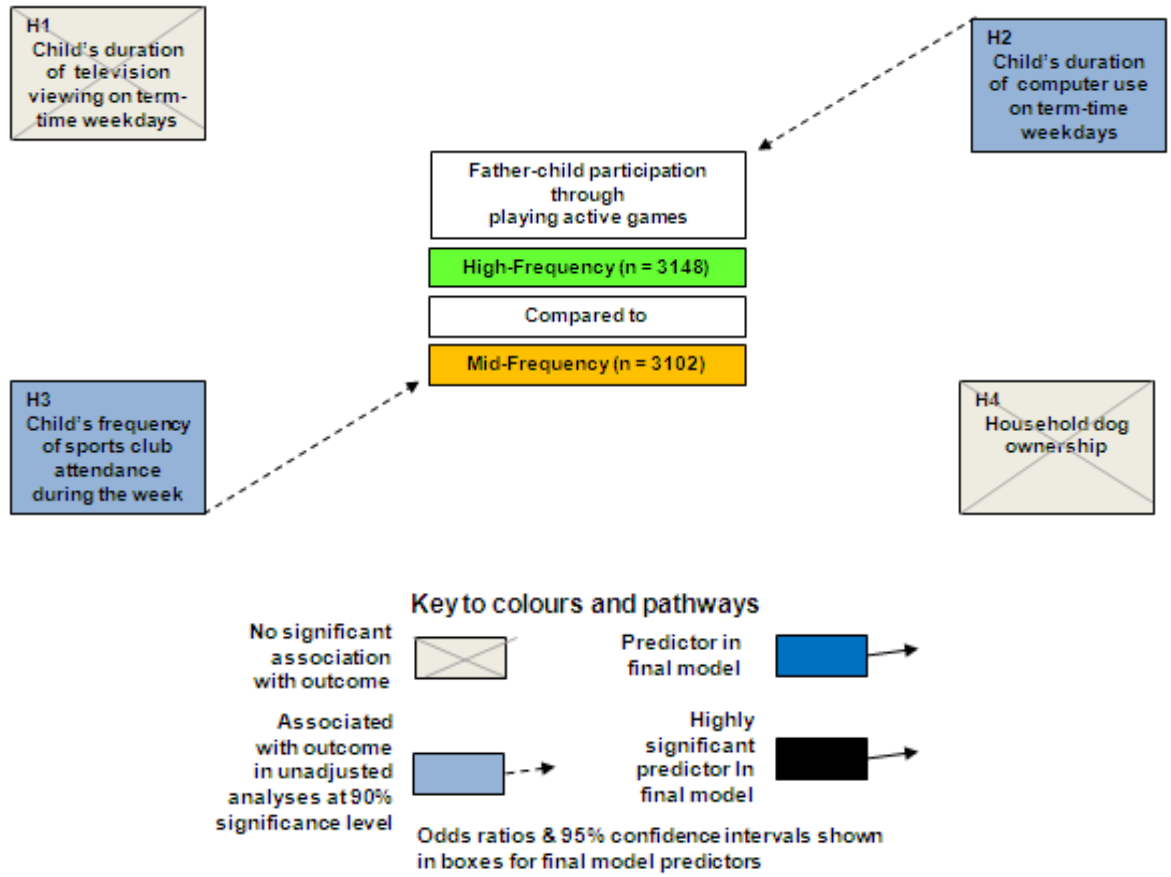
In this sub-section, the relationships between these activity variables and the outcomes for father-child outcomes are investigated, following the same format as the previous sub-section. Multinomial logistic regression analyses were carried out to investigate the four modes of participation and facilitation outcomes, using the adjusted models presented in Chapters 6. Tables showing the results from the four sets of analyses are presented on the following pages, together with descriptions.

Table 5-32 on page 199 provides a synthesis of the four sets of analyses.

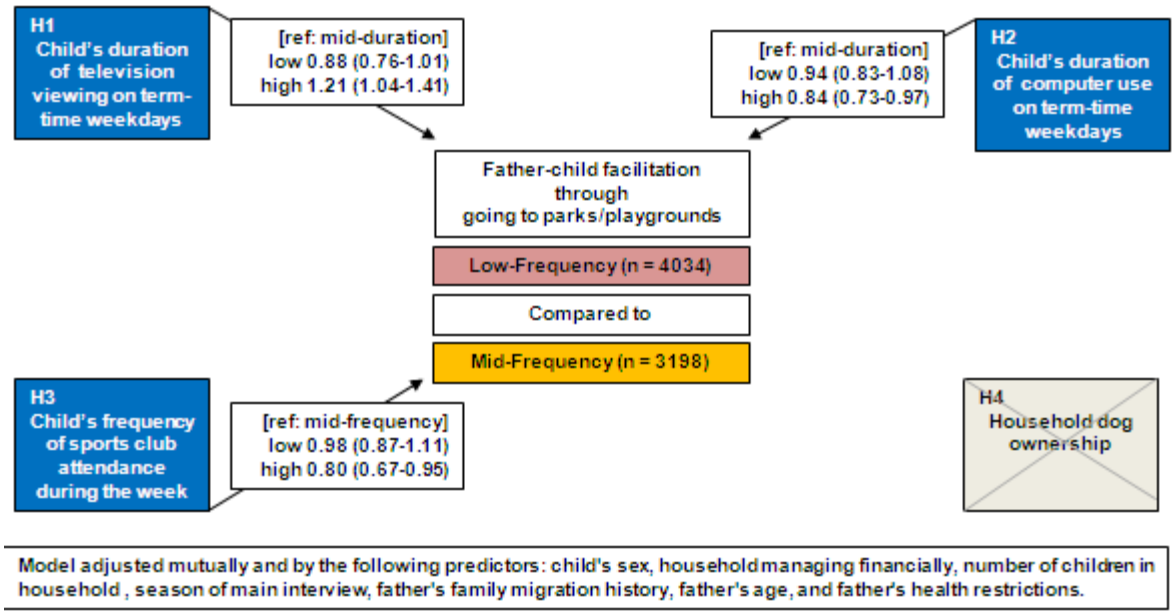
5-28. Logistic regression model flow diagram for other activities in the model for father-child low-frequency compared to mid-frequency participation through playing active games. Constructed from results from Table A 46 on page A/75.



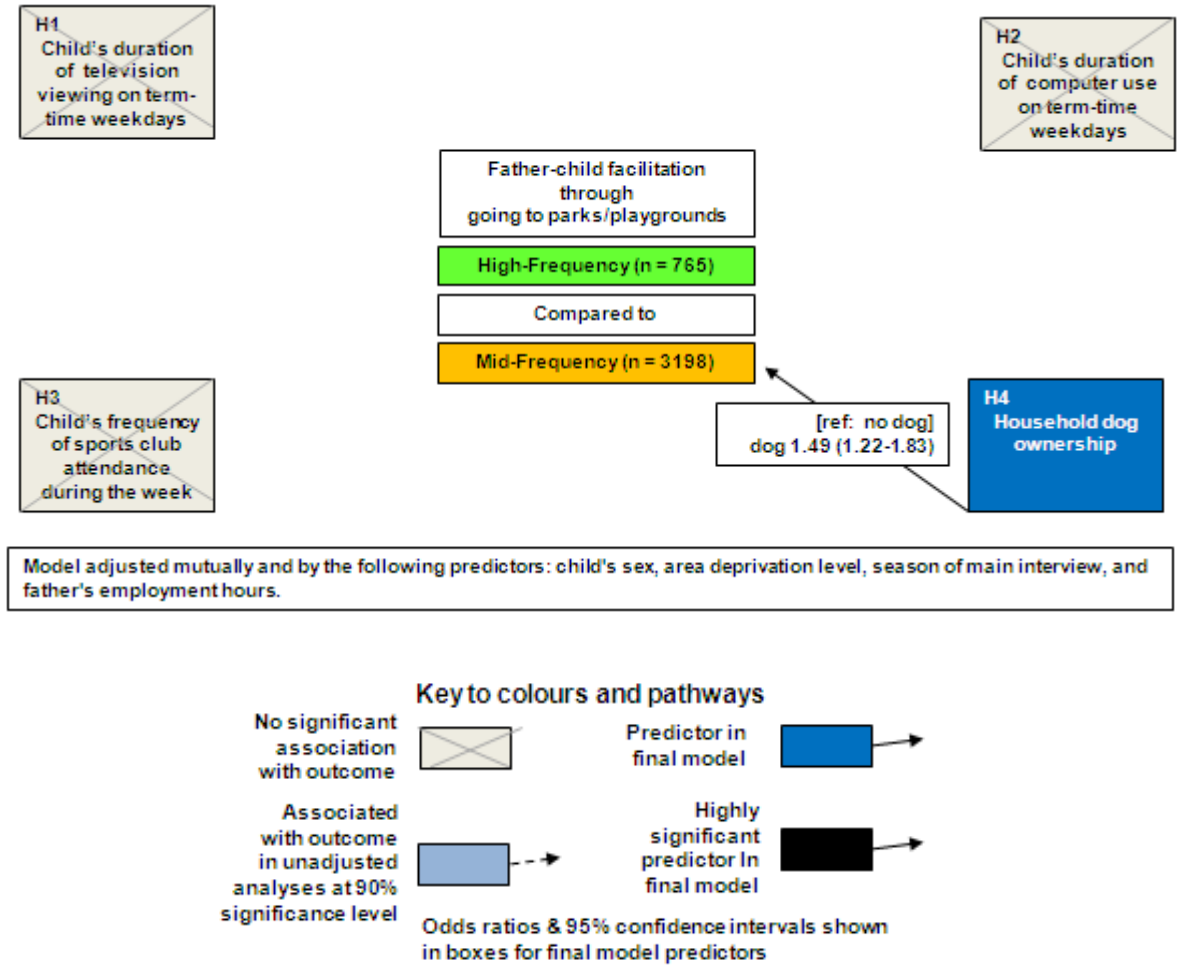
5-29. Logistic regression model flow diagram for other activities in the model for father-child high-frequency compared to mid-frequency participation through playing active games. Constructed from results from Table A 47 on page A/76.



5-30. Logistic regression model flow diagram for other activities in the model for father-child low-frequency compared to mid-frequency facilitation through going to parks/playgrounds. Constructed from results from Table A 48 on page A/77.



5-31. Logistic regression model flow diagram for other activities in the model for father-child high-frequency compared to mid-frequency facilitation through going to parks/playgrounds. Constructed from results from Table A 49 on page A/78.



5-32. Summary table of the predictors of father-child involvement in active play, for child's other activities variables

Father-Child Involvement in Active Play (Two parent families)	Participation ('active games')		Facilitation ('park/playground visits')		Key to coloured rings. Variable has..... no significant association with outcome; unadjusted association (at 90% significance); adjusted association (at 95% sig.); statistically strong adjusted assoc. (OR ≥1.5 or ≤0.67, 99% sig.)	
	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Low-freq compared to Mid-frequency	High-freq compared to Mid-frequency	Importance	Short description of adjusted model findings
H. Other Activities						
H1. Child's television viewing on term-time weekdays					Level 3	High-frequency television viewing associated with increased likelihood of low-frequency park/playground visits.
H2. Child's computer use on term-time weekdays					Level 3	High-frequency computer use associated with decreased likelihood of low-freq park/playground visits.
H3. Child's sports club attendance each week					Level 2	Low-frequency sports club attendance associated with increased likelihood of low-frequency active games. High-frequency sports club attendance associated with decreased likelihood of active games & park/playground visits.
H4. Household dog ownership					Level 3	Dog ownership associated with increased likelihood of high-frequency park/playground visits.

Level 1: Statistically strong predictor **&** in multiple adjusted models
Level 2: Statistically strong predictor **or** in multiple final models
Level 3: Predictor in a one adjusted model, but not statistically strong
Level 4: Associated in unadjusted analyses but in no adjusted models
Level 5: Not associated with any of the outcomes.

The findings on the four activity variables have been sorted into two levels of importance, from the criteria set out in Chapter 4 (from page 136). None were found to be at level 1, 4 or 5.

Level 2: Child's other activity predictors which were either statistically strong in one final model or in multiple final models (father-child)

Child's Sports Club Attendance

Compared to children who attended sports clubs on one or two days a week, children who attended less than one day a week were 20% more likely and those who attended three or more days a week were 37% less likely to have low-frequency participation through playing active games with their fathers. Children who attended sports clubs on three or more days per week were also 25% less likely to have low-frequency park or playground visits with father.

Level 3: Predictors which were in one of the single final models, but were not statistically strong (father-child)

Child's Television Viewing

Children who watched at least three hours of television on term-time weekdays were 21% more likely than those who watched between one and three hours to have low-frequency park or playground visits with their fathers.

Child's Computer Use

Children who used a computer for at least one hour on term-time weekdays were 19% less likely than those who used a computer for less than one hour to have low-frequency park or playground visits with father.

Household Dog Ownership

Children living with a dog were 49% more likely than those with no dog to have high-frequency park or playground visits with their fathers.

5.5. Chapter Summary

Key findings on mother-child and father-child involvement in active play

The analyses presented in this chapter provides strong evidence to suggest that the number of siblings children live with and their mother's/father's health restrictions are both important influences on the frequency of involvement in active play they experience with their parents. Additionally, there was strong evidence that child's ethnicity has an impact on involvement with mothers, and that child's gender has an impact involvement with fathers.

Specifically, the findings suggest that:

- Mothers and fathers with more children are involved less frequently with their child through active games and park/playground visits than parents with only the one child.

- For some mothers and fathers, their health is likely to impact on their involvement through playing active games and going to parks or playgrounds with their children. For other mothers, increased health problems may be associated with more frequent opportunities for play together.

- Children in Pakistani, Bangladeshi and Black African ethnic groups have lower frequency active games with their mothers than white children. Children in the Indian ethnic group have higher frequency park and playground visits with their mothers than white children.

- Boys have higher frequency of physically active play opportunities with their fathers than girls, both through playing active games together and going to parks or playgrounds together.

Other findings on mother-child involvement in active play

There was fairly strong evidence to suggest that a child's gender, their disability status, how the household is managing financially, the mother's opinion of area, the area deprivation level, mother's employment, season of interview, television viewing, sports club attendance and dog ownership have some impact on mother-child involvement in active play. Here, findings suggest that:

- Boys have more active involvement with their mothers than girls through playing games, but there is no difference in frequency of park and playground visits.

- Children with disabilities have more frequent involvement with their mothers through active games and park/playground visits than children without disabilities.

- Mothers who report that they are having financial difficulties have higher frequency park and playground visits with their child, yet are less likely to have frequent participation through playing active games with them.

- Mothers who think their area is excellent for children demonstrate greater frequency of involvement through playing actively and taking their children to parks/playgrounds than mothers who think it is less than excellent.

- Mothers living in poorer areas are more likely to have experience high-frequency involvement through active games and park/playground visits with their children, but also have an increase in likelihood of low-frequency active games.

- Mothers who work four or more days per week have less frequent involvement through active games and park/playground visits than those who are not working.

- Mothers interviewed in traditionally warmer months are more likely to report higher frequency active games and playground visits.

- Children who watch fewer hours of television each day are more likely to experience higher frequency involvement with their mothers through active games and park or playground visits.

- Children who attend more sports clubs each week play active games and go to park or playground more frequently with their mothers.

- Children in households with a dog go to parks or playgrounds and play active games more frequently with their mothers than those without a dog.

There was weaker evidence to suggest that child's age, access to motor vehicles in the household, the age the mother left education, mother's family migration history, mother's age at interview, and child's duration of computer use are predictors of mother-child involvement in active play.

Although associated with the mother-child outcomes in unadjusted analyses, the evidence suggested that the number of parents/carers, mother's socio-economic status at age 14, her age and her marital status are not important predictors.

Other findings on father-child involvement in active play

There was fairly strong evidence to suggest that child's ethnicity, how the household is managing financially, the level of area deprivation, father's employment status, father's age, season of interview, sports club attendance and dog ownership all have some impact on father-child involvement in active play. The findings on these factors suggest that:

- Bangladeshi children and Pakistani children have lower frequency active games with their fathers than white children.

- Fathers in households which are considered by the mother to be in more financially difficulties experience lower frequency active games together, and possibly also lower frequency park or playground visits.

- Children living in poorer areas have lower frequency active games with their fathers, but are more likely to have high-frequency visits to park or playgrounds with them.

- Fathers who work a greater number of hours are less likely to facilitate active play through high frequency park or playground visits than those who are not working.

- Older fathers experience less frequent involvement through active games and park or playground visits than younger fathers.

- Higher frequency involvement is more likely to be reported by fathers where interviews take place in warmer seasons.

- Children who attend more sports clubs each week play active games and go to park or playground more frequently with their fathers.

There was weaker evidence to suggest that child's age, access to motor vehicles in the household, the age the father left education, father's family migration history, child's duration of television use, child's duration of computer use and household dog ownership are predictors of father-child involvement in active play.

Although associated with the father-child outcomes in unadjusted analyses, the evidence suggests that mother's opinion of area and father's socio-economic circumstances at age fourteen are not important predictors. There was no evidence to suggest that child's disability status and father's marital status are associated with frequency of father-child involvement in active play.

Relationships between factors

Further analyses among two-parent households suggested that the predictors of mother-child and father-child involvement are very similar, but there were some differences. Namely:

Boys may be more likely to have high frequency active involvement with their parents than girls, but these inequalities may be more may be wide-ranging for involvement with fathers than mothers.

Inequalities according to child's disability were only evident for mother-child involvement.

Among mothers, second generation migrants were more likely than third (or more) generation to have low-frequency park/playground visits whereas among fathers the association was reverse: third (or more) generation were more likely than second generation.

Low frequency active games were most likely among older fathers and younger mothers.

There was also evidence from further analyses which showed that revealed different modes of involvement were highly related. Frequency of park/playground visits was a strong predictor of frequency of physically active play for both mothers and fathers. Within the two-parent family sample mother's active involvement was found to be highly predictive of father's active involvement.

In the next chapter, the findings from this chapter are discussed in the context of previous research.

Chapter 6.
Discussion and Conclusions to the Thesis

Chapter 6
Discussion and Conclusions to the Thesis

The final chapter is divided into four main sections.

A short summary of what the thesis involved.

Drawing on the whole thesis, some of the main strengths of the research are given, as well as some of the limitations.

This section looks at the results from the analyses of the MCS, and puts these in the context of published contemporary research.

Some ideas are presented on what sort of research could follow this thesis to build on the findings..

6.1. Summary of the research process

This research was developed jointly in collaboration with Play England. It was designed to investigate inequalities in some aspect of children's play or play-related health, using secondary data analyses. The first challenge was therefore to identify a concise thesis aim related to inequalities in children's play which previous research suggested was important and under-studied *and* which could be addressed using an existing UK dataset. Informed by a review of literature, government policy in England and investigation of relevant UK surveys, the thesis was chosen aim as:

To investigate inequalities in parent-child involvement in active play

The Millennium Cohort Study (MCS) was chosen as a data source for the main analyses. It contained data about children, their families and the areas in which they lived, which provided broad indicators of parent and child involvement in physically active play: frequency of mother-child and father-child playing active games (participation); and frequency of mother-child and father-child going to parks or outdoor playgrounds (facilitation).

Guided by the literature review presented in Chapters 2 and 3, a range of dimensions of inequality were investigated using measures available in the MCS. The selection of measures and construction of variables were described in Chapter 4, together with methods of the analysis. The analysis focused on identifying significant predictors of children's high-frequency (more than twice a week) and low-frequency (less than once a week) engagement in active games and visits to parks or outdoor playgrounds with their mothers and fathers. The main findings from the analyses were presented in Chapter 5**,** with detailed descriptions of the results and tables in the appendices.

As well as the overall thesis aim, there were four further aims which are addressed on the following page.

The topic was important to children

Through identifying children's views of parental involvement in their physically active play in qualitative research, it was evident that this was a topic which was important to many children. They spoke about the activities they enjoyed doing with their families and had strong views on the ways in which they wanted their parents to help them.

There was a need for new quantitative research on the topic

The literature review revealed that there was little previous quantitative research on inequalities in parent-child involvement in active play. Just eight relevant primary quantitative studies published were identified in the literature review, and these looked mainly at parent-child involvement in general physical activity rather than play. Five literature review were included in the review which identified further quantitative studies, but the majority of these did not investigate parent-child involvement in active play either. Although a range of factors were investigated across these studies, each factor was only usually in one or two studies.

A relevant dataset and methodologically strong approaches were used

The measures included in the analyses of the MCS were informed by background evidence, mainly from qualitative studies, The method of multinomial logistic regression took account of the complexity of relationships between potential predictors. Although there are more complex techniques which involve identifying the pathways which exist between different factors, this method was considered appropriate for a preliminary analysis of parent-child participation in physically active play using the MCS study.

Original research was undertaken

As far as the author is aware there has been no previous detailed analyses of parent-child involvement in active play using the MCS. Original methods for presenting the analyses were devised: the analyses of weighted proportions and the logistic regression model flow diagrams were designed to convey the results to readers in a more visual and imaginative way than the standard format of tables. The method of assigning variables to a level of importance

based on their statistical significance and the number of models in which they were significant predictors was also devised to aid interpretation of the findings.

The last stages of the research process are discussed in this chapter. In the following section, strengths and limitations of the research are discussed.

6.2. Strengths and limitations of the research

This research was primarily a quantitative project, but was informed by a number of previous studies that used qualitative methods. Such an approach is recognized to be a useful way of cross-checking findings, as well as adding depth to research (Ritchie and Lewis, 2003). Using child-centred qualitative research to guide the selection of factors to include the regression models, and returning to that research again in the interpretation of the results (in section 6.3.), helped to ground the quantitative analysis in an appreciation of the importance that children attach to their play.

In this section several strengths and limitations of the thesis are discussed.

