NEIGHBOURHOOD AND FAMILY INFLUENCES ON THE COGNITIVE ABILITY OF CHILDREN IN THE BRITISH NATIONAL CHILD DEVELOPMENT STUDY[1]

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ABSTRACT

This paper investigates the association between family poverty, the level of deprivation in electoral wards and children's cognitive test scores using data from the second generation in the 1991 sweep of the British National Child Development Study (1958 birth cohort). Family poverty has a significant association with lower test scores in children of all ages (4-18 years). Neighbourhood poverty has a significant association with lower test scores in children aged 4-5 years which, though somewhat attenuated, is independent of other socioeconomic indicators. Among children aged between 6 and 9 years, the association with neighbourhood deprivation is statistically accounted for by individual characteristics. Among children aged between 10 and 18 years, levels of neighbourhood deprivation were for the most part statistically insignificant. The family poverty – test score association among children aged between 10 and 18 years was mediated by the home environment. Mediated effects were stronger for family poverty – test score associations than for neighbourhood poverty. Explanations for the links between family poverty and test scores range from the effects of long-term material disadvantage in poor families to problematic parenting behaviours resulting from the multiple stresses of living in poverty. Explanations for the influence of neighbourhoods on young children range from the resources and services available in less deprived neighbourhoods to the kinds of role models that more affluent neighbourhoods might provide. The size of the estimated effects of neighbourhood conditions are much smaller than the estimated effects of family level conditions. Thus, it appears that families still should be viewed as the key agents in promoting positive development in children.

NON-TECHNICAL SUMMARY

There is a growing body of research which examines the characteristics of neighbourhoods and communities that affect children, youth and families; the nature of those effects; and the mechanisms and mediating processes at the community, family and individual levels through which the effects operate. Recent research in the USA has demonstrated a significant relationship between neighbourhood quality and the well-being of the children and youth who live in them. Even after controlling for relevant personal and family background characteristics, residence in low income neighbourhoods has been shown to have negative effects on developmental outcomes in the first 4 to 5 years of children's lives and to be associated with higher rates of high school drop out and teen parenthood (Brooks-Gunn, Duncan & Aber, 1997). Additionally, neighbourhood income effects have been found to be smaller than the effects of family income, maternal education or maternal marital status (Klebanov, Brooks-Gunn, McCarton & McCormick 1998).

In this paper we use data from the second generation in the 1991 sweep of the British National Child Development Study (NCDS) to examine whether local concentrations of deprived households, along with the associated economic and social neighbourhood disadvantage, have an affect on children's scores on a cognitive test. We examine whether neighbourhood poverty is mediated by family structures and processes, or whether it exerts a separate and powerful influence on children's lives, over and above individual family influences.

Family poverty has a significant association with lower test scores in children of all ages (4-18 years). Neighbourhood poverty has a significant association with lower test scores in children aged 4-5 years which, though somewhat attenuated, is independent of other socioeconomic indicators. Among children aged between 6 and 9 years, the association with neighbourhood deprivation is statistically accounted for by individual characteristics. Among children aged between 10 and 18 years, levels of neighbourhood deprivation were for the most part statistically insignificant. The family poverty – test score association among children aged between 10

and 18 years was mediated by the home environment. Mediated effects were stronger for family poverty – test score associations than for neighbourhood poverty. Explanations for the links between family poverty and test scores range from the effects of long-term material disadvantage in poor families to problematic parenting behaviours resulting from the multiple stresses of living in poverty. Explanations for the influence of neighbourhoods on young children range from the resources and services available in less deprived neighbourhoods to the kinds of role models that more affluent neighbourhoods might provide. The size of the estimated effects of neighbourhood conditions are much smaller than the estimated effects of family level conditions. Thus, it appears that families still should be viewed as the key agents in promoting positive development in children.