Strengths of using the MCS

The quantitative component of the research benefited from the use of a large sample size, with data from over twelve thousand families from across the UK included in the analyses. The MCS was designed to include a higher proportion of families living in more disadvantaged areas and in ethnically diverse areas which is likely to have improved the representation of children from poorer and ethnic minority backgrounds. This approach may have enabled the sample sizes for some groups to be large enough for significant results to emerge than would have otherwise been possible. The analyses were weighted so they took account of this sampling strategy, and showed results which were likely to be representative of four to six year olds and their families in the UK population.

As well as being large with respect to sample size, the dataset was also large in terms of the number of measures which were available, enabling a range of variables to be investigated which had been identified as potential predictors in the literature review. These variables related to the individual child, their family and the area they lived in, corresponding to the three levels of influence on children's health introduced in Chapter 1. Research indicated that factors relating to an individual's background as well as their current situation could contribute to inequalities (Graham, 2007). Through using data from across the

first three waves of the MCS, it was possible to investigate variables relating to the child's situation at the time of interview, as well as details from their family's past. The approach combined cross-sectional (at the time) with longitudinal (over time) measures.

An advantage of using the MCS study was the 'completeness' of the data within it. Among the families considered eligible for these analyses, the number for whom data were unknown was below 1% for the majority of the variables, with the exception of father's migration history for which the unknown responses were included as a separate category in the analyses. Where demographic data were missing from the most recent wave, in most cases it was possible to gain this from previous waves.

A number of the issues discussed in this chapter relate to sources of potential *bias.* This term refers to any issue occurring during the course of a study which produces findings that are systematically inconsistent with the truth (Grimes and Schulz, 2002). In relation to quantitative studies, it refers to issues which lead to masked or spurious associations between factors, or over or underestimation of the effect sizes. Techniques in statistical analysis are used to minimise bias, although it is impossible the eliminate all sources of bias.

In cohort studies, non-response or attrition among families across the sweeps is a potential source of bias. Using data from the first and second sweeps of the MCS, Plewis (2007b) found differences in characteristics of respondent and non-respondent families. For example, main respondents who did not take part in the second sweep (but had taken part in the first) were more likely than those who took part in the second sweep to be from ethnic minority groups, be younger and have a lower level of education. There are likely to be similar patterns in non-response at the third sweep. Such systematic differences in non-response could potentially contribute to bias in the results. Plewis (2007b) suggests however that the application of their sample weights, as was used in this thesis, goes some way to correcting this issue. A further point made by Plewis (2007b) is that unlike some previous birth cohort studies, the MCS recruited children who were born at all times of year rather than those born in a

particular week. This implies that the sample is likely to be more representative of the whole population of children of this age-group.

It was evident in the background literature involving parents that the majority of study participants were mothers. In most studies, a small proportion of fathers were included; in many, none at all. In the MCS, both a main respondent, and a partner respondent, were encouraged to be interviewed in dual-carer families. The partner interview was relatively short compared to the main interview, and so the fact that it contained the questions on active games and park/playground visits, as well as those relating to their background and situation, was extremely useful. This made it possible for both mother-child and father-child involvement in physically active play to be investigated, which enabled a broader investigation of inequalities. All the fathers included in the analyses were in two-parent families which did limit the generalisability of their results, but additional analyses of mothers in two-parent families enabled some investigation of inequalities according to parent's gender.

Limitations of using the MCS

A limitation of the MCS was that children were not included as study participants, so the results were based entirely on the parents' perspectives. Thus, although this research was a child-focused study, the analyses do not represent what the children thought. Instead, children's perspectives were gained through the literature review and used to inform the analyses. Later releases of MCS data will include the children as respondents, and it will be interesting to see if they are asked questions about their physical activity opportunities with their parents.

As with all studies employing interview or survey techniques, there was the possibility that parents' answers to some of the questions were subject to reporting bias. For example, for the questions on the household financial situation and how good the area was for children, some mothers may have given answers which they (consciously or sub-consciously) felt were most

appropriate, and for some their answers may have been influenced by some recent event. Similarly, the outcome questions on parent-child involvement in play may also have been susceptible to bias, particularly since answers to these questions may have been seen by parents as a reflection of the quality of their parenting practices. If there are social differentials in the tendency to under- or over-report parental involvement – for example, if mothers in more advantaged circumstances are more likely to report high frequency of active play with their children and less likely to report low frequency active play – this will lead to an overestimate of the magnitude of inequalities in children's play opportunities. The literature review did not find evidence of differential reporting; however, the possibility needs to be noted here.

The MCS proved to be a useful data source on children's early childhoods for the majority of children in the UK. However, there were few children living with adoptive, foster or step mothers and fathers, and no cases of children living in institutional care. Due to the small numbers in these groups, the main analyses were limited to children living with their birth mothers, and with their birth fathers in the sub-set analyses. Inequalities in carer-child participation in physically active play involving children in other family circumstances, and among children in care, could be an area for future research, but the MCS is not an appropriate source of data for these groups.

Strengths of the Quantitative Analyses

There was little previous quantitative research identified on inequalities in parent-child participation in active play, and this was the first known investigation of the MCS outcomes on active games and park/playground visits. Thus it was decided to take a broad exploratory approach in order to generate hypotheses for future research. The method of analysis, multinomial logistic regression, enabled low- and high-frequency support from mothers and fathers to be compared to the modal mid-frequency group for each model. The advantage of this approach was that the analysis was sensitive to identifying inequalities at both ends of this 'spectrum'. Since each of the models involved

mutual adjustment of significant predictors, they presented a more comprehensive picture of the inequalities in parental support than would have been the case if only unadjusted analyses had been carried out. The process of adjustment ensured that where associations were explained by other factors, only those with the closest relationship with the outcome remained in the final model.

Many factors were identified as predictors, and so there was a large number of results to report on which initially led to difficulties in presenting the results. It was also likely that, by testing so many variables, a few statistically significant results may have occurred by chance. With these issues in mind, an approach was developed to provide an overall picture of the findings. For each set of four models (i.e. for mother-child involvement, for father-child involvement), each of the variables was assigned to one of five levels of importance based on the strength of its associations with the outcomes and the number of models it was in. The system was designed so that every variable was assigned to a level, even those which were significant only in the unadjusted analysis or not being related to the outcomes at all. This had the advantage that the 'non-significant results' were still flagged up as findings. Although this was a simple method of assessing the importance of variables post-analysis, and may therefore be considered by some statisticians as having little statistical plausibility (Johnson and LeBreton, 2004), it is thought that this would allow the findings to be presented clearly to readers in an original way.

The choice of analysis technique, multinomial logistic regression, was explained in Chapter 4 , Section 4.3. Strengths of this method included its ability to compare different groups, suitability for a large sample size and possible application to future policy decisions.

Limitations of the Quantitative Analyses

Although Multinomial Logistic Regression was considered to be the most appropriate method for the research question, limitations of the method should

also be acknowledged. The method required the outcomes to be categorised into (at least) three groups, but for each analysis only those in two of those groups were included. This means that each model did not take account of the whole sample and by presenting them individually this can obscure the whole picture. This also suggests that the techniques used to weight the dataset so it was representative of the UK population may have led to less accurate results compared to using standard logistic regression. Further to this it is unusual to look at the relationship between all of the outcome groups. For this thesis, high-frequency and mid-frequency, and low-frequency and mid-frequency were compared, but not high-frequency and low-frequency. If this latter comparison was included, this may have led to some interesting findings but the presentation of results would have been more complicated and difficult to follow.

There were also technical issues encountered by using Stata to run the multinomial logistic regression models. For example, the value of R-Squared which is used to guide the model fit in logistic regression was not generated and it was not possible to use automatic step-wise techniques in the modelling process. A more simple process of modelling was therefore undertaken manually. Consequently there may be a greater chance of a mistake occurring due to human error. All models were run twice to reduce the chance of this.

A limitation of all regression analyses is that confounding from unmeasured factors may have occurred. In this case there may have been further predictors, which could potentially have changed the shape of the model if included. It is never possible to include all the factors which influence the outcome: these analyses merely present a simplified illustration of those which are measureable and have been supported by background evidence.

There may have been weaknesses regarding the use of the area deprivation variable. It was based on indices from the four countries in the UK which were combined to form the one variable. Researchers have suggested that since the four countries use different measures, it is not advisable to combine them in this way (Shaw et al., 2007). It was also noted that in some of the regression

models, the area deprivation variable had a particular strong influence in contributing to variables relating to the child and family to be dropped. Yet the child and family variables may be more informative predictors.

It is recognized that the outcome variables give a general and somewhat limited indication of the nature of parent-child involvement in physically active play. The background research indicated that children do not always appreciate their parents being actively involved in their play, and consequently parental involvement can lead to an activity not being fun for children. A parent accompanying their child to a park or playground could, on one hand, indicate that the parent is being active in providing instrumental support, but on the other hand may indicate restriction of the child's autonomy. It is possible therefore that these indicators do indeed always represent what a child considers as important.

The outcome measures were also limited in that they only addressed frequency of active games and park/playground visits. It is likely that many mothers and fathers in the study dedicated particular days, for example at the weekend, to their family and may have spent long durations during those period playing actively with their children, or being in parks or playgrounds together. This study therefore indicated the inequalities of 'how often' parents and children are involved in active play together , but unfortunately could not provide any insight into the inequalities of 'how much'. This is something that could perhaps have been investigated through prospective activity diaries as a component or nested study within the MCS.

Limitations of the Overall Approach

The term 'mixed-methods' is used to refer to the integration of qualitative and quantitative data within a study (O'Cathain and Thomas, 2006). Qualitative research was included in the form of secondary information through the literature review, but this was of course constrained to the factors that other researchers had investigated. Using a mixed-methods approach in data

collection may have enabled a more focused and detailed enquiry into inequalities in parent-child involvement in play. Different study designs are suited to answering different types of question, and can be used together to allow for a more rounded picture (Greenhalgh and Taylor, 1997). The quantitative component of this thesis using the MCS was concerned with investigating whether inequalities in parent-child involvement in active play existed; an additional primary qualitative component would, for example, have allowed for exploration of the reasons why these inequalities were found.

On Table 3-1 on page 57 (Chapter 3) four reasons were presented based on O'Cathain and Thomas's work (2006), on why this study is likely to have benefited from the mixed-methods literature review. These related to hypothesis generation, generalisability, interpretation and richness. The same reasons are applicable to why the thesis may have benefited from a mixed-methods approach to data collection. Further to this, O'Cathain and Thomas refer to the consideration of the order of different components in a mixed-method study, proposing three different approaches: sequence of two methods, an iterative process, or concurrently. Table 6-1 has been produced to illustrate five research scenarios, demonstrating how this study may have benefited from these different mixed-method approaches. Time constraints however prevented these from being viable options. It is thought that the process of design, ethical approval, recruitment, data collection, analysis and integration of findings for a primary study would have taken at least a further two years. There may however be scope for a further qualitative and/or quantitative components to be carried out in the future to add to this research – for example through approaches 2 or 4 in Table 6-1.

6-1. Table illustrating five mixed-method scenarios

1. Sequence of two methods (qualitative then quantitative)		
Focus groups with children to investigate their views on their active play opportunities with their parents and to develop hypotheses.	MCS analysis designed to test hypotheses.	
2. Sequence of two methods (quantitative then qualitative)		
MCS analysis to explore broad range of inequalities in parent-child involvement in active play.	Semi-structured interviews with parents and children designed to further explore interesting findings.	
3. Interactive process (qualitative, quantitative, qualitative)		
Focus groups to develop hypotheses	MCS analysis to test hypothesis.	Semi-structured interviews to explore interesting findings
4. Interactive process (quantitative, qualitative, quantitative)		
MCS analysis to explore broad range of inequalities	Semi-structured interviews to explore interesting findings, and to generate further hypotheses,	Further quantitative analysis (MCS or primary) to investigate further hypotheses.
5. Concurrently		
Interviews with children and parents, including collection of in-depth quantitative and qualitative data. Different types of data brought together in analysis, and patterns explored.		

6.3. Findings on inequalities in parent-child involvement in active play, in the context of previous literature

The main findings from the analyses are presented here under ten headings, and discussed with reference to studies from the literature review and to other contemporary research:

- Mothers and Fathers
- Boys and Girls
- Siblings
- Child's Ethnicity
- Health and Disability
- Socio-economic Factors
- Parents' Employment
- Parents' Age
- Season of Interview.
- Other Activities

Mothers and Fathers

Making comparisons between mothers and fathers was not a focus of this study, due to the differences between the datasets for the main analyses of mothers and fathers. Four factors - child's gender, child's disability status, parent's migration history and parent's age – emerged as having differing levels of statistical importance between mothers and fathers. These are discussed in more detail in the following sections, in which findings for mother-child involvement and father-child involvement are presented together.

Boys and Girls

The findings from the main analyses suggested that boys tend to get more opportunities than girls to play actively with their mothers, and there was also strong evidence for this trend in father-child involvement among two-parent families. Background evidence suggested that boys tend to be more physically active than girls (Sallis et al., 2000, Hinkley et al., 2008), thus we would expect that this factor would have important contribution to such gender differences. Parents may be more likely to play actively with boys because boys are generally more active. Parental behaviours may also be shaped by expectation

that boys should or want to be more active (Goodway and Smith, 2005).

There was also indication among two-parent families that boys are more likely than girls to go to parks and outdoor playgrounds with their fathers, suggesting that fathers differentiate between their sons and daughters in their instrumental support. In contrast, there were no significant gender differences for park and outdoor playground visits with the mother. This suggests that, although mothers may be less likely to join in actively with girls, they provide similar informal play opportunities through park and playground visits for both boys and girls. Evidence from previous studies suggested that boys receive greater instrumental support from parents than girls, but did not identify differences between fathers and mothers for this factor (Gustafson and Rhodes, 2006).

Siblings

There was strong evidence in the analyses to suggest that children with a greater number of siblings have fewer active play opportunities each week with their mothers and fathers. Background research offered an explanation for this finding: parents may not feel that they are required to join in play if they have children who play together and may also experience other barriers as a consequence of caring for more children (Irwin et al., 2005, McGarvey et al., 2006, Brady et al., 2008, Wright et al., 2008, Lopez-Dicastillo et al., 2010).

Child's Ethnicity

There was strong statistical evidence to suggest that, compared to white children, Pakistani, Bangladeshi and Black African children have increased likelihood of low frequency active games with their mothers, and Indian children have decreased likelihood of high frequency park or playground visits with their mothers. Among two-parent families, Pakistani and Bangladeshi children are also more likely to experience low frequency participation with their fathers through active games. Previous research has suggested that there are inequalities in children's and parent's physical activity behaviours according to

ethnicity (Gustafson and Rhodes, 2006), which may offer some explanation for these results. Apart from the previous analysis on fathers from the second sweep of the MCS which showed similar findings (Dex and Ward, 2007), no other quantitative studies were identified which have investigated ethnicity-related predictors of children's play opportunities with their parents. It seems likely that these variations will be related to a range of factors linked to ethnicity, including differences in parenting practices between groups (Hofferth, 2003, Barn et al., 2006, Phoenix and Husain, 2007). Migration history of the parents was also investigated but did not emerge as particularly important predictors for either mother-child or father-child involvement in active play.

Health and Disability

Some of the statistically strongest, but less surprising findings, were that children generally have lower frequency active games and park/playground visits with mothers and fathers who have self-reported health restrictions. What was more surprising however, was the finding that children with mothers who report high health restrictions on activities are more likely than those with no restrictions to engage in high frequency active games together. No evidence or theory has been identified to offer an explanation for this finding. It does seem likely that mothers experiencing greater health restrictions spend less time away from their home, and therefore have increased time available to play with their child.

There was strong evidence in the analyses to suggest that, in the general population and in two-parent families, children with disabilities have more frequent physically active play opportunities with their mothers, for both active games and park/playground visits. In contrast, there was no evidence to suggest that frequency of father-child involvement is any different between children with and without disabilities in two-parent families. Some research was identified in the literature review in which the physically active play opportunities of siblings with and without disabilities were compared (Mactavish et al., 1997). The parents in this study reported giving greater active play time to their

disabled children. There were no studies identified that compared children with and without disabilities from different families, and no studies which made comparisons between mothers' and fathers' involvement with children with disabilities. It is possible that mothers of children with disabilities have a particularly high awareness of the benefits of spending time playing with their child and may have the benefit of receiving specialist support and advice. Further analyses on the data suggested that children with disabilities were less likely than those without disabilities to attend sports clubs. It is possible that this factor has some impact on active involvement with mothers.

Socio-economic Factors

Several different socio-economic measures were included in this study, relating to the household and parents' situation at the time of interview as well as in the past. The findings suggested that generally factors relating to the current situation were better predictors of engagement in active games and playground visits than those relating to the past.

One of the main findings was that children in families in the most disadvantaged situations, defined by mother's opinion of the household's financial situation and affluence of area, may have higher frequency park and playground visits with their mothers. Similar patterns were seen in the study according to affluence of area for fathers in two-parent families. These was in contrast to findings from another cohort study in England, ALPSAC, which reported that children of lower socio-economic circumstances measured by occupation of the father, had fewer visits to parks each week at seven years of age (Propper and Rigg, 2007). Research has not found the availability of parks and playgrounds to differ significantly between more and less advantaged areas (Moore et al., 2008) although there is suggestion that the quality and safety of playgrounds may be worse in more deprived areas (Cradock et al., 2005, Ellaway et al., 2007). Families in different socio-economic circumstances may have different strategies for helping their children to play actively: providing instrumental support by going regularly to a park or playground may be favoured to a greater

extent by more disadvantaged families because they have limited options for other activities (McNeill et al., 2006). Parents who are better off financially may, for example, have more space and a garden for their children to play at home (Evans, 2004), have easier access to other play locations, and have greater preferences for organised activities for their children (Sidebotham, 2001, Hart et al., 2003).

Children in families in more disadvantaged situations were found to have increased likelihood of lower frequency active games with their mothers and fathers. The inequalities in the physical environment of advantaged and disadvantaged families noted above may mean that playing actively with their children is given less weight in the culture of disadvantaged families. In addition, adults from poorer backgrounds may be less likely to take part in physical activity themselves (Lindström et al., 2001), which may impact on how often they join in actively with their children. Evidence also suggests that some families may feel restricted in play together due to the financial cost of activities (Sidebotham, 2001).

Combining the findings on active games and park/playground visits with parents points to an interesting contrast with more disadvantaged families being more likely to go to parks and playgrounds, but less likely to play actively together. No other studies have been identified which have investigated these factors together.

Parents' Employment

There was indication that lower frequency involvement through active games and park/playground visits are particularly likely among mothers in full-time employment. Among two-parent families, children with fathers in full-time employment are also less likely to have high frequency playground visits together. These were not surprising findings, since these parents are likely to have less time to spend caring for their children and therefore fewer opportunities for play together. This is supported by previous research, which

indicated that mothers and fathers in employment feel they have less time to give to activities as a family (Mulvihill et al., 2000, McGarvey et al., 2006).

Parents' Age

The findings suggested that, among two-parent families, children are more likely to have low frequency active play and parks and playground visits with older fathers. Previous evidence suggests that physical activity tends to decline with age, especially for males (Sallis, 2000), which may provide some explanation for this finding. There was no evidence identified in the literature review however on the relationship between parent's age and involvement in active play with their children. A hypothesis could be that older fathers are more likely to live in a property where they have access to a garden, and perhaps there is less motivation for visiting parks and playgrounds: this could be explored further using the MCS data. Perhaps going to parks and playgrounds and playing actively is a more important part of the culture of younger fathers. Although mother's age was not found to be a predictor of involvement in the main models, this factor did emerge as significant in the models for two-parent families. In contrast to the findings for fathers, younger mothers were more likely to have low-frequency involvement.

Season of Interview

Looking beyond measures of social inequality, season of interview also emerged as an important factor in the analyses. Higher frequency physically active play opportunities were more likely to be reported when interviews took place in generally warmer months. However, it is not appropriate to draw any conclusions about differences between play opportunities in different seasons since the MCS questions on active games and park/playground visits did not specify a reference period for which the respondents should answer. It seems likely from the results that many respondents drew on their most recent experiences. Seasonal differences in outdoor play opportunities have been reported by children and parents in previous studies (Irwin et al., 2005, Brady et

al., 2008, Pearce et al., 2009). The findings point to the potential variability of responses according to when the interview takes place. It is also possible that the day of the week, time of day and weather conditions around the time of the interview had some impact on responses.

Other Activities

To explore further of how social inequalities may be related to parent-child involvement in active play, additional analyses were undertaken on the contribution of other activities, both sedentary (television viewing and computer use), and non-sedentary (going to sports clubs and owning a dog). These activities are also socially patterned, and in addition, they are associated with the parental support outcomes.

The evidence indicated that children who watch fewer hours of television each day (on term-time weekdays) are more likely to experience higher frequency involvement with their mothers through active games and park or playground visits. There was some support for this finding: a systematic review of quantitative studies indicated that greater television viewing was associated with lower physical activity among children (Marshall et al., 2004). There was weak evidence from the analyses to suggest that frequency of children's computer use may be associated with increased facilitation from mothers through going to parks or playgrounds, but no background evidence was available to support this finding.

There was fairly strong evidence to suggest that children who attend more sports clubs each week play active games and go to park or playground more frequently with their mothers. The findings were similar for involvement with fathers in two-parent families. It seems likely that parents who encourage high-attendance at sports clubs will be particularly enthusiastic about physical activity. No background evidence was identified in the reviews to corroborate these findings.

Finally, the analyses also suggested that having a dog was related to mother-child involvement in active play: children in households with a dog were found to go to parks/ or playgrounds and play active games more frequently with their mothers. Among the two-parent families, children with dogs also went to parks or playgrounds more frequently with their fathers. Evidence was identified to suggest that dog ownership may be related to people's physical activity due to taking them out for walks (Mulvihill et al., 2000, Veitch et al., 2006, Cutt et al., 2007, DCSF, 2008a). Although these findings may be considered by some as quirky and not for serious consideration for further research, it seems likely that this is the sort of research that children will be interested in.

6.4. Ideas for further research

This thesis was an investigation of inequalities in parent-child involvement in physically active play when children are aged four to six years. It was the first known study on this topic using data from the Millennium Cohort Study, and aimed to provide an overview of potential factors which impact on the outcomes of active play and park/playground visits. This final section of this thesis discusses the possibilities of future research using the MCS and other sources, to further develop research in this area.

Further analyses using the MCS

An important finding in this research was the relationship between the number of siblings a child lives with and the frequency of involvement with their parents. This area could be further researched using the MCS, through investigating in more detail how the ages and gender of the siblings may lead to differing findings in relation to the parental involvement. Siblings are not often considered as a factor which would be important in relation to health inequalities, so this could be are area to develop. As well using the physically active play outcomes, it would be interesting to also investigate the other five 'how often…' questions on reading, telling stories, doing musical activities, being creative, and playing with toys or games indoors. Through investigating these, it may be possible to find differences and similarities between the predictors of parent-child involvement for different types of activity.

Being a longitudinal study, the MCS is likely to offer ongoing opportunities to further investigate children's physically active play. Three different approaches to longitudinal research could be possible. One approach could involve taking predictor data at say 9 months, and investigating an outcome at 15 years. This may enable the process of cause and effect to be better investigated than with this research, which included mainly cross-sectional and as well as a few 'historical' variables relating to the parents. A second approach could be to look at predictors of change in the parent-child involvement outcomes over time, if these questions are repeated in subsequent waves. For example, some

children may 'migrate' from having high-frequency to low-frequency participation or facilitation, and it could be possible to investigate what factors this is attributable to. Thirdly, the impact on outcomes of changes in family circumstances could be investigated. So, for example, parental break-up and formation of new relationships could be examined to see if these impact on involvement in active play.

Qualitative Research

This study benefited from previous qualitative research which informed the quantitative models. As discussed previously, a useful and interesting follow-up to this research would be to carry out a qualitative study in order to gain further understanding of the issues relating to the findings. No background research was identified relating to some of the quantitative findings, and so a new study could be designed to try to fill in some of these gaps. If a large enough study was carried out, it could aim to include mothers, fathers and children from a range of backgrounds and circumstances in order to capture a variety of perspectives. In most of the background research reported on in this thesis, data were collected from either parents or children. If both parents and children were included in a study, they tended to take part in separate interviews or focus groups from each other. A more appropriate and child-friendly approach for this area of research could involve creative 'physically active' methods. For example, drawing inspiration from Darbyshire et al.'s (2005) jumping focus groups, parents and children could discuss topics with a researcher alongside having an opportunity to participate in active games together. This would provide a context for the discussion whilst being inspiring and fun for the families taking part.

Appendices

List of Tables, Figures and Charts in the Appendices

Appendix for Section 3.2

Search Strategies

OVID

(Parent-Child Relations/ OR Mother-Child Relations/ OR Father-Child Relations/ OR Child/ OR (child$ or parent$ OR mother$ OR father$).m_titl.)

AND

("Play and Playthings"/ OR Exercise/ OR Sports/ OR (play OR physical activi$ OR sport$ OR exercise).m_titl.)

Restricted to 1998-2009

Number of studies generated (on 21/01/2010): 7344

EMBASE (via OVID)

(Child/ OR parent/ or child parent relation/ OR (child$ or parent$ OR mother$ OR father$).m_titl.)

AND

(play/ OR physical activity/ OR exercise/ OR sport/ or "sports and sport related phenomena"/ OR (play OR physical activi$ OR sport$ OR exercise).m_titl.)

Restricted to 1998-2009

Number of studies generated (on 21/01/2010): 7355

British Library Integrated Catalogue

Search for ‘any word’, restricted to 1998 to 2009

Parent-child (98 results); Play and Parent (60); Play and Inequality (5); Play and Socio-economic (0); Play and Employment (12); Play and Income (3); Play and Poverty (6); Play and Disability (8); Play and Ethnicity (9); Play and Culture (258); Play and Migration (5); Play and Age (68); Play and Gender (75); Play and Sex (66); Play and Health (89); Play and Safety (65); Play and Risk (30); Physical Activity and Parent (6); Physical Activity and Child (5); Physical Activity and Inequality (0); Physical Activity and Socio-Economic (3); Physical Activity and Employment (6); Physical Activity and Income (2); Physical Activity and Poverty (0); Physical Activity and Disability (10); Physical Activity and Ethnicity (1); Physical Activity and Culture (13); Physical Activity and Migration (0); Physical Activity and Gender (12); Physical Activity and Sex (4); Physical Activity and Health (214); Physical Activity and Safety (15); Physical Activity and Risk (38).

Quality criteria for studies to be included in literature review

Adapted from Spencer et al.'s framework for assessing qualitative evaluations (Spencer et al., 2003), the STROBE checklist for epidemiological studies (Von Elm et al., 2007), and further reading (Ritchie and Lewis, 2003, Pope and Mays, 2006)
Criteria number 1 was required for all studies, and at least 16 of the other 20 criteria required to be 'Yes' for inclusion in the review.

	Qualitative Research	**Quantitative Research** (Epidemiological)	**Y/N**	**Notes**
Publication				
1.	Is the study published in a peer-reviewed journal or within/in collaboration with a recognised research body or organisation?			
Background and ethnics				
2.	Is background evidence and rationale for the study given?			
3.	Is it stated that ethical approval was gained? If not, were consent forms completed and anonymity preserved?			
Basic study details				
4.	Is the approximate date range of the study given?			
5.	Is the geographic area in which the study took place given or described?			
6.	Is there description of the methods of approach and recruitment?			
7.	Are reason(s) for aspect(s) of the sample selection given?			
8.	Are the numbers of participants at each stage of the study given?			
9.	Are characteristics of study participants described?			

Continued on following page

Continued from previous page

	Qualitative Research	**Quantitative Research** (Epidemiological)	**Y/N**	**Notes**
Data Collection and Analysis				
10.	Are the procedures used for collection, recording and measurement of data described (for each variable in quantitative studies)?			
11.	Are reason(s) for aspect(s) of the data collection methods given?			
12.	Are the methods of analysis described?			
13.	Are reason(s) for aspect(s) of the analysis methods given?			
14.	Are the results from the analyses clearly presented and explained?			
15.	Is there presentation of illuminating textual extracts/observations?	Are the measures used in the analyses (e.g. predictors, outcomes, potential confounders) clearly defined and justified?		
16.	Are conceptual links made between commentary and presentation of data?	Is sufficient detail from the analyses presented, according to the commentary?		
17.	Is there description and illumination of diversity/multiple perspectives/alternative positions?	Is there discussion on missing data and how this was addressed?		
Discussion				
18.	Is there discussion of findings with possible explanations, in the context of previous evidence?			
19.	Is generalisability/transferability of findings to a wider population discussed?			
20.	Apart from generalisability/transferability, are any limitation(s) of the study given?			

Literature Review Quality Appraisal

Adapted from Pope et al. (2007, p181) ‘Questions to ask of a review for policy and management.’

1. Is the aim of the review clear?

2. Are the methods explicitly and comprehensively described?

3. Is each step in the review and adaptation of the protocol clearly justified?

4. Is the search process comprehensible?

5. Is there appropriate fit between questions asked and types/sources of evidence assembled?

6. Are individual studies and other sources critically appraised for relevance and quality?

7. Are appropriate inclusion and exclusion criteria used?

8. Is the choice of synthesis method appropriate?

9. Are the overall conclusions or explanations consistent with the evidence from the synthesis?

Appendix for Section 5.1

Analyses of Weighted Proportions: mother-child participation through playing active games

This section refers to Charts A 1 to A 5 from page A/14.

Child's Characteristics

For active games with their mothers, greater proportions of girls than boys were in the lower frequency group. Compared to white children, children in minority ethnic groups were more often in the low-frequency group: this was most apparent for Bangladeshi, Pakistani, and Black African children. Younger children and those with a disability were more likely to be in the high- frequency group

Household Situation

Socio-economic gradients can be seen in the charts. There was greatest prevalence in the low-frequency group among children whose mothers reported that they were finding it more difficult financially, among children in one-parent households, and among children with two or more siblings. Children in households which did not have access to a motor vehicle were more likely than those with access to a vehicle to be in the high-frequency group, and were also more likely to be in the low-frequency group.

Area and Season

For the area deprivation level, the proportions in the low-frequency group increased with greater disadvantage. For mother's opinion of area there was a similar pattern: those living in areas considered average-poor for children were slightly more likely to be in the high-frequency group. Seasonal differences were apparent with high-frequency participation more likely to be reported in interviews in warmer seasons.

Mother's Background

Gradients indicating increased prevalence in the low-frequency group were apparent with lower-level childhood socio-economic status of the mother, decreased age mother left education, and with more recent migration history.

Mother's Situation

Mothers who were not working and those who were unmarried appeared more likely to have lower frequency active games with their children. Mothers who reported greater health restrictions were less likely to be in the mid-frequency group compared to both the extremes. Younger mothers were slightly more likely to be in the high-frequency group.

A 1. Analyses of weighted proportions chart for frequency of mother-child participation through playing active games - child's characteristics variables

Analysis of weighted proportions: frequency of mother-child participation through playing active games by Child's Chartacteristics variables

Mothers Sample, n = 12,619

	low	mid	high	low	mid	mid	high
Overall distribution	40.5	36.4	23.1	52.6	47.4	61.2	38.8
CHILD'S CHARACTERISTICS:							
(A1) CHILD'S SEX	0.0000 (chi2 p values)			0.0354		0.0000	
Boy	38.2	36.2	25.6	51.3	48.7	58.6	41.4
Girl	42.8	36.6	20.6	53.9	46.1	64.0	36.0
(A2) CHILD'S AGE	0.0001			0.0673		0.0196	
4y4-4y11	36.6	36.8	26.6	49.8	50.2	58.1	41.9
5y0-5y3	41.0	36.2	22.8	53.1	46.9	61.3	38.7
5y4-6y1	42.1	36.5	21.5	53.6	46.4	62.9	37.1
(A3) CHILD HAS DISABILITY	0.0243			0.2259		0.0077	
No	40.5	36.7	22.9	52.5	47.5	61.6	38.5
Yes	40.4	32.2	27.4	55.7	44.3	54.0	46.0
(A4) CHILD'S ETHNICITY	0.0000			0.0000		0.5762	
White	39.2	37.4	23.4	51.1	48.9	61.5	38.5
Mixed	42.1	34.0	23.9	55.4	44.7	58.7	41.3
Indian	43.3	35.2	21.5	55.2	44.8	62.1	37.9
Pakistani	57.5	24.4	18.0	70.2	29.8	57.6	42.4
Bangladeshi	61.9	20.1	18.0	75.5	24.5	52.9	47.1
Black Caribbean	48.2	27.5	24.3	63.6	36.4	53.1	46.9
Black African	59.8	22.0	18.2	73.1	26.9	54.7	45.3
Other	49.4	28.8	21.8	63.2	36.8	56.9	43.1

A 2. Analyses of weighted proportions chart for frequency of mother-child participation through playing active games – household situation variables

Analysis of weighted proportions: frequency of mother-child participation through playing active games by Household Situation variables

Mothers Sample, n = 12,619

	low	mid	high	low	mid	mid	high
Overall distribution	40.5	36.4	23.1	52.6	47.4	61.2	38.8
HOUSEHOLD SITUATION:							
(B1) MANAGING FINANCIALLY	0.0000 (chi2 p values)			0.0000		0.2040	
Comfortable	35.7	38.7	25.7	48.0	52.0	60.1	39.9
Stable	38.4	38.6	23.0	49.9	50.1	62.6	37.4
Difficulties	45.8	32.7	21.5	58.4	41.6	60.3	39.7
(B2) NUMBER OF PARENTS	0.0839			0.0287		0.5687	
Two	40.0	36.8	23.2	52.1	48.0	61.3	38.7
One	42.8	34.5	22.7	55.4	44.6	60.4	39.6
(B3) NUMBER OF CHILDREN	0.0000			0.0000		0.2137	
1	34.1	40.1	25.9	45.9	54.1	60.8	39.2
2	38.2	38.5	23.3	49.8	50.2	62.2	37.8
3 or more	46.5	31.9	21.6	59.3	40.7	59.6	40.4
(B4) ACCESS TO MOTOR VEHICLE(S)	0.0014			0.0001		0.0258	
Yes	39.9	37.0	23.1	51.9	48.1	61.7	38.4
No	44.2	32.2	23.6	57.9	42.1	57.7	42.3

A 3. Analyses of weighted proportions chart for frequency of mother-child participation through playing active games – area and season variables

Analysis of weighted proportions: frequency of mother-child participation through playing active games by Area and Season variables

Mothers Sample, n = 12,619	low	mid	high	low	mid	mid	high
Overall distribution	40.5	36.4	23.1	52.6	47.4	61.2	38.8
AREA & SEASON:							
(C1) MOTHER'S OPINION OF AREA	0.0000 (chi2 p values)			0.0000		0.0002	
Excellent	35.9	37.0	27.1	49.2	50.8	57.7	42.3
Good	40.9	37.8	21.3	52.0	48.0	64.0	36.0
Average-Very Poor	45.5	33.4	21.1	57.7	42.3	61.4	38.7
(C2) AREA DEPRIVATION SCORE	0.0000			0.0000		0.1958	
Most advantaged: 9-10	34.5	40.8	24.7	45.8	54.2	58.6	41.5
7-8	38.3	38.7	23.0	49.8	50.3	59.2	40.8
5-6	40.3	37.1	22.6	52.1	47.9	62.1	37.9
3-4	43.4	33.5	23.1	56.4	43.6	62.8	37.3
Most disadvantaged: 1-2	47.2	30.9	21.9	60.4	39.6	62.3	37.7
(C3) SEASON OF MAIN INTERVIEW	0.0000			0.0000		0.0015	
Spring	42.7	35.6	21.7	54.5	45.5	62.2	37.8
Summer	35.3	37.2	27.5	48.6	51.4	57.5	42.5
Autumn	37.5	39.2	23.3	49.0	51.1	62.7	37.3
Winter	48.4	34.9	16.8	58.1	41.9	67.5	32.5

A 4. Analyses of weighted proportions chart for frequency of mother-child participation through playing active games – mother's background variables

Analysis of weighted proportions: frequency of mother-child participation through playing active games by Mother's Background variables

Mothers Sample, n = 12,619	low	mid	high	low	mid	mid	high
Overall distribution	40.5	36.4	23.1	52.6	47.4	61.2	38.8
MOTHER'S BACKGROUND:							
(D1) MOTHER'S SES AT 14	0.0002 (chi2 p values)			0.0001		0.6042	
Managerial and professional	37.3	37.9	24.8	49.6	50.4	60.5	39.5
Intermediate	38.7	38.0	23.2	50.5	49.5	62.1	37.9
Rountine and manual	41.8	36.1	22.1	53.7	46.3	62.0	38.0
Father not working	44.9	33.1	22.0	57.6	42.4	60.0	40.0
Unclassifed	44.5	32.8	22.7	57.6	42.4	59.1	40.9
(D2) MOTHER'S AGE LEFT ED	0.0000			0.0000		0.1286	
20+	35.2	40.8	23.9	46.3	53.7	63.0	37.0
18-19	37.5	39.2	23.4	48.9	51.1	62.7	37.4
16-17	43.4	34.0	22.6	56.1	44.0	60.1	39.9
<16	43.0	33.4	23.6	56.3	43.8	58.6	41.4
(D3) MOTHER'S FAM. MIGRATION	0.0000			0.0000		0.5073	
3rd Generation or more	39.2	37.2	23.6	51.3	48.7	61.2	38.8
2nd Generation	45.4	34.4	20.2	56.8	43.2	63.0	37.0
1st Generation	47.7	31.0	21.3	60.6	39.4	59.3	40.7

A 5. Analyses of weighted proportions chart for frequency of mother-child participation through playing active games – mother's situation variables

Analysis of weighted proportions: frequency of mother-child participation through playing active games by mother's situation variables

Mothers Sample, n = 12,619	low	mid	high	low	mid	mid	high
Overall distribution	40.5	36.4	23.1	52.6	47.4	61.2	38.8
MOTHER'S SITUATION:							
(E1) MOTHER'S AGE AT INTERVIEW	0.0050 (chi2 p values)			0.0180		0.0543	
18-24	38.6	35.8	25.6	51.9	48.1	58.3	41.7
25-29	41.6	33.3	25.1	55.5	44.5	57.1	42.9
30-34	39.5	38.1	22.5	50.9	49.1	62.8	37.2
35-39	39.1	37.3	23.6	51.2	48.8	61.3	38.7
40-66	43.9	35.2	20.9	55.5	44.5	62.8	37.2
(E2) MOTHER'S EMPLOYMENT HOURS	0.0000			0.0000		0.0000	
Not in work	43.1	32.8	24.1	56.8	43.2	57.6	42.4
<30 hrs per wk / unknown hrs	37.9	39.1	23.1	49.2	50.8	62.9	37.1
30+ hrs per week	40.6	38.4	21.0	51.3	48.7	64.7	35.3
(E3) MOTHER'S MARITAL STATUS	0.0050			0.0006		0.2234	
Married	39.3	37.5	23.2	51.2	48.8	61.8	38.2
Not married	42.7	34.3	23.0	55.5	44.5	59.9	40.2
(E4) MOTHER'S HEALTH RESTRICTIONS	0.0000			0.0000		0.0048	
No restrictions	37.6	38.0	24.4	49.7	50.3	61.0	39.0
Some restrictions	43.7	35.6	20.6	55.1	44.9	63.3	36.7
High restrictions	54.2	24.3	21.6	69.0	31.0	53.0	47.0

Analyses of Weighted Proportions: mother-child facilitation through going to parks or playgrounds

This section refers to Charts A 6 to A 10 from page A/18.

Child's Characteristics

Children with a disability appeared more likely than those without to have high-frequency group. Compared to white children, Indian children were more often in the high-frequency group, and Black African children were more often in the low-frequency group. No significant differences were seen for child's gender or age.

Household Situation

There was greatest prevalence of high-frequency playground visits among children and mothers living in households experiencing financial difficulties, with no partner, and without access to motor vehicles. Where there were more siblings in the household, there seemed to increased likelihood of being in the low-frequency group.

Area and Season

Mothers living in more deprived areas appeared to be more likely to be in the high-frequency group. Those who considered their neighbourhood to be good for children seemed less likely to be in the high-frequency group than those who considered it excellent. Where interviews took place in summer or autumn, increased reporting of higher frequency facilitation was evident.

Mother's Background

Mothers who left school at an earlier age and those who reported that their fathers were out of work at when they were fourteen were more likely to report being in the high-frequency group. There was high prevalence of mothers whose own mothers were migrants to the UK (second generation) in both the low- and high-frequency groups.

Mother's Situation

Mothers who had increased work hours and older mothers were more likely to report lower frequency facilitation. Mothers who were unmarried were more likely to be in the high-frequency group. When mothers had greater health restrictions, being in the low-frequency group was more common, but there was also a high prevalence of those with high health restrictions in the high-frequency group.