There is a growing body of research which examines the characteristics of neighbourhoods and communities that affect children, youth and families; the nature of those effects; and the mechanisms and mediating processes at the community, family and individual levels through which the effects operate. Investigation of community influences often focuses on children's schools. Characteristics of schools and classrooms that define their social character (e.g. teachers' attitudes, school values) are significant sources of variation in students' achievement (Rutter, 1983; Raudenbush & Willms, 1995). Recent research in the USA has demonstrated a significant relationship between neighbourhood quality and the well-being of the children and youth who live in them. Even after controlling for relevant personal and family background characteristics, residence in low income neighbourhoods has been shown to have negative effects on developmental outcomes in the first 4 to 5 years of children's lives and to be associated with higher rates of high school drop out and teen parenthood (Brooks-Gunn, Duncan & Aber, 1997). Additionally, neighbourhood income effects have been found to be smaller than the effects of family income, maternal education or maternal marital status (Klebanov, Brooks-Gunn, McCarton & McCormick 1998).

Central to the study of neighbourhoods is the notion that the aggregate of individuals and families within a neighbourhood setting creates a context that influences child development (Brooks-Gunn et al., 1997; Wilson, 1987). The resources, role models and safety of a neighbourhood combine to define that context. The resources available for children growing up in neighbourhoods are indicated by the collective incomes and family compositions within the area; higher proportions of poverty and single-parent families translate to less human capital available to promote development. Adults within a neighbourhood serve as role models for children and their educational attainment represents what a child can expect to attain in school (Wilson, 1987). The presence of risk at the neighbourhood level, particularly, danger, violence and crime also may influence child and adolescent development. Such risks are likely to be more widespread when communities lack informal control and, consequently, the ability to regulate the behaviour of children and youth. As with neighbourhood poverty there has been little

investigation of whether effects of risk at the neighbourhood level change as children move through childhood and then adolescence.

In Britain there has been a widening of the gap between rich and poor since the 1970's (Hills, 1996). In particular, there has been an increasing polarization of income and wealth at the local level, producing both a greater spatial segregation between better-off and poorer areas (Green, 1996), and a growth in concentrated poverty amongst communities within urban areas (Noble & Smith, 1996). In this paper we use data from the British National Child Development Study (NCDS) to examine whether local concentrations of deprived households, along with the associated economic and social neighbourhood disadvantage, places children at risk. We examine whether neighbourhood poverty is mediated by family structures and processes, or whether it exerts a separate and powerful influence on children's lives, over and above individual family influences.

Of importance is the fact that neighbourhoods may operate differently across developmental epochs (Aber, Gephart, Brooks-Gunn, Connell & Spencer, 1997). In early childhood the specific processes that lead to positive outcomes involve primarily transactions in the home that directly affect children. Even when young children encounter contexts outside the home, such as through a trip to the neighbourhood playground, parents limit and qualify the nature and extent of a child's experience. As children spend less time at home and more time at school and with peers, the quality of interactions with teachers and fellow students becomes a major contributor to the course of development during middle childhood. The epoch from about ten to sixteen years of age encompasses the transition from childhood to adolescence. In addition to parents, peers and school, early adolescents become directly involved in a host of contexts, from formal youth organisations to informal neighbourhood groups. We hypothesize that the effects of neighbourhoods on development during early childhood will be primarily indirect, through the effects of neighbourhoods on the quality of the home environment. Further we hypothesise that by middle childhood and early adolescence, (1) children will come into increasingly direct contact with neighbourhoods, so that neighbourhood effects should increase in

magnitude, and (2) new processes will mediate the effects of neighbourhoods on development, in particular, children's perceptions of their home, peer, and school environments, as well as their self-perceptions (Klebanov, Brooks-Gunn, Chase-Landsdale & Gordon, 1997). Accordingly, we examine different developmental epochs: early childhood (4-5 years), middle childhood (6-9 years), and late childhood and adolescence (10 to 18 years). Each age group encompasses at least one major transition in a child's life, such as school entrance or exit, biological development and possible role shifts. The developmental challenges during these periods are relatively universal and require new modes of adaptation to biological, psychological or social changes (Graber & Brooks-Gunn, 1996). The following section will review the empirical evidence on how neighbourhood factors affect the development of children. Studies reviewed will be limited to those examining individual-level outcomes, rather than outcomes aggregated at the neighbourhood level.