A 6. Analyses of weighted proportions chart for frequency of mother-child facilitation through going to parks/playgrounds - child's characteristics variables

Analysis of weighted proportions: frequency of mother-child facilitation through going to parks/playgrounds by Child's Chartacteristics variables

Mothers Sample, n = 12,619

	low	mid	high	low	mid	mid	high
Overall distribution	39.6	43.2	17.3	47.8	52.2	71.4	28.6
CHILD'S CHARACTERISTICS							
(A1) CHILD'S SEX	0.1263 (chi2 p values)			0.4877		0.1387	
Boy	38.9	43.1	18.0	47.4	52.6	70.6	29.4
Girl	40.2	43.3	16.5	48.2	51.8	72.4	27.6
(A2) CHILD'S AGE	0.5915			0.9931		0.2870	
4y4-4y11	39.0	42.7	18.3	47.8	52.2	70.0	30.0
5y0-5y3	39.5	43.2	17.4	47.8	52.2	71.3	28.7
5y4-6y1	40.0	43.5	16.4	47.9	52.1	72.6	27.4
(A3) CHILD HAS DISABILITY	0.0171			0.7256		0.0060	
No	39.6	43.3	17.0	47.8	52.2	71.8	28.2
Yes	38.1	40.2	21.8	48.7	51.4	64.9	35.1
(A4) CHILD'S ETHNICITY	0.0000			0.0000		0.0000	
White	39.7	43.1	17.2	48.0	52.1	71.5	28.5
Mixed	36.7	45.1	18.2	44.8	55.2	71.3	28.7
Indian	43.8	44.2	12.0	49.7	50.3	78.6	21.4
Pakastani	37.9	42.3	19.8	47.3	52.7	68.1	31.9
Bangladeshi	38.7	43.2	18.1	47.2	52.8	70.5	29.5
BlackCaribbean	40.6	35.1	24.3	53.6	46.4	59.1	41.0
BlackAfrican	40.0	42.2	17.8	48.6	51.4	70.3	29.7
Other	32.0	50.4	17.6	38.8	61.2	74.1	25.9

A 7. Analyses of weighted proportions chart for frequency of mother-child facilitation through going to parks/playgrounds – household situation variables

Analysis of weighted proportions: frequency of mother-child facilitation through going to parks/playgrounds by Household Situation variables

Mothers Sample, n = 12,619

	low	mid	high	low	mid	mid	high
Overall distribution	39.6	43.2	17.3	47.8	52.2	71.4	28.6
HOUSEHOLD SITUATION							
(B1) MANAGING FINANCIALLY	0.0041 (chi2 p values)			0.0444		0.0003	
Comfortable	39.3	44.9	15.9	46.7	53.3	73.9	26.1
Stable	38.8	44.5	16.7	46.6	53.4	72.6	27.4
Difficulties	40.5	40.7	18.8	49.9	50.1	68.4	31.6
(B2) NUMBER OF PARENTS	0.0000			0.1837		0.0000	
Two	40.3	43.4	16.3	48.2	51.8	72.7	27.3
One	36.0	42.3	21.8	46.0	54.0	66.0	34.0
(B3) NUMBER OF CHILDREN	0.0000			0.0000		0.5588	
1	34.4	47.5	18.1	42.1	58.0	72.4	27.6
2	38.6	44.0	17.4	46.7	53.3	71.7	28.3
3 or more	43.2	40.1	16.7	51.8	48.2	70.6	29.4
(B4) ACCESS TO MOTOR VEHICLE(S)	0.0000			0.9733		0.0000	
Yes	40.0	43.6	16.4	47.8	52.2	72.7	27.3
No	36.8	40.2	23.1	47.8	52.3	63.6	36.4

A 8. Analyses of weighted proportions chart for frequency of mother-child facilitation through going to parks/playgrounds – area and season variables

Analysis of weighted proportions: frequency of mother-child facilitation through going to parks/playgrounds by Area and Season variables

Mothers Sample, n = 12,619	low	mid	high	low	mid	mid	high
Overall distribution	39.6	43.2	17.3	47.8	52.2	71.4	28.6
AREA & SEASON							
(C1) MOTHER'S OPINION OF AREA	0.0045 (chi2 p values)			0.0985		0.0161	
Excellent	37.3	43.7	19.0	46.1	53.9	69.7	30.3
Good	40.5	43.8	15.7	48.1	52.0	73.6	26.4
Average-Very Poor	40.8	41.6	17.6	49.5	50.5	70.3	29.7
(C2) AREA DEPRIVATION SCORE	0.0149			0.2610		0.0032	
Most advantaged: 9-10	37.9	41.3	20.8	47.9	52.1	66.5	33.5
7-8	40.6	42.1	17.3	49.1	50.9	70.8	29.2
5-6	40.5	43.4	16.2	48.3	51.7	72.9	27.1
3-4	41.3	42.4	16.3	49.3	50.7	72.2	27.8
Most disadvantaged: 1-2	37.8	46.2	16.0	45.0	55.0	74.3	25.8
(C3) SEASON OF MAIN INTERVIEW	0.0000			0.0034		0.0000	
Spring	41.8	43.0	15.2	49.3	50.7	73.9	26.1
Summer	35.6	43.0	21.4	45.3	54.7	66.8	33.2
Autumn	35.7	44.1	20.2	44.8	55.2	68.6	31.4
Winter	43.1	44.1	12.8	49.4	50.6	77.5	22.5

A 9. Analyses of weighted proportions chart for frequency of mother-child facilitation through going to parks/playgrounds – mother's background variables

Analysis of weighted proportions: frequency of mother-child facilitation through going to parks/playgrounds by Mother's Background variables

Mothers Sample, n = 12,619	low	mid	high	low	mid	mid	high
Overall distribution	39.6	43.2	17.3	47.8	52.2	71.4	28.6
MOTHER'S BACKGROUND							
(D1) MOTHER'S SES AT 14	0.0535 (chi2 p values)			0.2116		0.0251	
Managerial and professional	40.0	43.3	16.7	48.0	52.0	72.2	27.8
Intermediate	40.9	43.0	16.2	48.7	51.3	72.7	27.3
Rountine and manual	38.7	44.1	17.3	46.8	53.3	71.9	28.1
Father not working	41.2	38.0	20.8	52.0	48.0	64.7	35.3
Unknown/father died	37.7	43.6	18.7	46.3	53.7	69.9	30.1
(D2) MOTHER'S AGE LEFT ED	0.0343			0.5744		0.0015	
20+	40.7	43.4	15.9	48.4	51.6	73.2	26.8
18-19	39.9	44.3	15.8	47.4	52.6	73.8	26.3
16-17	38.9	43.3	17.8	47.3	52.7	70.8	29.2
<16	40.0	39.3	20.8	50.4	49.6	65.5	34.6
(D3) MOTHER'S FAM. MIGRATION	0.1134			0.0490		0.1085	
3rd Generation or more	39.4	43.6	17.1	47.5	52.5	71.8	28.2
2nd Generation	43.2	38.1	18.7	53.2	46.8	67.0	33.0
1st Generation	38.3	44.2	17.4	46.4	53.6	71.7	28.3

A 10. Analyses of weighted proportions chart for frequency of mother-child facilitation through going to parks/playgrounds – mother's situation variables

Analysis of weighted proportions: frequency of mother-child facilitation through going to parks/playgrounds by Mother's Situation variables

Mothers Sample. n = 12,619	low	mid	high	low	mid	mid	high
Overall distribution	39.6	43.2	17.3	47.8	52.2	71.4	28.6
MOTHER'S SITUATION							
(E1) MOTHER'S AGE AT INTERVIEW	0.0000 (chi2 p values)			0.0104		0.0031	
18-24	32.0	44.0	24.0	42.1	57.9	64.7	35.3
25-29	36.8	43.7	19.5	45.7	54.3	69.1	30.9
30-34	40.0	44.5	15.5	47.3	52.7	74.2	25.8
35-39	40.1	42.8	17.1	48.4	51.7	71.5	28.5
40-66	42.9	41.1	16.0	51.0	49.0	72.0	28.1
(E2) MOTHER'S EMPLOYMENT HOURS	0.0000			0.0920		0.0000	
Not in work	37.6	42.1	20.4	47.2	52.8	67.3	32.7
Working <30 hrs per wk / unknown hrs	39.6	44.3	16.1	47.2	52.8	73.4	26.6
Working 30+ hrs per week	44.0	43.1	12.9	50.5	49.5	76.9	23.1
(E3) MOTHER'S MARITAL STATUS	0.0001			0.1122		0.0005	
Married	40.7	43.3	16.0	48.5	51.6	73.1	26.9
Not married	37.2	42.9	19.9	46.4	53.6	68.4	31.6
(E4) MOTHER'S HEALTH RESTRICTIONS	0.0001			0.0001		0.0480	
No restrictions	38.1	44.2	17.7	46.3	53.7	71.4	28.7
Some restrictions	41.4	42.6	16.0	49.2	50.8	72.7	27.3
High restrictions	46.0	35.8	18.2	56.2	43.8	66.3	33.7

Main Analyses: mother-child low-frequency compared to mid-frequency participation through playing active games

This section refers to Table A 11 from page A/22, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-5 on page 153.

Child's Characteristics

Girls were more likely to have low-frequency active play with mother than boys (OR 1.12, 95% CI 1.01-1.24). Those from some minority ethnic groups were more likely than white children to be in the low-frequency group: Pakistani (1.62, 1.22-2.14), Bangladeshi (2.21, 1.25-3.91), and Black African (2.19, 1.43-3.37). Child's age was significant at a 90% level in unadjusted analysis, but this was not in the final model.

Household Situation

Children living with mothers who reported having financial difficulties were more likely to have low-frequency participation compared to those living comfortably (1.20, 1.05-1.36). Children with a greater number of siblings at home were also more likely to have low-frequency participation, with a gradient in the odds ratios for one sibling (1.26, 1.10-1.45) and two siblings or more (1.66, 1.45-1.90). Although significant at 95% significance level in unadjusted analysis, the variables for number of parents/carers and access to motor vehicles were not in the final model.

Area and Season

For the area deprivation score, increase in advantage was associated with reduced likelihood of being in the low-frequency group (0.97, 0.95-0.98). Those interviewed in summer (0.83, 0.72-0.95) and autumn (0.86, 0.75-0.98) were significantly less likely to report being the low-frequency group compared to those interviewed in spring. Mother's opinion of area was significant in unadjusted analysis but not in the final model.

Mother's Background

An increase in mother's age of leaving full-time education was associated with a decrease in the of being in the low-frequency group (0.96, 0.94-0.98). Mother's socio-economic status at fourteen and migration history were significant in the unadjusted analyses, but dropped from the final model.

Mother's Situation

For parent's health, there was an increasing gradient of risk with increased health restrictions: compared to those with no health restrictions, mothers with some (1.18, 1.07-1.31) or high (2.04, 1.66-2.50) restrictions were more likely to be in the low-frequency group. Mother's marital status and employment hours were significantly associated with the low-frequency outcome in unadjusted analysis but not in the final model.

A 11. Logistic regression analyses table for mother-child low-frequency compared to mid-frequency participation through playing active games

Mother-child participation through playing active games							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 4477	n = 4972	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	2264	2398	1.00		1.00		
Girl	2213	2574	1.12	0.026	1.12	0.028	1.01 to 1.24
A2. Child's Age							
Continuous: 1 year increase	4477	4972	1.17	0.103			
A3. Child has Disability							
No	4249	4684	1.00				
Yes	228	288	1.15	0.191			
A4. Child's Ethnicity							
White	3991	4099	1.00		1.00		
Mixed	112	143	1.21	0.137	1.14	0.315	0.89 to 1.46
Indian	106	118	1.20	0.294	1.20	0.301	0.85 to 1.69
Pakistani	110	268	2.13	<0.0005	1.62	0.001	1.22 to 2.14
Bangladeshi	40	109	2.92	<0.0005	2.21	0.007	1.25 to 3.91
BlackCaribbean	36	61	1.66	0.015	1.35	0.151	0.90 to 2.03
BlackAfrican	41	104	2.58	<0.0005	2.19	<0.0005	1.43 to 3.37
Other	41	70	1.65	0.054	1.53	0.104	0.92 to 2.56
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	1141	1054	1.00		1.00		
Stable	1848	1839	1.08	0.216	0.96	0.557	0.85 to 1.09
Difficulties	1488	2079	1.52	<0.0005	1.20	0.006	1.05 to 1.36
B2. Number of Parents/Carers							
Two	3723	4026	1.00				
One	754	946	1.15	0.027			
B3. Number of Children							
One	774	669	1.00		1.00		
Two	2258	2232	1.16	0.038	1.26	0.001	1.10 to 1.45
Three or more	1445	2071	1.70	<0.0005	1.66	<0.0005	1.45 to 1.90
B4. Access to Motor Vehicle(s)							
Yes	3919	4213	1.00				
No	558	759	1.28	<0.0005			

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Mother-child participation through playing active games							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 4477	n = 4972	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1437	1381	1.00				
Good	1904	1999	1.11	0.076			
Average-Very Poor	1136	1592	1.40	<0.0005			
C2. Area Deprivation Deciles							
Continuous:1 decile increase	4477	4972	0.93	<0.0005	0.97	<0.0005	0.95 to 0.98
C3. Season of Main Interview							
Spring	2224	2635	1.00		1.00		
Summer	1218	1184	0.80	0.001	0.83	0.006	0.72 to 0.95
Autumn	802	811	0.81	0.002	0.86	0.024	0.75 to 0.98
Winter	233	342	1.15	0.177	1.17	0.129	0.96 to 1.43
D. MOTHER'S BACKGROUND							
D1. Mother's SES at Age 14							
Managerial & professional	1173	1099	1.00				
Intermediate	991	1043	1.04	0.593			
Routine & manual	1572	1837	1.19	0.01			
Father was not working	314	443	1.38	0.001			
Unknown/father died	427	550	1.39	<0.0005			
D2. Mother's Age Left Full-time Education							
Continuous: 1 year increase	4477	4972	0.94	<0.0005	0.96	<0.0005	0.94 to 0.98
D3. Mother's Family Migration History							
Third Generation or more	3740	3883	1.00				
Second Generation	317	409	1.25	0.017			
First Generation	420	680	1.44	<0.0005			
E. MOTHER'S SITUATION							
E1. Mother's Age							
Continuous: 1 year increase	4477	4972	1.00	0.306			
E2. Mother's Employment Hours							
Not in work	1674	2222	1.00				
<30 hrs per wk / unknown hrs	1891	1819	0.74	<0.0005			
30+ hrs per week	912	931	0.79	<0.0005			
E3. Mother's Marital Status							
Married	3057	3257	1.00				
Not married	1420	1715	1.19	<0.0005			
E4. Mother's Health Restrictions							
No restrictions	3022	3015	1.00		1.00		
Some restrictions	1241	1504	1.24	<0.0005	1.18	0.001	1.07 to 1.31
High restrictions	214	453	2.29	<0.0005	2.04	<0.0005	1.66 to 2.50

Main Analyses: mother-child high-frequency compared to mid-frequency participation through playing active games

This section refers to Table A 12 from page A/25, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-6 on page 154.

Child's Characteristics

Girls were less likely than boys (OR 0.79, 95% CI 0.71-0.88), and children with a disability were more likely than those without (1.31, 1.04-1.66) to have high-frequency participation. A 1 year decrease in the child's age was associated with approximately a 28% increase in likelihood (inverse of 0.78, 0.62-0.98) of being in the high-frequency group.

Household Situation

Motor vehicle(s) was significant in unadjusted analysis but was not in the final model.

Area and Season

Children whose mothers thought their local area as excellent were more likely to be in the high-frequency group than those who reported that it was good (0.72, 0.63-0.83) or average (0.72, 0.60-0.85). Increased advantage of the area was associated with decrease in likelihood of being in this group (0.96, 0.94-0.99). Children whose mothers were interviewed in the summer compared to those interviewed in spring were more likely to be in the high frequency group (1.21, 1.05-1.39).

Mother's Background

Mother's age at leaving full-time education, significant in the unadjusted analysis, was not retained in the final model.

Mother's Situation and Health

Interestingly, mothers with high health restrictions were 34% more likely to be in the high-frequency group (1.34, 1.03-1.74). The two comparisons for mother's employment hours were significant in the final model: not working was associated with increased likelihood of being in the high-frequency group compared to those working fewer than 30 hours per week (0.83, 0.74-0.93) and over 30 hours per week (0.75, 0.64-0.88). Mother's age at interview was significant at a 90% level in unadjusted analysis, but not in the final model.

A 12. Logistic regression analyses table for mothers-child high-frequency compared to mid-frequency participation through playing active games.

Mother-child participation through playing active games							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 4477	n = 2988	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	2264	1670	1.00		1.00		
Girl	2213	1318	0.79	<0.0005	0.79	<0.0005	0.71 to 0.88
A2. Child's Age							
Continuous: 1 year increase	4477	2988	0.74	0.008	0.78	0.033	0.62 to 0.98
A3. Child has Disability							
No	4249	2785	1.00		1.00		
Yes	228	203	1.37	0.008	1.31	0.024	1.04 to 1.66
A4. Child's Ethnicity							
White	3991	2630	1.00				
Mixed	112	71	1.15	0.417			
Indian	106	66	0.99	0.940			
Pakistani	110	83	1.13	0.504			
Bangladeshi	40	30	1.42	0.234			
BlackCaribbean	36	30	1.41	0.247			
BlackAfrican	41	43	1.36	0.270			
Other	41	35	1.21	0.425			
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	1141	818	1.00				
Stable	1848	1150	0.90	0.162			
Difficulties	1488	1020	0.99	0.875			
B2. Number of Parents/Carers							
Two	3723	2468	1.00				
One	754	520	1.04	0.548			
B3. Number of Children							
One	774	522	1.00				
Two	2258	1442	0.94	0.445			
Three or more	1445	1024	1.04	0.594			
B4. Access to Motor Vehicle(s)							
Yes	3919	2569	1.00				
No	558	419	1.18	0.025			
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1437	1100	1.00		1.00		
Good	1904	1146	0.77	<0.0005	0.72	<0.0005	0.63 to 0.83
Average-Very Poor	1136	742	0.87	0.047	0.72	<0.0005	0.60 to 0.85
C2. Area Deprivation Deciles							
Continuous:1 decile increase	4477	2988	0.98	0.03	0.96	0.003	0.94 to 0.99
C3. Season of Main Interview							
Spring	2224	1403	1.00		1.00		
Summer	1218	959	1.22	0.006	1.21	0.009	1.05 to 1.39
Autumn	802	515	0.99	0.866	0.98	0.792	0.84 to 1.14
Winter	233	111	0.79	0.088	0.80	0.104	0.61 to 1.05

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Mother-child participation through playing active games							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 4477	n = 2988	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
D. MOTHER'S BACKGROUND							
D1. Mother's SES at Age 14							
Managerial & professional	1173	768	1.00				
Intermediate	991	646	0.93	0.295			
Routine & manual	1572	1046	0.94	0.375			
Father was not working	314	226	1.01	0.923			
Unknown/father died	427	302	1.07	0.475			
D2. Mother's Age Left Full-time Education							
Continuous: 1 year increase	4477	2988	0.98	0.009			
D3. Mother's Family Migration History							
Third Generation or more	3740	2490	1.00				
Second Generation	317	178	0.93	0.536			
First Generation	420	320	1.07	0.445			
E. MOTHER'S SITUATION							
E1. Mother's Age							
Continuous: 1 year increase	4477	2988	0.99	0.067			
E2. Mother's Employment Hours							
Not in work	1674	1269	1.00		1.00		
<30 hrs per wk / unknown hrs	1891	1190	0.80	<0.0005	0.83	0.002	0.74 to 0.93
30+ hrs per week	912	529	0.74	<0.0005	0.75	<0.0005	0.64 to 0.88
E3. Mother's Marital Status							
Married	3057	2017	1.00				
Not married	1420	971	1.08	0.241			
E4. Mother's Health Restrictions							
No restrictions	3022	2028	1.00		1.00		
Some restrictions	1241	772	0.91	0.110	0.91	<0.0005	0.80 to 1.02
High restrictions	214	188	1.39	0.013	1.34	<0.0005	1.03 to 1.74

Main Analyses: mother-child low-frequency compared to mid-frequency facilitation through going to parks or playgrounds

This section refers to Table A 13 from page A/28, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-7 on page 155.

Child's Characteristics

Child's ethnicity was significant in unadjusted analysis, but was not in the final model.

Household Situation

Children with more siblings in the household were more likely to be in the low-frequency group. Compared to only-children, children with one sibling were more likely to be in the low-frequency group (OR 1.22, 95% CI 1.04-1.42), and those with two or more siblings were more likely to be in the low-frequency group (1.50, 1.28-1.76). Managing financially, significant at the 90% level in unadjusted analyses, was not in the final model.

Area and Season

Children living in an area which was according to mother's opinion average-poor for children, were more likely to be in the low-frequency group compared to those living in an area considered to be excellent (1.17, 1.02-1.34). Mothers who had interviews in the summer (0.86, 0.77-0.97) and autumn (0.84, 0.74-0.95) were more likely to report low-frequency facilitation compared to those interviewed in the spring.

Mother's Background

Mother's family migration history and mother's socio-economic status at age 14 which had significant comparisons at 95% and 90% levels respectively in unadjusted analysis, were not retained in the final model.

Mother's Situation

Children with older mothers were more likely to be in the low-frequency group (one year increase in age: 1.01, 1.01-1.02). Children whose mothers were working at least 30 hours per week were more likely to be in the low-frequency group (1.25, 1.08-1.43). Children whose mothers reported some (1.11, 1.00-1.23) and high (1.49, 1.22-1.81) health restrictions were more likely than those reporting no restrictions to be in the low-frequency group.

A 13. Logistic regression analyses table for mother-child low-frequency compared to mid-frequency facilitation through going to parks/playgrounds.

Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 5416	n = 4776	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	2726	2402	1.00				
Girl	2690	2374	1.03	0.573			
A2. Child's Age							
Continuous: 1 year increase	5416	4776	0.96	0.701			
A3. Child has Disability							
No	5118	4513	1.00				
Yes	298	263	1.05	0.6			
A4. Child's Ethnicity							
White	4662	4137	1.00				
Mixed	155	108	0.88	0.392			
Indian	121	133	1.09	0.625			
Pakistani	210	159	0.95	0.678			
Bangladeshi	73	73	0.96	0.856			
BlackCaribbean	41	52	1.24	0.293			
BlackAfrican	82	64	1.00	0.99			
Other	72	50	0.69	0.036			
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	1379	1135	1.00				
Stable	2170	1828	0.99	0.912			
Difficulties	1867	1813	1.13	0.052			
B2. Number of Parents/Carers							
Two	4481	4001	1.00				
One	935	775	0.92	0.226			
B3. Number of Children							
One	936	647	1.00		1.00		
Two	2652	2211	1.19	0.024	1.22	0.013	1.04 to 1.42
Three or more	1828	1918	1.48	<0.0005	1.50	<0.0005	1.28 to 1.76
B4. Access to Motor Vehicle(s)							
Yes	4736	4148	1.00				
No	680	628	1.00	0.967			
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1715	1457	1.00		1.00		
Good	2245	1948	1.08	0.177	1.08	0.151	0.97 to 1.21
Average-Very Poor	1456	1371	1.14	0.051	1.17	0.027	1.02 to 1.34
C2. Area Deprivation Deciles							
Continuous:1 decile increase	5416	4776	0.99	0.272			
C3. Season of Main Interview							
Spring	2707	2538	1.00		1.00		
Summer	1456	1178	0.86	0.007	0.86	0.012	0.77 to 0.97
Autumn	950	769	0.84	0.007	0.84	0.007	0.74 to 0.95
Winter	303	291	1.01	0.909	1.00	0.963	0.83 to 1.21

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Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 5416	n = 4776	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
D. MOTHER'S BACKGROUND							
D1. Mother's SES at Age 14							
Managerial & professional	1329	1185	1.00				
Intermediate	1133	1080	1.04	0.576			
Routine & manual	1996	1664	0.96	0.495			
Father was not working	397	383	1.19	0.089			
Unknown/father died	561	464	0.92	0.317			
D2. Mother's Age Left Full-time Education							
Continuous: 1 year increase	5416	4776	1.00	0.866			
D3. Mother's Family Migration History							
Third Generation or more	4426	3876	1.00				
Second Generation	352	381	1.26	0.017			
First Generation	638	519	0.95	0.527			
E. MOTHER'S SITUATION							
E1. Mother's Age							
Continuous: 1 year increase	5416	4776	1.02	<0.0005	1.01	0.001	1.01 to 1.02
E2. Mother's Employment Hours							
Not in work	2175	1902	1.00		1.00		
<30 hrs per wk / unknown hrs	2201	1867	1.00	0.972	1.06	0.296	0.95 to 1.19
30+ hrs per week	1040	1007	1.14	0.052	1.25	0.002	1.08 to 1.43
E3. Mother's Marital Status							
Married	3641	3326	1.00				
Not married	1775	1450	0.93	0.145			
E4. Mother's Health Restrictions							
No restrictions	3588	2978	1.00		1.00		
Some restrictions	1513	1419	1.12	0.031	1.11	0.045	1.00 to 1.23
High restrictions	315	379	1.50	<0.0005	1.49	<0.0005	1.22 to 1.81

Main Analyses: mother-child high-frequency compared to mid-frequency participation through going to parks or playgrounds

This section refers to Table A 14 from page A/31, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-8 on page 156.

Child's Characteristics

Children with a disability were significantly more likely to receive high-frequency facilitation (OR 1.33, 95% CI 1.05-1.68). For the child's ethnicity variable one of the comparisons was significant: children reported by their mothers to be of Indian ethnicity were nearly half as likely as those of white ethnicity to be in the high-frequency group (0.58, 0.39-0.89).

Household Situation

Children in households where the mothers reported financial difficulties were more likely to be in the high-frequency group than those who were financially comfortable (1.16, 1.00-1.36). Those who did not have access to motor vehicle(s) were more likely to be in the high-frequency group (1.29, 1.09-1.51). Although significant in unadjusted analysis, the variable for the number of parents/carers was not retained in the final model.

Area and Season

Children living in areas which were considered by their mother to be good (0.75, 0.65 to 0.87) and average-poor (0.72, 0.61 to 0.85) for children were significantly less likely to be in the high-frequency group than those who considered it excellent. With increased advantage of the area, there was decreased likelihood of being in the high-frequency group (1 decile increase: 0.96, 0.93-0.98). Mothers who were interviewed in the summer (1.43, 1.24 to 1.66) and autumn (1.29, 1.10 to 1.52) were more likely than those interviewed in spring to report high-frequency facilitation.

Mother's Background

Mothers who were second generation migrants (their mothers had migrated to the UK), were more likely to report high-frequency facilitation compared to third or more generation migrants (1.34, 1.02 to 1.77). Although significant factors in unadjusted analyses, mother's socio-economic status at age fourteen and her age of leaving full-time education were not retained in the final model.

Mother's Situation

Children whose mother's reported working fewer than thirty hours (0.82, 0.71-0.96) and those working at least thirty hours (0.67, 0.56-0.81) a week at the time of interview were significantly less likely to be in the high-frequency group than those who were not working. Mother's age, marital status and health restrictions were significant in unadjusted analyses at a 90% level, but not retained in the final model.

A 14. Logistic regression analyses table for mother-child high-frequency compared to mid-frequency facilitation through going to parks/playgrounds.

Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 5416	n = 2245	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	2726	1204	1.00				
Girl	2690	1041	0.91	0.130			
A2. Child's Age							
Continuous: 1 year increase	5416	2245	0.85	0.211			
A3. Child has Disability							
No	5118	2087	1.00		1.00		
Yes	298	158	1.38	0.006	1.33	0.018	1.05 to 1.68
A4. Child's Ethnicity							
White	4662	1921	1.00		1.00		
Mixed	155	63	1.00	0.992	0.88	0.526	0.60 to 1.30
Indian	121	36	0.67	0.041	0.58	0.012	0.39 to 0.89
Pakistani	210	92	1.19	0.282	0.85	0.414	0.57 to 1.26
Bangladeshi	73	33	1.05	0.822	0.74	0.207	0.47 to 1.18
BlackCaribbean	41	34	1.74	0.051	1.27	0.439	0.69 to 2.32
BlackAfrican	82	42	1.03	0.889	0.81	0.349	0.53 to 1.25
Other	72	24	0.88	0.575	0.75	0.263	0.45 to 1.24
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	1379	499	1.00		1.00		
Stable	2170	839	1.06	0.44	1.02	0.816	0.88 to 1.18
Difficulties	1867	907	1.29	0.001	1.16	0.053	1.00 to 1.36
B2. Number of Parents/Carers							
Two	4481	1735	1.00				
One	935	510	1.37	<0.0005			
B3. Number of Children							
One	936	382	1.00				
Two	2652	1069	1.02	0.787			
Three or more	1828	794	1.08	0.416			
B4. Access to Motor Vehicle(s)							
Yes	4736	1817	1.00		1.00		
No	680	428	1.53	<0.0005	1.29	0.002	1.09 to 1.51

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Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 5416	n = 2245	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1715	746	1.00		1.00		
Good	2245	856	0.82	0.008	0.75	<0.0005	0.65 to 0.87
Average-Very Poor	1456	643	0.96	0.616	0.72	<0.0005	0.61 to 0.85
C2. Area Deprivation Deciles							
Continuous:1 decile increase	5416	2245	0.96	<0.0005	0.96	0.001	0.93 to 0.98
C3. Season of Main Interview							
Spring	2707	1017	1.00		1.00		
Summer	1456	727	1.41	<0.0005	1.43	<0.0005	1.24 to 1.66
Autumn	950	409	1.31	0.001	1.29	0.002	1.10 to 1.52
Winter	303	92	0.82	0.095	0.81	0.084	0.64 to 1.03
D. MOTHER'S BACKGROUND							
D1. Mother's SES at Age 14							
Managerial & professional	1329	526	1.00				
Intermediate	1133	467	0.98	0.815			
Routine & manual	1996	795	1.03	0.727			
Father was not working	397	203	1.42	0.003			
Unknown/father died	561	254	1.11	0.335			
D2. Mother's Age Left Full-time Education							
Continuous: 1 year increase	5416	2245	0.97	0.007			
D3. Mother's Family Migration History							
Third Generation or more	4426	1811	1.00		1.00		
Second Generation	352	171	1.26	0.037	1.34	0.033	1.02 to 1.77
First Generation	638	263	1.00	0.998	1.07	0.583	0.84 to 1.35
E. MOTHER'S SITUATION							
E1. Mother's Age							
Continuous: 1 year increase	5416	2245	0.99	0.088			
E2. Mother's Employment Hours							
Not in work	2175	1088	1.00		1.00		
<30 hrs per wk / unknown hrs	2201	832	0.75	<0.0005	0.82	0.011	0.71 to 0.96
30+ hrs per week	1040	325	0.63	<0.0005	0.67	<0.0005	0.56 to 0.81
E3. Mother's Marital Status							
Married	3641	1364	1.00				
Not married	1775	881	1.26	<0.0005			
E4. Mother's Health Restrictions							
No restrictions	3588	1499	1.00				
Some restrictions	1513	585	0.93	0.221			
High restrictions	315	161	1.27	0.041			

Appendix for Section 5.2

Main Analyses: father-child low-frequency compared to mid-frequency participation through playing active games

This section refers to Table A 15 from page A/35, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-14 on page 169.

Child's Characteristics

Girls were significantly more likely than boys to be in the low-frequency group (OR 1.45, 95% CI 1.27-1.66). Compared to children of white ethnicity, those of Pakistani (1.43, 1.03 to 1.97) and particularly Bangladeshi (2.61, 1.55 to 4.38) ethnicity were at more likely to be in the low-frequency group.

Household Situation

Among families where financial difficulties were reported, compared to those reporting financial comfort there was greater likelihood (1.28, 1.07 to 1.52) of being in the low-frequency group. In households where there were three or more children, the cohort child was more likely (1.47, 1.16 to 1.86) to have low-frequency participation, compared to those in only-child households. Although significant in unadjusted analysis, having access to motor vehicle(s) was not retained in the final model.

Area and Season

Children living in more advantaged areas were less likely to be in the low-frequency group (0.95, 0.93 to 0.97), but the variable for mother's opinion of the area for children was not in the final model. Where the main interviews took place in the summer compared to spring, there was a highly significant reduced likelihood of being in the low-frequency group (0.69. 0.58 to 0.82).

Father's Background

Three variables (father's socio-economic status at fourteen, age at leaving full-time education and migration status), were significant in unadjusted analysis but none were retained in the final model.

Father's Situation

Children with older fathers were more likely to be in the low-frequency group (one year increase: 1.02, 1.01 to 1.03). Those with fathers reporting high health restrictions were at increased likelihood compared to no restrictions (1.90, 1.39 to 2.60). Father's employment status was significant in unadjusted analyses but not in the final model.

A 15. Logistic regression analyses table for father-child low-frequency compared to mid-frequency participation through playing active games.

Father-child participation through playing active games							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3102	n = 1747	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	1506	693	1.00		1.00		
Girl	1596	1054	1.43	<0.0005	1.45	<0.0005	1.27 to 1.66
A2. Child's Age							
Continuous: 1 year increase	3102	1747	1.09	0.516			
A3. Child has Disability							
No	2944	1653	1.00				
Yes	158	94	1.09	0.604			
A4. Child's Ethnicity							
White	2784	1453	1.00		1.00		
Mixed	46	49	1.71	0.031	1.61	0.060	0.98 to 2.65
Indian	79	55	1.29	0.289	1.22	0.386	0.78 to 1.89
Pakastani	94	89	1.84	<0.0005	1.43	0.030	1.03 to 1.97
Bangladeshi	26	50	3.38	<0.0005	2.61	<0.0005	1.55 to 4.38
BlackCaribbean	16	10	1.03	0.952	0.95	0.921	0.35 to 2.59
BlackAfrican	23	18	1.73	0.037	1.38	0.245	0.80 to 2.40
Other	34	23	1.16	0.636	0.97	0.910	0.52 to 1.79
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	958	427	1.00		1.00		
Stable	1277	689	1.23	0.015	1.16	0.090	0.98 to 1.38
Difficulties	867	631	1.52	<0.0005	1.28	0.006	1.07 to 1.52
B3. Number of Children							
One	358	165	1.00		1.00		
Two	1644	826	1.10	0.39	1.18	0.141	0.95 to 1.47
Three or more	1100	756	1.51	<0.0005	1.47	0.001	1.16 to 1.86
B4. Access to Motor Vehicle(s)							
Yes	2970	1629	1.00				
No	132	118	1.55	0.012			
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	534	1142	1.00				
Good	759	1315	1.24	0.01			
Average-Very Poor	454	645	1.36	0.002			
C2. Area Deprivation Deciles							
Continuous:1 decile increase in advantage	3102	1747	0.93	<0.0005	0.95	<0.0005	0.93 to 0.97
C3. Season of Main Interview							
Spring	1630	985	1.00		1.00		
Summer	782	354	0.68	<0.0005	0.69	<0.0005	0.58 to 0.82
Autumn	492	296	0.88	0.221	0.92	0.395	0.76 to 1.12
Winter	198	112	1.06	0.698	1.08	0.619	0.80 to 1.44

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Father-child participation through playing active games							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3102	n = 1747	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
F. FATHER'S BACKGROUND							
F1. Father's SES at Age 14							
Managerial & professional	699	329	1.00				
Intermediate	646	333	1.14	0.233			
Routine & manual	1028	653	1.32	0.008			
Father was not working	150	88	1.41	0.063			
Unknown/father died	579	344	1.17	0.187			
F2. Father's Age Left Full-time Education							
Continuous: 1 year increase	3102	1747	0.97	0.005			
F3. Father's Family Migration History							
Third Generation or more	2369	1245	1.00				
Second Generation	177	101	0.95	0.723			
First Generation	266	225	1.55	<0.0005			
Unknown	290	176	1.03	0.827			
G. FATHER'S SITUATION							
G1. Father's Age							
Continuous: 1 year increase	3102	1747	1.01	0.026	1.02	0.003	1.01 to 1.03
G2. Father's Employment Status							
Not in work	166	160	1.00				
<30 hrs per wk / unknown hrs	117	88	0.80	0.341			
30+ hrs per week	2819	1499	0.64	0.003			
G3. Father's Marital Status							
Married	2602	1476	1.00				
Not married	500	271	0.89	0.183			
G4. Father has Health Restrictions							
No restrictions	2277	1183	1.00		1.00		
Some restrictions	711	439	1.12	0.108	1.08	0.290	0.94 to 1.24
High restrictions	114	125	2.11	<0.0005	1.90	<0.0005	1.39 to 2.60

Main Analyses: father-child high-frequency compared to mid-frequency participation through playing active games

This section refers to Table A 16 from page A/38, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-15 on page 170.

Child's Characteristics

Girls were significantly less likely than boys to be in the high-frequency group (OR 0.59, 95% CI 0.53-0.67). Older children were less likely to be in the high-frequency group (1 year increase in age: 0.73, 0.58-0.92). In unadjusted analysis, Black African children were significantly less likely to be in the high-frequency group, but the ethnicity variable did not remain in the final model.

Household Situation

Children in households without access to a motor vehicle were more likely to be in the high-frequency group (1.41, 1.07-1.85). Number of children was significant in unadjusted analysis at the 90% level, but not in the final model.

Area and Season

For children whose main interviews took place in the summer, there was increased likelihood compared to those which took place in spring of their father reporting high-frequency participation (1.26, 1.10-1.43). Although the area deprivation level was of significance at a 90% level in unadjusted analysis, it was not retained in the model.

Father's Background

Children whose fathers left full-time education at an older age were less likely to be in the high-frequency group (1 year increase in age left education: 0.97, 0.96-0.99). Father's socio-economic status in childhood and family migration history were significant in adjusted analysis at the 90% level but not in the final model.

Father's Situation

Father's age and employment status at interview were both significant variables in unadjusted analysis at the 90% level, but were not in the final model.

A 16. Logistic regression analyses table for father-child high-frequency compared to mid-frequency participation through playing active games.

Father-child participation through playing active games							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3102	n = 3148	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	1506	1857	1.00		1.00		
Girl	1596	1291	0.60	<0.0005	0.59	<0.0005	0.53 to 0.67
A2. Child's Age							
Continuous: 1 year increase	3102	3148	0.69	0.002	0.73	0.009	0.58 to 0.92
A3. Child has Disability							
No	2944	2991	1.00				
Yes	158	157	1.00	0.984			
A4. Child's Ethnicity							
White	2784	2846	1.00				
Mixed	46	52	1.15	0.435			
Indian	79	84	1.00	0.981			
Pakastani	94	83	0.90	0.541			
Bangladeshi	26	28	1.03	0.905			
BlackCaribbean	16	10	0.48	0.163			
BlackAfrican	23	11	0.55	0.069			
Other	34	34	0.87	0.62			
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	958	957	1.00				
Stable	1277	1281	1.02	0.751			
Difficulties	867	910	1.06	0.432			
B3. Number of Children							
One	358	410	1.00				
Two	1644	1701	0.94	0.507			
Three or more	1100	1037	0.86	0.093			
B4. Access to Motor Vehicle(s)							
Yes	2970	2958	1.00		1.00		
No	132	190	1.45	0.008	1.41	0.015	1.07 to 1.85
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	534	1187	1.00				
Good	759	1332	0.94	0.369			
Average-Very Poor	454	629	0.91	0.208			
C2. Area Deprivation Deciles							
Continuous:1 decile increase in advantage	3102	3148	0.98	0.053			
C3. Season of Main Interview							
Spring	1630	1542	1.00		1.00		
Summer	782	962	1.27	0.001	1.26	0.001	1.10 to 1.43
Autumn	492	510	1.03	0.779	1.03	0.718	0.87 to 1.23
Winter	198	134	0.80	0.095	0.79	0.073	0.61 to 1.02

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Father-child participation through playing active games							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3102	n = 3148	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
F. FATHER'S BACKGROUND							
F1. Father's SES at Age 14							
Managerial & professional	699	666	1.00				
Intermediate	646	615	1.04	0.715			
Routine & manual	1028	1105	1.11	0.122			
Father was not working	150	143	0.94	0.64			
Unknown/father died	579	619	1.16	0.077			
F2. Father's Age Left Full-time Education							
Continuous: 1 year increase	3102	3148	0.97	0.011	0.97	0.011	0.96 to 0.99
F3. Father's Family Migration History							
Third Generation or more	2369	2412	1.00				
Second Generation	177	168	0.91	0.447			
First Generation	266	255	0.97	0.737			
Unknown	290	313	1.15	0.093			
G. FATHER'S SITUATION							
G1. Father's Age							
Continuous: 1 year increase	3102	3148	0.99	0.013			
G2. Father's Employment Status							
Not in work	166	219	1.00				
<30 hrs per wk / unknown hrs	117	156	1.05	0.827			
30+ hrs per week	2819	2773	0.78	0.078			
G3. Father's Marital Status							
Married	2602	2635	1.00				
Not married	500	513	0.94	0.463			
G4. Father has Health Restrictions							
No restrictions	2277	2330	1.00				
Some restrictions	711	690	0.93	0.266			
High restrictions	114	128	1.09	0.625			

Main Analyses: father-child low-frequency compared to mid-frequency facilitation through going to parks or playgrounds

This section refers to Table A 17 from page A/41, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-16 on page 171.

Child's Characteristics

Girls were significantly more likely than boys to be in the low-frequency group (OR 1.29, 95% CI 1.15-1.44). Although child's ethnicity was significant in unadjusted analysis, this variable was not retained in the final model.

Household Situation

Children living in households reported by the mother as being financially stable, were significantly more likely than those in financially comfortable households to be in the low-frequency group (1.15, 1.01-1.31). The financial difficulties comparison was not significant in the model. In households where there were three or more children, there was greater likelihood of the cohort child being in the low-frequency group compared to only-child families (1.52, 1.25-1.84).

Area and Season

Children in households where the main interview was in the autumn were compared to spring were less likely to fall into the low-frequency group (0.80, 0.68-0.94). Mother's opinion of the area with significant at 90% in unadjusted analysis but not in the final model.

Father's Background

Compared to children whose fathers were at least third generation migrants, those whose fathers were first generation migrants (0.67, 0.54-0.84) and unclassified status (0.80, 0.67-0.96) were less likely to be in the low-frequency group.

Father's Situation

Children with older fathers were more likely to be in the low-frequency group (one year increase in age: 1.01, 1.00-1.02). For fathers reporting some health restrictions, there was an increase in likelihood of being in this group (1.18, 1.02-1.36).

A 17. Logistic regression analyses table for father-child low-frequency compared to mid-frequency facilitation through going to parks/playgrounds.

Father-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3198	n = 4034	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	1697	1917	1.00		1.00		
Girl	1501	2117	1.29	<0.0005	1.29	<0.0005	1.15 to 1.44
A2. Child's Age							
Continuous: 1 year increase	3198	4034	1.05	0.696			
A3. Child has Disability							
No	3046	3827	1.00				
Yes	152	207	1.07	0.614			
A4. Child's Ethnicity							
White	2801	3621	1.00				
Mixed	63	71	0.93	0.715			
Indian	91	106	0.92	0.624			
Pakastani	125	105	0.72	0.045			
Bangladeshi	39	55	1.22	0.536			
BlackCaribbean	15	16	0.70	0.317			
BlackAfrican	19	26	1.44	0.341			
Other	45	34	0.50	0.016			
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	1015	1119	1.00		1.00		
Stable	1254	1673	1.16	0.021	1.15	0.030	1.01 to 1.31
Difficulties	929	1242	1.13	0.079	1.09	0.244	0.94 to 1.25
B3. Number of Children							
One	427	413	1.00		1.00		
Two	1748	2022	1.11	0.264	1.13	0.204	0.94 to 1.35
Three or more	1023	1599	1.48	<0.0005	1.52	<0.0005	1.25 to 1.84
B4. Access to Motor Vehicle(s)							
Yes	3032	3827	1.00				
No	166	207	1.07	0.572			
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1157	1417	1.00				
Good	1389	1708	1.05	0.486			
Average-Very Poor	652	909	1.14	0.109			
C2. Area Deprivation Deciles							
Continuous:1 decile increase in advantage	3198	4034	1.01	0.616			
C3. Season of Main Interview							
Spring	1638	2152	1.00		1.00		
Summer	832	1017	0.90	0.133	0.91	0.161	0.79 to 1.04
Autumn	543	640	0.82	0.019	0.80	0.008	0.68 to 0.94
Winter	185	225	0.99	0.916	0.98	0.853	0.78 to 1.22

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Father-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3198	n = 4034	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
F. FATHER'S BACKGROUND							
F1. Father's SES at Age 14							
Managerial & professional	681	852	1.00				
Intermediate	604	824	1.05	0.616			
Routine & manual	1140	1382	0.94	0.477			
Father was not working	159	199	0.98	0.904			
Unknown/father died	614	777	0.92	0.377			
F2. Father's Age Left Full-time Education							
Continuous: 1 year increase	3198	4034	0.99	0.27			
F3. Father's Family Migration History							
Third Generation or more	2347	3112	1.00		1.00		
Second Generation	187	225	0.90	0.336	0.86	0.224	0.68 to 1.09
First Generation	335	319	0.73	0.007	0.67	0.001	0.54 to 0.84
Unknown	329	378	0.80	0.019	0.80	0.016	0.67 to 0.96
G. FATHER'S SITUATION							
G1. Father's Age							
Continuous: 1 year increase	3198	4034	1.01	0.03	1.01	0.038	1.00 to 1.02
G2. Father's Employment Status							
Not in work	216	241	1.00				
<30 hrs per wk / unknown hrs	141	170	1.08	0.71			
30+ hrs per week	2841	3623	1.13	0.29			
G3. Father's Marital Status							
Married	2676	3406	1.00				
Not married	522	628	0.95	0.496			
G4. Father has Health Restrictions							
No restrictions	2382	2858	1.00		1.00		
Some restrictions	684	981	1.17	0.036	1.18	0.027	1.02 to 1.36
High restrictions	132	195	1.19	0.19	1.17	0.238	0.90 to 1.52

Main Analyses: father-child high-frequency compared to mid-frequency facilitation through going to parks or playgrounds

This section refers to Table A 18 from page A/44, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-17 on page 172.