NEIGHBOURHOODS AND CHILDREN

Increasingly research is finding that community and neighbourhood factors play a role in decisions to marry, have children (in or out of marriage) (South & Crowder, 1999), family stability as well as children's psychological well-being and educational achievement (Brooks-Gunn, Duncan, Klebanov & Sealand, 1993; Brooks-Gunn et al., 1997; Leventhal & Brooks-Gunn. 2000). A growing body of empirical research in the USA has directed attention to the impact of the geographic concentration of socioeconomic disadvantage on outcomes for children and families. Most research on neighbourhood poverty has focused on adolescents or young adults. Adolescents who grow up in affluent neighbourhoods or neighbourhoods with a higher percentage of affluent families complete more years of school and have lower school dropout rates than adolescents from similar families who grow up in poor neighbourhoods or neighbourhoods with proportionately fewer affluent families (Brooks-Gunn et al., 1993, 1997). The presence of affluent neighbours was associated with higher intelligence test scores at 5 years of age, in regressions also controlling for family income, family structure,

maternal education, age and ethnicity (Brooks-Gunn et al. 1997). Similar findings have been reported for verbal ability of 5 and 6 year olds using data from the National Longitudinal Study of Youth (Chase-Lansdale, Gordon, Brooks-Gunn & Klebanov, 1997). In another study, Klebanov, Brooks-Gunn & Duncan (1994) examined the effects of neighbourhood and family poverty on maternal psychological and behavioural characteristics and on the quality of the home environment. They found that residing in a poor neighbourhood was associated with a worse physical environment in the home and with less maternal warmth toward the children. Together, these studies suggest that adolescents and children who reside in poorer neighbourhoods are more likely to experience worse outcomes than adolescents and children who reside in more affluent neighbourhoods. These results provide further evidence that the effects of neighbourhoods on preschool children are likely to be mediated in part by parental behaviour. A number of recent observers have pointed to socioeconomic status as a feature of the community that may influence adolescents behaviours through its relationship to both the opportunities for attainment that teenagers perceive as open to them, and to the normative patterns of behaviour that they observe in the adults around them.

The quality of life in neighbourhoods and the safety of the physical environment are critical to healthy child development. Within the community, children can interact with their peers and with adults who can help them develop trust, autonomy and initiative. Factors such as the distance between houses, access to public facilities such as parks, the density of the child population, and safety all influence measures of children's social activity such as the number of friends, the formality and rigidity of children's friendship patterns, and the spontaneity of their play patterns (Parke & Bhavnagri, 1989). Thus, the kind of neighbourhoods in which children and families live exerts a critical influence on children's social participation. Communities provide a context where shared values and expectations are developed, and they are host to networks of formal and informal services in health, education, social services, housing and recreation. Neighbourhoods that offer child safety, social support and access to good facilities can contribute positively to

children's readiness to learn as they enter school and to their achievements in school. The crime within a child's neighbourhood serves as another community characteristic influencing development. Research has found that children who live in neighbourhoods that are unsafe or that lack services face greater risks of developing problem behaviours such as hyperactivity, aggression or withdrawal, regardless of the quality of their family life (Peeples & Loeber, 1994).

Several theoretical perspectives suggest links between children's well-being and characteristics of the communities in which they grow up. A number of recent observers have pointed to socioeconomic status as a feature of the community that may influence adolescents behaviours through its relationship to both the opportunities for attainment that teenagers perceive as open to them, and to the normative patterns of behaviour that they observe in the adults around them. Wilson (1991) argued that the increasing concentrations of male joblessness, poverty and female-headed households in American cities in the 1970's and 1980's may have led to social isolation and a shift in neighbourhoods social and cultural norms. Wilson argues that the presence of disadvantaged neighbours encourages out-of-wedlock childbearing and other non-normative or undesirable behaviours because high-poverty neighbourhoods lack "mainstream role models that help keep alive the perception that education is meaningful, that steady employment is a viable alternative to welfare and that family stability is the norm, not the exception (1987, p. 56)". According to this view, families who live in deprived neighbourhoods may establish family routines that may be less conducive to the development of skills associated with school and work. Parents who feel that they lack personal control over their own lives may lack daily planning or organisation skills that help success in school or employment. In contrast, families living in more affluent neighbourhoods, where more parents have access to jobs, may reinforce family practices conducive to future success. Deprived neighbourhoods may also be characterised by social disorganisation (Sampson & Groves, 1989). The central idea in social disorganisation theory is that the impact of communities is found primarily in the factors that facilitate or inhibit networks of social

support and value consensus. According to this view, the degree of social organisation in a community, or the degree to which residents are able to realise common goals and exercise social control, reflects the establishment of social relationships in the community and the content and consensus of values. Community-level structural factors that are thought to impede social organisation include residential instability, family disruption and high ethnic heterogeneity. These factors may lead to a weakening of adult friendship networks and value consensus in the neighbourhood and increase the likelihood of deviant behaviour.