Child's Characteristics

Girls were significantly less likely than boys to be in the high-frequency group father (OR 0.80, 95% CI 0.67-0.97).

Household Situation

Having access to motor vehicle(s) was a significant variable in unadjusted analysis, but not in the final model.

Area and Season

Living in more advantaged areas was associated with decreased likelihood of children and fathers being in the high-frequency group (1 decile increase in advantage: 0.95, 0.92-0.98). For households having their main interview in the summer, compared to spring the fathers were significantly more likely to report being in the high-frequency group (1.42, 1.14-1.77).

Father's Situation

Children with fathers who were working thirty or more hours per week were significantly less likely than those who were not working to be in the high-frequency group (0.62, 0.46-0.84). Father's health restrictions had a significant comparison in unadjusted analysis, but was not retained in the final model.

A 18. Logistic regression analyses table for father-child high-frequency compared to mid-frequency facilitation through going to parks/playgrounds.

Father-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3198	n = 765	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	1697	442	1.00		1.00		
Girl	1501	323	0.81	0.028	0.80	0.024	0.67 to 0.97
A2. Child's Age							
Continuous: 1 year increase	3198	765	1.28	0.182			
A3. Child has Disability							
No	3046	715	1.00				
Yes	152	50	1.28	0.158			
A4. Child's Ethnicity							
White	2801	661	1.00				
Mixed	63	13	1.07	0.829			
Indian	91	21	0.95	0.816			
Pakastani	125	36	1.31	0.115			
Bangladeshi	39	10	1.09	0.801			
BlackCaribbean	15	5	1.34	0.648			
BlackAfrican	19	7	1.51	0.406			
Other	45	12	1.08	0.842			
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	1015	208	1.00				
Stable	1254	320	1.20	0.112			
Difficulties	929	237	1.20	0.153			
B3. Number of Children							
One	427	93	1.00				
Two	1748	401	1.12	0.439			
Three or more	1023	271	1.15	0.391			
B4. Access to Motor Vehicle(s)							
Yes	3032	698	1.00				
No	166	67	1.88	0.001			
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1157	289	1.00				
Good	1389	309	0.85	0.115			
Average-Very Poor	652	167	0.96	0.731			
C2. Area Deprivation Deciles							
Continuous:1 decile increase in advantage	3198	765	0.94	<0.0005	0.95	0.002	0.92 to 0.98
C3. Season of Main Interview							
Spring	1638	367	1.00		1.00		
Summer	832	249	1.38	0.004	1.42	0.002	1.14 to 1.77
Autumn	543	115	1.07	0.591	1.09	0.485	0.85 to 1.40
Winter	185	34	0.83	0.398	0.81	0.324	0.53 to 1.24

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Father-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3198	n = 765	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
F. FATHER'S BACKGROUND							
F1. Father's SES at Age 14							
Managerial & professional	681	161	1.00				
Intermediate	604	166	1.17	0.192			
Routine & manual	1140	264	1.01	0.935			
Father was not working	159	23	0.66	0.138			
Unknown/father died	614	151	1.13	0.388			
F2. Father's Age Left Full-time Education							
Continuous: 1 year increase	3198	765	0.97	0.136			
F3. Father's Family Migration History							
Third Generation or more	2347	567	1.00				
Second Generation	187	34	0.82	0.289			
First Generation	335	92	1.15	0.318			
Unknown	329	72	1.00	0.978			
G. FATHER'S SITUATION							
G1. Father's Age							
Continuous: 1 year increase	3198	765	1.00	0.713			
G2. Father's Employment Status							
Not in work	216	88	1.00		1.00		
<30 hrs per wk / unknown hrs	141	50	0.82	0.463	0.86	0.566	0.51 to 1.45
30+ hrs per week	2841	627	0.56	<0.0005	0.62	0.002	0.46 to 0.84
G3. Father's Marital Status							
Married	2676	631	1.00				
Not married	522	134	0.99	0.951			
G4. Father has Health Restrictions							
No restrictions	2382	550	1.00				
Some restrictions	684	175	1.20	0.086			
High restrictions	132	40	1.58	0.044			

Appendix for Section 5.3

Supplementary Analyses (two-parent families): mother's low-frequency compared to mother's mid-frequency support through playing active games with child

A 19. Logistic regression analyses table (2-parent families) for mother-child low-frequency compared to mid-frequency participation through playing active games.

Mother-child participation through playing active games							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 2965	n = 3116	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	1475	1515	1.00				
Girl	1490	1601	1.07	0.254			
A2. Child's Age							
Continuous: 1 year increase	2965	3116	1.08	0.528			
A3. Child has Disability							
No	2840	2944	1.00				
Yes	125	172	1.34	0.062			
A4. Child's Ethnicity							
White	2695	2655	1.00		1.00		
Mixed	55	61	1.07	0.698	1.07	0.692	0.76 to 1.51
Indian	82	87	1.20	0.424	1.22	0.374	0.79 to 1.9
Pakistani	61	158	2.57	<0.0005	1.90	0.001	1.31 to 2.76
Bangladeshi	24	64	3.03	0.002	2.27	0.029	1.09 to 4.73
BlackCaribbean	9	24	2.38	0.007	2.10	0.035	1.05 to 4.18
BlackAfrican	13	28	2.55	<0.0005	2.01	0.003	1.27 to 3.18
Other	26	39	1.53	0.128	1.43	0.194	0.83 to 2.46
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	899	806	1.00		1.00		
Stable	1265	1195	1.06	0.494	0.96	0.588	0.81 to 1.13
Difficulties	801	1115	1.61	<0.0005	1.30	0.001	1.11 to 1.53
B3. Number of Children							
One	390	298	1.00		1.00		
Two	1632	1536	1.28	0.012	1.35	0.002	1.12 to 1.64
Three or more	943	1282	1.80	<0.0005	1.70	<0.0005	1.41 to 2.04
B4. Access to Motor Vehicle(s)							
Yes	2824	2927	1.00				
No	141	189	1.19	0.178			
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1067	986	1.00				
Good	1316	1324	1.10	0.177			
Average-Very Poor	582	806	1.37	<0.0005			
C2. Area Deprivation Deciles							
Continuous:1 decile increase	2965	3116	0.93	<0.0005	0.95	<0.0005	0.93 to 0.98
C3. Season of Main Interview							
Spring	1526	1715	1.00		1.00		
Summer	772	697	0.78	0.003	0.82	0.014	0.69 to 0.96
Autumn	512	489	0.79	0.005	0.82	0.024	0.69 to 0.97
Winter	155	215	1.08	0.531	1.10	0.438	0.87 to 1.38

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Mother-child participation through playing active games							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 2965	n = 3116	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
D. MOTHER'S BACKGROUND							
D1. Mother's SES at Age 14							
Managerial & professional	862	784	1.00				
Intermediate	693	693	1.01	0.893			
Routine & manual	1012	1130	1.13	0.091			
Father was not working	156	220	1.55	0.001			
Unknown/father died	242	289	1.33	0.020			
D2. Mother's Age Left Full-time Education							
Continuous: 1 year increase	2965	3116	0.94	<0.0005	0.96	<0.0005	0.94 to 0.98
D3. Mother's Family Migration History							
Third Generation or more	2485	2463	1.00				
Second Generation	201	249	1.28	0.037			
First Generation	279	404	1.37	0.002			
E. MOTHER'S SITUATION							
E1. Mother's Age							
Continuous: 1 year increase	2965	3116	1.01	0.059	1.03	<0.0005	1.01 to 1.04
E2. Mother's Employment Hours							
Not in work	949	1170	1.00				
<30 hrs per wk / unknown hrs	1395	1301	0.79	<0.0005			
30+ hrs per week	621	645	0.86	0.066			
E3. Mother's Marital Status							
Married	2555	2635	1.00				
Not married	410	481	1.18	0.037			
E4. Mother's Health Restrictions							
No restrictions	2065	1964	1.00		1.00		
Some restrictions	805	928	1.25	<0.0005	1.21	0.003	1.07 to 1.37
High restrictions	95	224	2.64	<0.0005	2.41	<0.0005	1.83 to 3.17

Supplementary Analyses (two-parent families): mother's high-frequency compared to mother's mid-frequency support through playing active games with child

A 20. Logistic regression analyses table (2-parent families) for mother-child high-frequency compared to mid-frequency participation through playing active games.

Mother-child participation through playing active games							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 2965	n = 1916	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	1475	1066	1.00		1.00		
Girl	1490	850	0.76	<0.0005	0.77	<0.0005	0.67 to 0.88
A2. Child's Age							
Continuous: 1 year increase	2965	1916	0.76	0.055			
A3. Child has Disability							
No	2840	1804	1.00		1.00		
Yes	125	112	1.45	0.016	1.46	0.015	1.08 to 1.99
A4. Child's Ethnicity							
White	2695	1733	1.00				
Mixed	55	31	1.11	0.652			
Indian	82	49	0.97	0.893			
Pakistani	61	47	1.22	0.386			
Bangladeshi	24	16	1.05	0.907			
BlackCaribbean	9	3	0.71	0.622			
BlackAfrican	13	11	1.32	0.564			
Other	26	26	1.38	0.294			
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	899	637	1.00				
Stable	1265	787	0.88	0.127			
Difficulties	801	492	0.90	0.189			
B3. Number of Children							
One	390	245	1.00				
Two	1632	1003	1.02	0.854			
Three or more	943	668	1.11	0.384			
B4. Access to Motor Vehicle(s)							
Yes	2824	1806	1.00				
No	141	110	1.22	0.198			
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1067	810	1.00		1.00		
Good	1316	766	0.76	<0.0005	0.75	<0.0005	0.64 to 0.87
Average-Very Poor	582	340	0.78	0.013	0.73	0.003	0.60 to 0.90
C2. Area Deprivation Deciles							
Continuous:1 decile increase	2965	1916	0.98	0.078			
C3. Season of Main Interview							
Spring	1526	916	1.00		1.00		
Summer	772	629	1.37	<0.0005	1.36	0.001	1.14 to 1.62
Autumn	512	297	0.96	0.707	0.93	0.482	0.77 to 1.13
Winter	155	74	0.85	0.288	0.84	0.268	0.62 to 1.14

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Mother-child participation through playing active games							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 2965	n = 1916	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
D. MOTHER'S BACKGROUND							
D1. Mother's SES at Age 14							
Managerial & professional	862	565	1.00				
Intermediate	693	439	0.90	0.224			
Routine & manual	1012	659	0.92	0.344			
Father was not working	156	104	1.03	0.844			
Unknown/father died	242	149	1.00	0.997			
D2. Mother's Age Left Full-time Education							
Continuous: 1 year increase	2965	1916	0.98	0.107	0.99	0.055	0.98 to 1.00
D3. Mother's Family Migration History							
Third Generation or more	2485	1613	1.00				
Second Generation	201	97	0.84	0.237			
First Generation	279	206	1.10	0.397			
E. MOTHER'S SITUATION							
E1. Mother's Age							
Continuous: 1 year increase	2965	1916	0.99	0.091			
E2. Mother's Employment Hours							
Not in work	949	688	1.00		1.00		
<30 hrs per wk / unknown hrs	1395	853	0.83	0.009	0.83	0.013	0.72 to 0.96
30+ hrs per week	621	375	0.80	0.018	0.80	0.023	0.67 to 0.97
E3. Mother's Marital Status							
Married	2555	1643	1.00				
Not married	410	273	1.11	0.316			
E4. Mother's Health Restrictions							
No restrictions	2065	1370	1.00				
Some restrictions	805	465	0.86	0.096			
High restrictions	95	81	1.37	0.077			

Supplementary Analyses (two-parent families): mother's low-frequency compared to mother's mid-frequency support through taking child to parks or playgrounds

A 21. Logistic regression analyses table (2-parent families) for mother-child low-frequency compared to mid-frequency facilitation through going to parks/playgrounds.

Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3449	n = 3230	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	1728	1618	1.00				
Girl	1721	1612	1.03	0.597			
A2. Child's Age							
Continuous: 1 year increase	3449	3230	0.96	0.791			
A3. Child has Disability							
No	3285	3061	1.00				
Yes	164	169	1.16	0.272			
A4. Child's Ethnicity							
White	3068	2855	1.00				
Mixed	58	59	1.22	0.339			
Indian	90	103	1.12	0.608			
Pakistani	106	106	1.26	0.177			
Bangladeshi	41	48	1.04	0.874			
BlackCaribbean	14	15	1.07	0.894			
BlackAfrican	22	18	0.97	0.929			
Other	50	26	0.47	0.010			
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	1064	903	1.00				
Stable	1419	1294	1.08	0.297			
Difficulties	966	1033	1.22	0.007			
B3. Number of Children							
One	456	324	1.00		1.00		
Two	1850	1612	1.25	0.018	1.28	0.009	1.06 to 1.54
Three or more	1143	1294	1.59	<0.0005	1.58	<0.0005	1.3 to 1.92
B4. Access to Motor Vehicle(s)							
Yes	3286	3051	1.00				
No	163	179	1.11	0.428			
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1274	1081	1.00				
Good	1465	1408	1.18	0.014			
Average-Very Poor	710	741	1.26	0.008			
C2. Area Deprivation Deciles							
Continuous:1 decile increase	3449	3230	0.97	0.003	0.96	0.001	0.94 to 0.98
C3. Season of Main Interview							
Spring	1771	1752	1.00		1.00		
Summer	905	784	0.89	0.088	0.91	0.151	0.79 to 1.04
Autumn	580	500	0.85	0.033	0.84	0.026	0.72 to 0.98
Winter	193	194	0.95	0.662	0.94	0.616	0.75 to 1.19

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Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3449	n = 3230	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
D. MOTHER'S BACKGROUND							
D1. Mother's SES at Age 14							
Managerial & professional	965	883	1.00				
Intermediate	759	765	1.07	0.398			
Routine & manual	1243	1110	0.99	0.859			
Father was not working	178	211	1.38	0.017			
Unknown/father died	304	261	0.93	0.466			
D2. Mother's Age Left Full-time Education							
Continuous: 1 year increase	3449	3230	0.98	0.156			
D3. Mother's Family Migration History							
Third Generation or more	2849	2639	1.00		1.00		
Second Generation	199	259	1.33	0.009	1.27	0.033	1.02 to 1.58
First Generation	401	332	0.92	0.380	0.86	0.139	0.7 to 1.05
E. MOTHER'S SITUATION							
E1. Mother's Age							
Continuous: 1 year increase	3449	3230	1.02	0.015	1.02	0.003	1.01 to 1.03
E2. Mother's Employment Status							
Not in work	1165	1119	1.00				
<30 hours per wk / unknown hrs	1582	1390	0.83	0.005			
30+ hours per week	702	721	1.06	0.435			
E3. Mother's Marital Status							
Married	2945	2795	1.00				
Not married	504	435	0.97	0.681			
E4. Mother's Health Restrictions							
No restrictions	2362	2120	1.00		1.00		
Some restrictions	944	921	1.07	0.296	1.07	0.292	0.94 to 1.21
High restrictions	143	189	1.49	0.003	1.46	0.005	1.12 to 1.9

Supplementary Analyses (two-parent families): mother's high-frequency compared to mother's mid-frequency support through taking child to parks or playgrounds

A 22. Logistic regression analyses table (2-parent families) for mother-child low-frequency compared to mid-frequency facilitation through going to parks/playgrounds.

Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3449	n = 1318	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
A. CHILD'S CHARACTERISTICS							
A1. Child's Sex							
Boy	1728	710	1.00				
Girl	1721	608	0.89	0.117			
A2. Child's Age							
Continuous: 1 year increase	3449	1318	0.78	0.125			
A3. Child has Disability							
No	3285	1242	1.00		1.00		
Yes	164	76	1.36	0.047	1.34	0.064	0.98 to 1.82
A4. Child's Ethnicity							
White	3068	1160	1.00				
Mixed	58	30	1.25	0.402			
Indian	90	25	0.69	0.124			
Pakistani	106	54	1.48	0.124			
Bangladeshi	41	15	0.75	0.348			
BlackCaribbean	14	7	1.22	0.699			
BlackAfrican	22	12	1.16	0.681			
Other	50	15	0.87	0.651			
B. HOUSEHOLD SITUATION							
B1. Managing Financially							
Comfortable	1064	375	1.00				
Stable	1419	534	1.09	0.293			
Difficulties	966	409	1.17	0.083			
B3. Number of Children							
One	456	153	1.00				
Two	1850	709	1.14	0.260			
Three or more	1143	456	1.16	0.261			
B4. Access to Motor Vehicle(s)							
Yes	3286	1220	1.00		1.00		
No	163	98	1.71	<0.0005	1.38	0.036	1.02 to 1.88
C. AREA AND SEASON							
C1. Mother's Opinion of Area for Children							
Excellent	1274	508	1.00				
Good	1465	533	0.89	0.185			
Average-Very Poor	710	277	0.93	0.500			
C2. Area Deprivation Deciles							
Continuous:1 decile increase	3449	1318	0.96	0.003	0.96	0.013	0.94 to 0.99
C3. Season of Main Interview							
Spring	1771	634	1.00		1.00		
Summer	905	409	1.40	<0.0005	1.43	<0.0005	1.19 to 1.71
Autumn	580	218	1.28	0.028	1.30	0.019	1.04 to 1.61
Winter	193	57	0.86	0.328	0.84	0.273	0.62 to 1.15

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Mother-child facilitation through going to parks/playgrounds							
DOMAINS	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3449	n = 1318	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
D. MOTHER'S BACKGROUND							
D1. Mother's SES at Age 14							
Managerial & professional	965	363	1.00				
Intermediate	759	301	0.97	0.757			
Routine & manual	1243	448	1.01	0.951			
Father was not working	178	91	1.45	0.035			
Unknown/father died	304	115	1.01	0.972			
D2. Mother's Age Left Full-time Education							
Continuous: 1 year increase	3449	1318	0.98	0.218			
D3. Mother's Family Migration History							
Third Generation or more	2849	1073	1.00				
Second Generation	199	89	1.21	0.214			
First Generation	401	156	1.03	0.832			
E. MOTHER'S SITUATION							
E1. Mother's Age							
Continuous: 1 year increase	3449	1318	0.99	0.271			
E2. Mother's Employment Status							
Not in work	1165	523	1.00		1.00		
<30 hours per wk / unknown hrs	1582	577	0.88	0.185	0.85	0.073	0.72 to 1.01
30+ hours per week	702	218	0.68	<0.0005	0.70	0.002	0.56 to 0.88
E3. Mother's Marital Status							
Married	2945	1093	1.00				
Not married	504	225	1.15	0.178			
E4. Mother's Health Restrictions							
No restrictions	2362	917	1.00				
Some restrictions	944	333	0.92	0.296			
High restrictions	143	68	1.31	0.118			

Mother-child facilitation as a predictor of mother-child participation?

Table A 23 is a cross tabulation of the number in each category for mother-child participation through playing active games and mother-child facilitation through going to parks or playgrounds. This uses the full data set of n = 12,619 families. There are two ways to look at this data:

- What at the patterns of participation through active games, given that we know the level of facilitation through park or playground visits?

- What are the patterns facilitation though park or playground visits, given that we know the level of participation through active games?

For the observations below, the first of these approaches was taken.

A 23. Cross-tabulation of mother-child active games and mother-child parks/playgrounds visits.

		Mother-child participation through playing active games				
		Low-Frequency	Mid-Frequency	High-Frequency	Unknown	Totals
Mother-child facilitation through going to parks/ playgrounds	Low-Frequency	2687	1475	678	0	4840
	Mid-Frequency	1797	2366	1328	2	5493
	High-Frequency	566	690	1021	0	2277
	Unknown	2	4	0	3	9
	Totals	5052	4535	3027	5	12,619

Among the 4840 mothers who reported low-frequency parks or playground visits, the majority, 2687, also reported low-frequency active games, with fewer reporting mid- (1475) or high- frequency (678) active games.

Among the 5493 mothers who reported mid-frequency parks or playground visits, the highest proportion, 2366, also reported mid-frequency active games. This was followed by 1797 who reported low-frequency and 1328 who reported high-frequency active games.

Among the 2277 mothers who reported high-frequency park or playground visits, the majority 1021 reported high-frequency active games, followed by mid-frequency (690), and low-frequency (566).

Overall there was indication that where low-frequency or mid-frequency support was reported for one of the modes of involvement, the same level was also most likely to reported for the other mode. If high-frequency parks and playgrounds was reported, it was most likely that the mother also reported high-frequency active play, but if high-frequency active games was reported, then they were most likely to have mid-frequency park or playground visits.

Logistic regression analyses were carried out. The adjusted models presented in Table A 24 show that mother-child low-frequency facilitation through parks or playground visits was highly associated with low-frequency participation through playing active games (OR 2.33, 95% CI 2.10-2.58). Similarly, in Table A 25, mother's high-frequency support for the two modes were also highly related (2.49, 2.18-2.84), and low-frequency support through park/playground visits was negatively associated with high frequency active games (0.77, 0.68-0.88).

A 24. Logistic regression analyses: mother-child facilitation as a predictor of low-frequency mother-child participation

Mother-child particiption through playing active games								
DOMAIN	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 4477	n = 4972	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
Mother-child facilitation through going to parks/playgrounds							
Mid-Freq	2332	1771	1.00		1.00		
Low-Freq	1461	2644	2.37	<0.0005	2.33	<0.0005	2.10 to 2.58
High-Freq	684	557	1.05	0.482	1.01	0.914	0.87 to 1.17
*Adjusted mutually and by the following predictors:	child's sex, child's ethnicity, household managing financially, number of children, area deprivation level, season of main interview, mother's age left full-time education, and mother's health restrictions.						

A 25. Logistic regression analyses: mother-child facilitation as a predictor of high-frequency mother-child participation

Mother-child particiption through playing active games							
DOMAIN	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 4477	n = 2988	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
Mother-child facilitation through going to parks/playgrounds							
Mid-Freq	2332	1313	1.00		1.00		
Low-Freq	1461	671	0.77	<0.0005	0.77	<0.0005	0.68 to 0.88
High-Freq	684	1004	2.61	<0.0005	2.49	<0.0005	2.18 to 2.84
*Adjusted mutually and by the following predictors:	child's sex, child's age, child has disability, mother's opinion of area for children, area deprivation level, season of main interview, mother's employmnet hours, and mother's health restrictions.						

Father-child facilitation as a predictor of father-child participation?

Table A 26 is a cross tabulation of the number in each category for father-child participation through playing active games and father-child facilitation through going to park/outdoor playgrounds. This used the subset of n = 8103 two-parent families. As with the analyses for mothers, there were two possible approaches for describing the data:

- What at the patterns of participation through active games, given that we know the level of facilitation through park or playground visits?

- What are the patterns of facilitation though park or playground visits, given that we know the level of participation through active games?

For the observations below, the second of these approaches was taken.

A 26. Cross-tabulation of father-child active games and father-child parks/playgrounds visits.

		Father-child participation through playing active games				
		Low-Frequency	Mid-Frequency	High-Frequency	Unknown	Totals
Father-child facilitation through going to parks/ playgrounds	Low-Frequency	1341	1560	1179	1	4081
	Mid-Frequency	371	1420	1450	1	3242
	High-Frequency	56	154	566	0	776
	Unknown	0	0	0	4	4
	Totals	1768	3134	3195	6	8103

Among the 1768 fathers who reported providing low-frequency active games, the majority, 1341, also reported low-frequency park or playground visits, with fewer reporting mid- (371) or high- frequency (56) park or playground visits.

Among the 3134 fathers who reported mid-frequency active games, similar proportions reported low- (1560) and mid-frequency (1420) park or playground visits, and a low proportion reported high-frequency (154) park or playground visits.

Among the 3195 fathers who reported high-frequency active games, the majority of 1179 reported mid-frequency park or playground visits, followed by 1450 who reported low-frequency and 566 who reported high-frequency park or playground visits.

Overall there was indication that where low-frequency is reported for one of the modes of involvement, it is fairly likely in the other. High-frequency park or playground visits is fairly rare among fathers, but for those who are in this group, they are also likely to have high-frequency active games with the child.

Logistic regression was carried out. In the adjusted model presented in Table A 27, father's low-frequency parks or playgrounds was highly associated with father's low-frequency active games (OR 3.32, 95% CI 2.84-3.87). As shown in Table A 28, father's high-frequency involvement for the two modes were also highly related (OR 3.79, 95% CI 3.01-4.78), and low-frequency park/playground visits was negatively associated with high frequency active games (0.66, 0.59-0.75).

The patterns were very similar to father as mothers, but the odds ratios were greater indicating that the two modes of support were more closely related.

A 27. Logistic regression analyses: father-child facilitation as a predictor of low-frequency father-child participation

Father-child particiption through playing active games								
DOMAIN	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3102	n = 1747	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
Father-child facilitation through going to parks/playgrounds							
Mid-Freq	1404	364	1.00		1.00		
Low-Freq	1548	1328	3.32	<0.0005	3.32	<0.0005	2.84 to 3.87
High-Freq	150	55	1.48	0.063	1.40	0.103	0.93 to 2.12
*Adjusted mutually and by the following predictors:	child's sex, child's ethnicity, household managing financially, number of children in household, area deprivation level, season of main interview, father's age, and father's health restrictions.						

A 28. Logistic regression analyses: father-child facilitation as a predictor of high-frequency father-child participation

Father-child particiption through playing active games							
DOMAIN	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3102	n = 3148	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
Father-child facilitation through going to parks/playgrounds							
Mid-Freq	1404	1430	1.00		1.00		
Low-Freq	1548	1158	0.67	<0.0005	0.66	<0.0005	0.59 to 0.75
High-Freq	150	560	3.89	<0.0005	3.79	<0.0005	3.01 to 4.78
*Adjusted mutually and by the following predictors:	child's sex, child's age, access to motor vehicle(s), season of main interview, and age father left education						

Mother-child participation as a predictor of father-child participation?

No cross tabulation is presented for these data, although the number in each category used in the regression analyses can be examined from Tables A 29 and A 30.

Adjusted logistic regression analyses was carried for the data on two-parent families and associations between mother-child and father-child participation through playing active games were evident. Table A 29 shows that low-frequency participation with mothers was associated with low-frequency participation with fathers (OR 1.57, 95% CI 1.35-1.83). Similarly, Table A 30 shows high-frequency participation with mothers and fathers were associated (1.69, 1.49-1.92).

A 29. Logistic regression analyses: mother-child participation as a predictor of low-frequency father-child participation

Father-child particiption through playing active games								
DOMAIN	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3102	n = 1747	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
Mother-child particiption through playing active games							
Mid-Freq	1264	555	1.00		1.00		
Low-Freq	1201	941	1.73	<0.0005	1.57	<0.0005	1.35 to 1.83
High-Freq	637	251	0.89	0.207	0.91	0.304	0.76 to 1.09
*Adjusted mutually and by the following predictors:		child's sex, child's ethnicity, household managing financially, number of children in household, area deprivation level, season of main interview, father's age, and father's health restrictions.					

A 30. Logistic regression analyses: mother-child participation as a predictor of high-frequency father-child participation

Father-child particiption through playing active games							
DOMAIN	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3102	n = 3148	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
Mother-child particiption through playing active games							
Mid-Freq	1264	1146	1.00		1.00		
Low-Freq	1201	974	0.89	0.081	0.88	0.067	0.77 to 1.01
High-Freq	637	1028	1.75	<0.0005	1.69	<0.0005	1.49 to 1.92
*Adjusted mutually and by the following predictors:		child's sex, child's age, access to motor vehicle(s), season of main interview, age father left education					

Mother-child facilitation as a predictor of father-child facilitation?

No cross tabulation is presented for these data, although the number in each category used in the regression analyses can be examined from Tables A 31 and A 32.

Adjusted logistic regression analyses were carried out using the dataset of two-parent families. Associations between mother-child and father-child facilitation through going to parks or playground were evident. Table A 31 shows that low-frequency facilitation from mothers was associated with low-frequency facilitation from fathers (2.77, 2.45-3.15), and Table A 32 that high-frequency facilitation from mothers was associated with high-frequency facilitation from fathers (2.54, 2.03-3.17).

A 31. Logistic regression analyses: mother-child facilitation as a predictor of low-frequency father-child facilitation

Father-child facilitation through going to parks/playgrounds								
DOMAIN	Mid-Freq	Low-Freq	Multinomial Logistic Regression				
Variables	n = 3198	n = 4034	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
Mother-child facilitation through going to parks/playgrounds							
Mid-Freq	1692	1456	1.00		1.00		
Low-Freq	895	2172	2.84	<0.0005	2.77	<0.0005	2.45 to 3.15
High-Freq	611	406	0.77	0.001	0.78	0.001	0.67 to 0.91
*Adjusted mutually and by the following predictors:	child's sex, household managing financially, number of children in household , season of main interview, father's family migration history, father's age, and father's health restrictions.						

A 32. Logistic regression analyses: mother-child facilitation as a predictor of high-frequency father-child facilitation

Father-child facilitation through going to parks/playgrounds							
DOMAIN	Mid-Freq	High-Freq	Multinomial Logistic Regression				
Variables	n = 3198	n = 765	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
Mother-child facilitation through going to parks/playgrounds							
Mid-Freq	1692	301	1.00		1.00		
Low-Freq	895	163	1.02	0.837	1.01	0.947	0.81 to 1.26
High-Freq	611	301	2.63	<0.0005	2.54	<0.0005	2.03 to 3.17
*Adjusted mutually and by the following predictors:	child's sex, area deprivation level, season of main interview, and father's employment hours.						

Appendix for Section 5.4

Potential predictors of children's other activities

This section looks at the eighteen variables investigated as predictors in Chapter 5, and the additional seven investigated in Chapter 6, to see whether these may be predictors of the four variables for children's activities: television viewing, computer use, sports club attendance and dog ownership. A sub-section follows for each of these activity variables.

The sub-sections on television viewing, computer use and sports club attendance each begin with a response re-categorisation chart (explained in Chapter 4, page 124) to show how the original responses from the questionnaires were re-categorised into three main response groups. This was not carried out for dog ownership due to the different format of the question, but this is explained.

Analyses of weighted proportions charts (explained in Chapter 4, page 126) are presented to show the patterns and chi squared tests for each activity variable and the predictor variables, and these are described. Regression analyses were not carried out to investigate associations since the aim was to get a general overview rather than identify predictors in detail.

Potential predictors of duration of television viewing

Boys were more likely than girls, and older children more likely than younger children, to have higher duration of television viewing. Children with disabilities were more likely to be in the high-duration group than those without disabilities. Children of Pakistani ethnicity were more often in the low-duration group, and those of Bangladeshi ethnicity were more often in the high-duration group.

Children in less financially comfortable households and those without access to motor vehicle(s) appeared more likely to have higher duration television viewing. Children with single mothers were also more likely to be in the high duration group. There were some significant differences in the distributions according to the number of siblings, but with no clear pattern.

Children living in areas considered worse for children by their mothers and those in poorer areas were more likely to have higher duration television viewing. Interviews in warmer mothers were generally associated with decreased duration of television.

Children whose mothers or fathers had more disadvantaged childhood backgrounds (as measured by their father's occupation) and those whose mothers left school at a younger age were more likely to have higher duration television viewing. Children whose mothers had a more recent migration history had increased likelihood of low duration of television, but no significant variation could be seen by father's migration history.

Children with younger, unmarried and non-working mothers or fathers were more likely to have high-duration of television viewing. Those with mothers or fathers who had greater health restrictions were also more likely to be in the high-duration group.

A 33. Analyses of weighted proportions chart for duration of children's television viewing – child's characteristics variables

Analyses of Weighted Proportions: Duration of Child's Television Viewing by Child's Chartacteristics variables

Mothers Sample, n=12,619	low	mid	high	low	mid		mid	high
Overall Distribution	21.3	64.0	14.6	25.0	75.0		81.4	18.6
CHILD'S CHARACTERISTICS:								
(A1) CHILD'S SEX	0.0001 (chi2 p values)			0.0008			0.0449	
Boy	19.7	64.7	15.6	23.3	76.7		80.6	19.4
Girl	23.0	63.3	13.6	26.7	73.3		82.3	17.7
(A2) CHILD'S AGE	0.0059			0.0310			0.0993	
4y4-4y11	23.9	63.5	12.6	27.3	72.7		83.5	16.5
5y0-5y3	21.5	63.7	14.8	25.2	74.8		81.1	18.9
5y4-6y1	19.6	64.8	15.6	23.2	76.8		80.6	19.4
(A3) CHILD HAS DISABILITY	0.0413			0.9845			0.0135	
No	21.4	64.2	14.4	25.0	75.0		81.6	18.4
Yes	20.4	61.3	18.4	24.9	75.1		76.9	23.1
(A4) CHILD'S ETHNICITY	0.0798			0.3372			0.0631	
White	21.2	64.5	14.3	24.8	75.3		81.9	18.2
Mixed	24.9	60.6	14.5	29.1	70.9		80.7	19.3
Indian	22.8	59.6	17.6	27.7	72.3		77.2	22.8
Pakistani	25.1	57.6	17.3	30.3	69.7		76.9	23.1
Bangladeshi	15.8	58.2	26.1	21.3	78.7		69.1	30.9
Black Caribbean	21.0	65.2	13.8	24.4	75.6		82.6	17.4
Black African	19.8	64.0	16.2	23.6	76.4		79.8	20.2
Other	17.7	62.5	19.8	22.1	77.9		76.0	24.0

A 34. Analyses of weighted proportions chart for duration of children's television viewing – household situation variables

Analyses of Weighted Proportions: Duration of Child's Television Viewing by Household Situation variables

Mothers Sample, n=12,619	low	mid	high	low	mid	mid	high
Overall Distribution	21.3	64.0	14.6	25.0	75.0	81.4	18.6
HOUSEHOLD SITUATION:							
(B1) MANAGING FINANCIALLY	0.0000 (chi2 p values)			0.0000		0.0000	
Comfortable	27.0	61.6	11.4	30.5	69.5	84.4	15.6
Stable	21.1	65.2	13.7	24.4	75.6	82.7	17.4
Difficulties	17.7	64.5	17.8	21.6	78.4	78.4	21.6
(B2) NUMBER OF PARENTS	0.0000			0.2174		0.0000	
Two	21.8	64.5	13.7	25.3	74.7	82.4	17.6
One	19.1	62.0	18.9	23.5	76.5	76.7	23.3
(B3) NUMBER OF CHILDREN	0.0008			0.0257		0.0004	
1	20.8	63.6	15.6	24.7	75.3	80.4	19.6
2	20.6	66.0	13.4	23.8	76.2	83.2	16.8
3 or more	22.5	61.5	16.0	26.8	73.2	79.3	20.7
(B4) ACCESS TO MOTOR..	0.0000			0.0007		0.0000	
Yes	22.1	64.3	13.5	25.6	74.4	82.6	17.4
No	16.0	62.0	22.1	20.5	79.5	73.7	26.3

A 35. Analyses of weighted proportions chart for duration of children's television viewing – area and season variables

Analyses of Weighted Proportions: Duration of Child's Television Viewing by Household Situation variables

Mothers Sample, n=12,619	low	mid	high	low	mid	mid	high
Overall Distribution	21.3	64.0	14.6	25.0	75.0	81.4	18.6
AREA & SEASON:							
(C1) MOTHER'S OPINION OF..	0.0000 (chi2 p values)			0.0000		0.0000	
Excellent	25.3	64.0	10.8	28.3	71.7	85.6	14.4
Good	20.9	64.1	15.0	24.6	75.4	81.1	18.9
Average-Very Poor	17.1	64.0	18.9	21.1	78.9	77.2	22.8
(C2) AREA DEPRIVATION SCORE	0.0000			0.0000		0.0000	
Most advantaged: 9-10	28.4	62.6	9.0	31.2	68.8	87.4	12.6
7-8	23.2	64.1	12.8	26.6	73.4	83.4	16.6
5-6	20.5	65.3	14.1	23.9	76.1	82.2	17.8
3-4	17.1	66.5	16.4	20.4	79.6	80.3	19.7
Most disadvantaged: 1-2	15.9	62.0	22.1	20.5	79.6	73.7	26.3
(C3) SEASON OF MAIN..	0.0000			0.0000		0.0000	
Spring	18.5	64.7	16.8	22.2	77.8	79.4	20.6
Summer	27.4	61.6	11.0	30.8	69.2	84.9	15.1
Autumn	25.2	63.2	11.6	28.5	71.5	84.5	15.5
Winter	13.9	69.7	16.4	16.6	83.4	81.0	19.0

Potential predictors of duration of computer use

Boys were more likely than girls, and older children more likely than younger children, to have higher duration computer use. Those with disabilities were more likely not to use computers at all. Children from all of the minority ethnic backgrounds were more likely to have high-duration of use than white children, and there was also variation for ethnicity in the no- and low-duration comparison.

Similar patterns were seen for managing financially, number of parents and access the vehicle(s) with children in more disadvantaged circumstances for each of these variables more likely to be in the no-duration group or the high-duration group. Children with three or more siblings were more likely than other children to have high-duration computer use.

Children living in areas considered worse for children by their mothers, and those in poorer areas, were more likely to have high-duration computer use. Although the distributions were significantly varied, there were no obvious patterns for the no-duration and low-duration comparison for these variables. Where interviews took place in the colder seasons, reported duration was generally higher.

Children whose mothers or fathers were of lower socio-economic position at age fourteen and left school at a younger age were more likely to have higher duration computer use. There indication that children of first and second generation migrant fathers had higher duration of computer use but migration history of the mother did not seem to be associated with any variation.

Children with younger, unmarried and non-working mothers or fathers tended to have higher duration of computer use, but there was indication that these groups (for mothers only) may also predict children having no computer use. Those with mothers or fathers who had greater health restrictions were also more likely to be in the high-duration group.

A 36. Analyses of weighted proportions chart for duration of children's computer use – child's characteristics variables

Analyses of Weighted Proportions: Duration of Child's Computer Use by Child's Chartacteristics variables

Mothers Sample, n=12,619	no	low	high	no	low	low	high
Overall Distribution	32.5	45.7	21.8	41.5	58.5	67.7	32.3
CHILD'S CHARACTERISTICS:							
(A1) CHILD'S SEX	0.0000 (chi2 p values)			0.0000		0.0000	
Boy	28.3	44.5	27.2	38.8	61.2	62.1	37.9
Girl	36.8	46.9	16.3	44.0	56.0	74.2	25.8
(A2) CHILD'S AGE	0.0000			0.0000		0.0015	
4y4-4y11	38.0	44.9	17.1	45.8	54.2	72.4	27.6
5y0-5y3	32.7	44.9	22.5	42.1	57.9	66.7	33.4
5y4-6y1	28.8	47.4	23.8	37.8	62.2	66.6	33.4
(A3) CHILD HAS DISABILITY	0.1289			0.0412		0.6980	
No	32.3	45.9	21.9	41.3	58.7	67.7	32.3
Yes	36.1	42.6	21.3	45.9	54.1	66.7	33.3
(A4) CHILD'S ETHNICITY	0.0000			0.4980		0.0000	
White	33.0	46.2	20.8	41.7	58.3	68.9	31.1
Mixed	27.9	45.5	26.6	38.0	62.0	63.1	36.9
Indian	27.9	43.5	28.6	39.0	61.0	60.4	39.7
Pakistani	34.5	37.1	28.4	48.2	51.8	56.7	43.3
Bangladeshi	30.9	44.1	25.1	41.2	58.8	63.8	36.2
Black Caribbean	20.3	41.1	38.6	33.0	67.0	51.6	48.4
Black African	24.6	39.5	36.0	38.3	61.7	52.3	47.7
Other	27.3	43.2	29.6	38.7	61.3	59.3	40.7

A 37. Analyses of weighted proportions chart for duration of children's computer use – household situation variables

Overall Distribution	32.5	45.7	21.8	41.5	58.5	67.7	32.3
HOUSEHOLD SITUATION:							
(B1) MANAGING FINANCIALLY	0.0000 (chi2 p values)			0.0023		0.0000	
Comfortable	32.9	50.2	16.8	39.6	60.4	74.9	25.1
Stable	32.1	47.3	20.7	40.4	59.6	69.6	30.4
Difficulties	32.5	41.0	26.5	44.2	55.8	60.7	39.3
(B2) NUMBER OF PARENTS	0.0000			0.0000		0.0000	
Two	32.0	47.2	20.8	40.4	59.6	69.4	30.6
One	34.8	38.6	26.6	47.4	52.6	59.2	40.8
(B3) NUMBER OF CHILDREN	0.0001			0.5130		0.0000	
1	34.4	45.3	20.3	43.2	56.8	69.0	31.0
2	32.8	46.9	20.3	41.2	58.8	69.8	30.2
3 or more	31.1	44.2	24.7	41.3	58.7	64.1	35.9
(B4) ACCESS TO MOTOR VEHICLE(S)	0.0000			0.0000		0.0000	
Yes	32.2	47.4	20.4	40.4	59.6	69.9	30.1
No	34.4	34.2	31.4	50.2	49.8	52.2	47.8

A 38. Analyses of weighted proportions chart for duration of children's computer use – area and season variables

Analyses of Weighted Proportions: Duration of Child's Computer Use by Area and Season variables

Mothers Sample, n=12,619	no	low	high	no	low	low	high
Overall Distribution	32.5	45.7	21.8	41.5	58.5	67.7	32.3
AREA & SEASON:							
(C1) MOTHER'S OPINION OF AREA	0.0000 (chi2 p values)			0.0290		0.0000	
Excellent	34.5	47.6	17.9	42.0	58.0	72.7	27.3
Good	31.4	47.5	21.1	39.9	60.2	69.2	30.8
Average-Very Poor	31.6	40.4	28.0	43.9	56.1	59.1	41.0
(C2) AREA DEPRIVATION SCORE	0.0000			0.0422		0.0000	
Most advantaged: 9-10	34.0	52.3	13.7	39.4	60.6	79.3	20.7
7-8	33.5	47.5	19.1	41.3	58.7	71.4	28.6
5-6	35.0	44.6	20.4	44.0	56.0	68.7	31.3
3-4	29.5	44.9	25.6	39.7	60.3	63.7	36.3
Most disadvantaged: 1-2	29.8	37.9	32.4	44.0	56.0	53.9	46.1
(C3) SEASON OF MAIN..	0.0000			0.0000		0.0000	
Spring	29.7	46.5	23.8	38.9	61.1	66.2	33.8
Summer	39.0	44.2	16.8	46.9	53.1	72.4	27.6
Autumn	32.7	45.9	21.4	41.6	58.4	68.2	31.8
Winter	29.5	43.8	26.6	40.3	59.7	62.2	37.8

Potential predictors of duration of frequency of sports club attendance

Frequency of sports club attendance was greater for boys than girls, and older children than younger children. Children with a disability were more likely to be in the low-frequency group. There was wide ethnic diversity: Children in the Pakistani and Bangladeshi groups were particularly likely to have low-frequency attendance, and those in the white and Black Caribbean groups most likely to have high-frequency attendance.

Lower frequency sports club attendance was more common for children living in households having financial difficulties, those with a single-mother, and those without access to motor vehicle(s). Children with one sibling were more often the low-frequency group than only-children and those with two or more siblings.

Children living in areas which were considered worse for children by their mothers and those with lower deprivation scores were more likely to be in the low-frequency group for sports club attendance. High-frequency attendance was most commonly reported in interviews which took place in the autumn.

Lower frequency sports club attendance was most common among children whose mothers and fathers were more deprived based on their fathers' occupation at age 14, left school at a younger age, and had a recent family migration history.

Children with mothers and fathers who were not working, were not married, and who had greater health restrictions were also more likely to be in the low-frequency group.

A 39. Analyses of weighted proportions chart for frequency of children going to sports clubs – child's characteristics variables

Analyses of Weighted Proportions: Frequency of Child's Sports Club Attendance by Child's Chartacteristics variables

Mothers Sample, n=12,619	low	mid	high	low	mid	mid	high
Overall Distribution	44.4	45.5	10.1	49.4	50.6	81.8	18.2
CHILD'S CHARACTERISTICS:							
(A1) CHILD'S SEX	0.0001 (chi2 p values)			0.0000		0.0000	
Boy	47.8	44.3	7.8	51.9	48.1	85.0	15.0
Girl	40.9	46.7	12.4	46.7	53.4	79.0	21.0
(A2) CHILD'S AGE	0.0000			0.0001		0.0069	
4y4-4y11	48.9	42.9	8.2	53.2	46.8	84.0	16.0
5y0-5y3	45.3	45.2	9.5	50.0	50.0	82.6	17.4
5y4-6y1	40.4	47.5	12.1	46.0	54.0	79.6	20.4
(A3) CHILD HAS DISABILITY	0.0000			0.0000		0.3883	
No	43.8	46.0	10.2	48.8	51.3	81.9	18.1
Yes	54.6	36.2	9.2	60.2	39.8	79.7	20.3
(A4) CHILD'S ETHNICITY	0.0000			0.0000		0.0547	
White	41.7	47.4	10.9	46.8	53.2	81.4	18.6
Mixed	50.6	42.4	7.1	54.4	45.6	85.7	14.3
Indian	56.5	37.6	5.9	60.0	40.0	86.4	13.6
Pakistani	82.9		16.1	83.7	16.3	94.4	5.6
Bangladeshi	89.3		10.0	89.7	10.3	95.8	4.2
Black Caribbean	56.2	35.7	8.1	61.1	38.9	81.4	18.6
Black African	66.0	29.8	4.2	68.9	31.1	87.6	12.4
Other	67.3	31.1	1.5	68.4	31.6	94.9	5.1

A 40. Analyses of weighted proportions chart for frequency of children going to sports clubs – household situation variables

Overall Distribution	44.4	45.5	10.1	49.4	50.6	81.8	18.2
HOUSEHOLD SITUATION:							
(B1) MANAGING FINANCIALLY	0.0000 (chi2 p values)			0.0000		0.0259	
Comfortable	29.7	56.1	14.2	34.6	65.4	79.8	20.2
Stable	42.7	47.2	10.1	47.5	52.5	82.3	17.7
Difficulties	56.2	36.5	7.3	60.6	39.4	83.4	16.6
(B2) NUMBER OF PARENTS	0.0000			0.0000		0.2456	
Two	40.8	48.3	10.9	45.8	54.2	81.6	18.4
One	61.1	32.5	6.4	65.3	34.7	83.5	16.6
(B3) NUMBER OF CHILDREN	0.0000			0.0000		0.5257	
1	45.6	44.0	10.4	50.9	49.1	80.9	19.1
2	38.2	50.4	11.4	43.1	56.9	81.6	18.4
3 or more	52.5	39.3	8.2	57.2	42.8	82.7	17.3
(B4) ACCESS TO MOTOR VEHICLE(S)	0.0000			0.0000		0.0002	
Yes	39.7	49.1	11.2	44.7	55.3	81.4	18.6
No	75.9		21.6	77.9	22.1	89.4	10.6

A 41. Analyses of weighted proportions chart for frequency of children going to sports clubs – area and season variables

Analyses of Weighted Proportions: Frequency of Child's Sports Club Attendance by Area and Season variables

Mothers Sample, n=12,619	low	mid	high	low	mid	mid	high
Overall Distribution	44.4	45.5	10.1	49.4	50.6	81.8	18.2
AREA & SEASON:							
(C1) MOTHER'S OPINION OF AREA	0.0000 (chi2 p values)			0.0000		0.0037	
Excellent	33.2	53.0	13.8	38.5	61.5	79.4	20.6
Good	42.9	47.6	9.5	47.4	52.6	83.4	16.6
Average-Very Poor	60.7	32.8	6.5	65.0	35.0	83.4	16.6
(C2) AREA DEPRIVATION SCORE	0.0000			0.0000		0.0017	
Most advantaged: 9-10	25.5	58.7	15.8	30.3	69.7	78.8	21.2
7-8	35.4	52.7	11.9	40.2	59.8	81.6	18.4
5-6	42.5	48.3	9.2	46.8	53.2	84.0	16.0
3-4	53.2	38.7	8.1	57.9	42.1	82.8	17.2
Most disadvantaged: 1-2	69.6	26.1	4.4	72.8	27.3	85.6	14.4
(C3) SEASON OF MAIN INTERVIEW	0.0000			0.1123		0.0002	
Spring	45.5	45.2	9.3	50.1	49.9	82.9	17.1
Summer	44.2	45.9	9.9	49.0	51.0	82.2	17.8
Autumn	38.5	46.1	15.4	45.5	54.5	74.9	25.1
Winter	46.8	45.1	8.0	50.9	49.1	84.9	15.1

Association between other activities and mother-child low-frequency participation

This section refers to Table A 42, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-23 on page 192.

Children who had high-duration television viewing (OR 1.17, 95% CI 1.02-1.34) and children who had low-frequency attendance at sports clubs (1.26, 1.14-1.40) were significantly more likely than those in the middle reference groups to have low-frequency active games with their mothers. Although child's computer use was significant in unadjusted analyses, it was not retained in the model. Household dog ownership was not a significant factor.

A 42. Logistic regression analyses table for children's other activities, in the model for mother-child low-frequency compared to mid-frequency participation

Mother-child participation through playing active games								
DOMAIN	Mid-Freq	Low-Freq	Multinomal Logistic Regression				
Variables	n = 4477	n = 4972	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
H. OTHER ACTIVITIES							
H1. Child's television viewing on term-time weekdays							
Mid: at least 1, but less than 3 hours per day	2893	3161	1.00		1.00		
Low: less than 1 hour per day	964	948	0.88	0.02	0.94	0.307	0.84 to 1.06
High: at least 3 hours per day	619	862	1.30	<0.0005	1.17	0.028	1.02 to 1.34
Unknown	1	1					
H2. Child's computer use on term-time weekdays							
Low: less than 1 hour per day	2090	2135	1.00				
No: none per day	1431	1627	1.07	0.191			
High: at least 1 hour per day	955	1209	1.31	<0.0005			
Unknown	1	1					
H3. Child's sports club attendance each week							
Mid: 1-2 days per week	2122	1964	1.00		1.00		
Low: Less often than one day per week	1870	2627	1.52	<0.0005	1.26	<0.0005	1.14 to 1.40
High: 3 or more days per week	485	381	0.88	0.167	0.92	0.375	0.77 to 1.10
Unknown	0	0					
H4. Household dog ownership							
No	3581	3980	1.00				
Yes	896	992	1.06	0.308			
Unknown	0	0					

*Adjusted mutually and by the following predictors:	child's sex, child's ethnicity, household managing financially, number of children, area deprivation level, season of main interview, mother's age left full-time education, and mother's health restrictions.

Association between other activities and mother-child high-frequency participation

This section refers to Table A 43, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-24 on page 192.

Children who had a high-frequency of attendance at sports clubs (1.35, 1.13-1.62) and those in households with a dog (1.43, 1.26-1.62) had increased likelihood of high-frequency of active games with their mothers. Child's computer use was significant in unadjusted analysis, but again was not significant when adjusted for other factors. Child's television use was not a significant factor.

A 43. Logistic regression analyses table for children's other activities, in the model for mother-child high-frequency compared to mid-frequency participation

Mother-child participation through playing active games							
DOMAIN	Mid-Freq	High-Freq	Multinomal Logistic Regression				
Variables	n = 4477	n = 2988	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
H. OTHER ACTIVITIES							
H1. Child's television viewing on term-time weekdays							
Mid: at least 1, but less than 3 hours per day	2893	1895	1.00				
Low: less than 1 hour per day	964	718	1.11	0.14			
High: at least 3 hours per day	619	375	0.97	0.695			
Unknown	1	0					
H2. Child's computer use on term-time weekdays							
Low: less than 1 hour per day	2090	1353	1.00				
No: none per day	1431	934	0.99	0.935			
High: at least 1 hour per day	955	700	1.16	0.037			
Unknown	1	1					
H3. Child's sports club attendance each week							
Mid: 1-2 days per week	2122	1340	1.00		1.00		
Low: Less often than one day per week	1870	1271	1.13	0.022	1.01	0.814	0.91 to 1.13
High: 3 or more days per week	485	377	1.30	0.003	1.35	0.001	1.13 to 1.62
Unknown	0	0					
H4. Household dog ownership							
No	3581	2249	1.00		1.00		
Yes	896	739	1.44	<0.0005	1.43	<0.0005	1.26 to 1.62
Unknown	0	0					
*Adjusted mutually and by the following predictors:	child's sex, child's age, child has disability, mother's opinion of area for children, area deprivation level, season of main interview, mother's employmnet hours, and mother's health restrictions.						

Association between other activities and mother-child low-frequency facilitation

This section refers to Table A 44, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-25 on page 193.

Children with low-frequency sports club attendance were more likely to have low-frequency park/playground visits with their mothers (1.20, 1.08-1.33). Those with high-frequency sports club attendance were less likely to have low-frequency park/playground visits (0.81, 0.68-0.96). Child's television viewing and computer use were significant at a 90% level in unadjusted analyses, but were not in the final model, and household dog ownership was not a significant factor.

A 44. Logistic regression analyses table for children's other activities, in the model for mother-child low-frequency compared to mid-frequency facilitation

Mother-child facilitation through going to parks/playgrounds							
DOMAIN	Mid-Freq	Low-Freq	Multinomal Logistic Regression				
Variables	n = 5416	n = 4776	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
H. OTHER ACTIVITIES							
H1. Child's television viewing on term-time weekdays							
Mid: at least 1, but less than 3 hours per day	3482	3079	1.00				
Low: less than 1 hour per day	1155	943	0.94	0.27			
High: at least 3 hours per day	779	752	1.13	0.063			
Unknown	0	2					
H2. Child's computer use on term-time weekdays							
Low: less than 1 hour per day	2458	2178	1.00				
No: none per day	1762	1495	0.91	0.085			
High: at least 1 hour per day	1194	1102	0.99	0.94			
Unknown	2	1					
H3. Child's sports club attendance each week							
Mid: 1-2 days per week	2453	2012	1.00		1.00		
Low: Less often than one day per week	2373	2358	1.18	0.002	1.20	0.001	1.08 to 1.33
High: 3 or more days per week	590	406	0.81	0.012	0.81	0.016	0.68 to 0.96
Unknown	0	0					
H4. Household dog ownership							
No	4313	3785	1.00				
Yes	1103	991	1.05	0.403			
Unknown	0	0					

*Adjusted mutually and by the following predictors: number of children in household, mother's opinion of area for children, season of main interview, mother's age, mother's employment hours, and mother's health restrictions.

Association between other activities and mother-child high-frequency facilitation

This section refers to Table A 45, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-26 on page 193.

Children with low-duration of television viewing were more likely to have high-frequency park or playgrounds visits with their mothers (1.17, 1.01-1.35). In contrast children with high-duration computer use were more likely to have high-frequency park or playground visits (1.21, 1.02-1.43). Children in families with dogs were also significantly more likely to be in this high-frequency group (1.35, 1.17-1.55). Child's sports club attendance was significant in unadjusted analyses, but not retained in the model.

A 45. Logistic regression analyses table for children's other activities, in the model for mother-child high-frequency compared to mid-frequency facilitation

Mother-child facilitation through going to parks/playgrounds							
DOMAIN	Mid-Freq	High-Freq	Multinomal Logistic Regression				
Variables	n = 5416	n = 2245	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
H. OTHER ACTIVITIES							
H1. Child's television viewing on term-time weekdays							
Mid: at least 1, but less than 3 hours per day	3482	1388	1.00		1.00		
Low: less than 1 hour per day	1155	532	1.15	0.052	1.17	0.038	1.01 to 1.35
High: at least 3 hours per day	779	325	1.06	0.565	0.97	0.766	0.80 to 1.18
Unknown	0	0					
H2. Child's computer use on term-time weekdays							
Low: less than 1 hour per day	2458	942	1.00		1.00		
No: none per day	1762	735	1.09	0.229	1.02	0.806	0.88 to 1.18
High: at least 1 hour per day	1194	568	1.27	0.005	1.21	0.028	1.02 to 1.43
Unknown	2	0					
H3. Child's sports club attendance each week							
Mid: 1-2 days per week	2453	961	1.00				
Low: Less often than one day per week	2373	1037	1.16	0.02			
High: 3 or more days per week	590	247	0.99	0.876			
Unknown	0	0					
H4. Household dog ownership							
No	4313	1712	1.00		1.00		
Yes	1103	533	1.37	<0.0005	1.35	<0.0005	1.17 to 1.55
Unknown	0	0					

*Adjusted mutually and by the following predictors: child has disability, child's ethnicity, household managing financially, access to motor vehicle(s), mother's opinion of area for children, area deprivation level, season of main interview, mother's family migration history, and mother's employment hours.

Association between other activities and father-child low-frequency participation

This section refers to Table A 46, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-28 on page 197

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Children who have low-frequency sports club attendance were more likely to have low-frequency participation (1.20, 1.04-1.39) and less likely to have high-frequency participation (0.73, 0.59-0.92) (compared to the middle reference group) with their fathers through playing active games. Child's television viewing and computer use were significant in unadjusted analyses, but the associations did not remain after adjustment for the other factors. Household dog ownership was not a significant factor.

A 46. Logistic regression analyses table for children's other activities, in the model for father-child low-frequency compared to mid-frequency participation

Father-child participation through playing active games								
	DOMAIN	Mid-Freq	Low-Freq	Multinomal Logistic Regression				
	Variables	n = 3102	n = 1747	Unadjusted		Adjusted *		
	Categories	n	n	OR	P	OR	P	95% CI
	H. OTHER ACTIVITIES							
	H1. Child's television viewing on term-time weekdays							
	Mid: at least 1, but less than 3 hours per day	1983	1119	1.00				
	Low: less than 1 hour per day	734	362	0.86	0.055			
	High: at least 3 hours per day	384	265	1.20	<0.0005			
	Unknown	1	1					
	H2. Child's computer use on term-time weekdays							
	Low: less than 1 hour per day	1532	794	1.00				
	No: none per day	973	556	1.06	0.464			
	High: at least 1 hour per day	597	397	1.27	0.006			
	Unknown	0	0					
	H3. Child's sports club attendance each week							
	Mid: 1-2 days per week	1551	774	1.00		1.00		
	Low: Less often than one day per week	1165	820	1.35	<0.0005	1.20	0.015	1.04 to 1.39
	High: 3 or more days per week	386	153	0.73	0.007	0.73	0.008	0.59 to 0.92
	Unknown	0	0					
	H4. Household dog ownership							
	No	2450	1382	1.00				
	Yes	652	365	0.94	0.496			
	Unknown	0	0					
	*Adjusted mutually and by the following predictors:	child's sex, child's ethnicity, household managing financially, number of children in household, area deprivation level, season of main interview, father's age, and father's health restrictions.						

Association between other activities and father-child high-frequency participation

This section refers to Table A 47, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-29 on page 197.

Child's television viewing, computer use and household dog ownership were not associated with high frequency active games with father. Child's sports club attendance was significant in unadjusted analysis at the 90% level in unadjusted analyses, but was not retained after adjustment. Thus there is no adjusted model to present.

A 47. Logistic regression analyses table for children's other activities, in the model for father-child high-frequency compared to mid-frequency participation

Father-child participation through playing active games							
DOMAIN	Mid-Freq	High-Freq	Multinomal Logistic Regression				
Variables	n = 3102	n = 3148	Unadjusted		Adjusted		
Categories	n	n	OR	P	OR	P	95% CI
H. OTHER ACTIVITIES							
H1. Child's television viewing on term-time weekdays							
Mid: at least 1, but less than 3 hours per day	1983	2052	1.00				
Low: less than 1 hour per day	734	688	0.93	0.283			
High: at least 3 hours per day	384	408	1.04	0.621			
Unknown	1	0					
H2. Child's computer use on term-time weekdays							
Low: less than 1 hour per day	1532	1522	1.00				
No: none per day	973	956	1.00	0.986			
High: at least 1 hour per day	597	669	1.16	0.083			
Unknown	0	1					
H3. Child's sports club attendance each week							
Mid: 1-2 days per week	1551	1528	1.00				
Low: Less often than one day per week	1165	1238	1.12	0.061			
High: 3 or more days per week	386	382	0.97	0.696			
Unknown	0	0					
H4. Household dog ownership							
No	2450	2466	1.00				
Yes	652	682	1.02	0.767			
Unknown	0	0					

Association between other activities and father-child low-frequency facilitation

This section refers to Table A 48, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-30 on page 198.

High-duration television viewing (1.21, 1.04-1.41) among children was associated with increased likelihood of low-frequency park or playground visits with father. In contrast, high-duration computer use (0.84, 0.73-0.97) and high-frequency sports club attendance (0.80, 0.67-0.95) were both associated with decreased likelihood of low-frequency park or playground visits with father. Dog ownership was not a significant factor.

A 48. Logistic regression analyses table for children's other activities, in the model for father-child low-frequency compared to mid-frequency facilitation

Father-child facilitation through going to parks/playground								
DOMAIN	Mid-Freq	Low-Freq	Multinomal Logistic Regression				
Variables	n = 3198	n = 4034	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
H. OTHER ACTIVITIES							
H1. Child's television viewing on term-time weekdays							
Mid: at least 1, but less than 3 hours per day	2048	2606	1.00		1.00		
Low: less than 1 hour per day	764	854	0.88	0.069	0.88	0.065	0.76 to 1.01
High: at least 3 hours per day	385	573	1.18	0.03	1.21	0.014	1.04 to 1.41
Unknown	1	1					
H2. Child's computer use on term-time weekdays							
Low: less than 1 hour per day	1533	1966	1.00		1.00		
No: none per day	1001	1242	0.94	0.326	0.94	0.39	0.83 to 1.08
High: at least 1 hour per day	664	825	0.88	0.06	0.84	0.02	0.73 to 0.97
Unknown	0	1					
H3. Child's sports club attendance each week							
Mid: 1-2 days per week	1535	1968	1.00		1.00		
Low: Less often than one day per week	1269	1639	0.99	0.88	0.98	0.799	0.87 to 1.11
High: 3 or more days per week	394	427	0.81	0.016	0.80	0.012	0.67 to 0.95
Unknown	0	0					
H4. Household dog ownership							
No	2563	3161	1.00				
Yes	635	873	1.10	0.147			
Unknown							
*Adjusted mutually and by the following predictors:	child's sex, household managing financially, number of children in household , season of main interview, father's family migration history, father's age, and father's health restrictions.						

Association between other activities and father-child high-frequency facilitation

This section refers to Table A 49, which shows the results for unadjusted logistic regression and the final adjusted logistic regression model. These results were used to construct the flow diagram Figure 5-31 on page 198.

Child's television viewing, computer use and sports club attendance were not associated with high-frequency park or playground visits with father. Dog ownership was highly associated with this outcome in the adjusted analyses (1.49, 1.22-1.83).

A 49. Logistic regression analyses table for children's other activities, in the model for father-child high-frequency compared to mid-frequency facilitation

Father-child facilitation through going to parks/playground							
DOMAIN	Mid-Freq	High-Freq	Multinomal Logistic Regression				
Variables	n = 3198	n = 765	Unadjusted		Adjusted *		
Categories	n	n	OR	P	OR	P	95% CI
H. OTHER ACTIVITIES							
H1. Child's television viewing on term-time weekdays							
Mid: at least 1, but less than 3 hours per day	2048	500	1.00				
Low: less than 1 hour per day	764	166	0.97	0.763			
High: at least 3 hours per day	385	99	0.92	0.541			
Unknown	1	0					
H2. Child's computer use on term-time weekdays							
Low: less than 1 hour per day	1533	349	1.00				
No: none per day	1001	242	1.00	0.988			
High: at least 1 hour per day	664	174	1.07	0.559			
Unknown	0	0					
H3. Child's sports club attendance each week							
Mid: 1-2 days per week	1535	350	1.00				
Low: Less often than one day per week	1269	315	1.08	0.412			
High: 3 or more days per week	394	100	1.13	0.378			
Unknown	0	0					
H4. Household dog ownership							
No	2563	574	1.00		1.00		
Yes	635	191	1.53	<0.0005	1.49	<0.0005	1.22 to 1.83
Unknown							

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