The concept of social capital (Coleman, 1988) overlaps with social disorganisation theory in the emphasis on the nature of social ties and community values. Social capital, which is derived from the density and quality of social ties, exists within families, as well as neighbourhoods and communities. Neighbourhoods, communities, and schools often serve as institutions that promote transfers of social capital, as they constitute social structures which tie people together. Having strong neighbourhood or community connections can provide an environment that reinforces school commitment and helps children remain engaged in school. Exchanges and support between parents, schools, and children are particular areas that can provide increased resources necessary for improving children's well-being. Sampson (1992) argued that the lack of social capital is one of the distinguishing features of individuals in socially disorganised communities. The lack or absence of social capital in a community is thus a further link between the structure of communities and the development of children.

A key issue in research on neighbourhoods and communities is how to conceptualise and measure the geographic and / or social units used to define and circumscribe them (Macintyre, Maciver & Sooman, 1993; Glennester, Lupton, Noden & Power, 1999). In the sense of knowing your neighbours areas are very small. In the sense of the catchment area for local shops, a primary school, the GP, areas may be much bigger. Some facilities like health centres or secondary schools may cover much wider catchment areas. Areas have different boundaries for different purposes, and these boundaries overlap. Increasing travel-to-work distances and increasing

mobility more generally are a cause of major changes in perceptions of neighbourhoods. Despite the elusiveness and geographical imprecision of the neighbourhood concept, research indicates that neighbourhoods operate as significant constraints on parents approaches and strategies of family management and on children's and adolescents' economic and social paths.

While there are a number of studies that find clear community and neighbourhood effects, there is a smaller literature which does not (Evans, Oates & Schwab, 1992). On some topics the mechanisms linking community and family variables are not well understood. Place of residence is likely to be a proxy for physical features of the environment, features of the domestic and working environment and for inequalities in the provision and / or use of services (Macintyre et al., 1993). Contextual effects on children's outcomes may be location specific and difficult to identify using aggregate census indicators (Duncan, Connell & Klebanov, 1997). Researchers have examined a number of mechanisms by which communities and neighbourhoods may affect families and children. They include community norms, economic opportunities, reference groups, relative deprivation, and social support networks. However, in many studies the mechanisms are not clearly delineated.

Nevertheless in the USA (Blos, Huston, Granger, Duncan, Brock & McLoyd, 1999; Ludwig, Duncan & Hirschfield, 1998), and since the election of the Labour Government in May 1997 in the UK (Glass, 1999), there has been a significant increase in area-based initiatives to deal with problems that appear to have their roots in community organisation. While some programs have achieved results, others have not. Whether the mixed results are due to program design or to the fact that it is not the community but some other factor at work is not clear. Differences in motivation, emotional health, self-efficacy, literacy and so on could account for any observed neighbourhood effects (Duncan et al. 1997). In summary, we have heavy investments both in research and programs based on the idea that communities affect families and children and at the same time questions about the validity of the link between communities, children and families. Understanding the extent to which geographically concentrated social and economic problems reinforce

one another in leading to further negative outcomes is clearly a key issue in assessing whether or not specific area targeting is particularly effective.

DATA

The National Child Development Study (NCDS) is a study of over 17,000 people in Britain born between the 3rd and 9th of March in 1958. Follow-up sweeps took place in 1965, 1969, 1974, 1981 and 1991. The 1991 NCDS follow-up obtained information not only from the cohort member, but from the children of 1 in 3 cohort members and from the mother of these children (Ferri, 1993). In this paper we use data from both children who had a mother who was an NCDS cohort member and children who had a father who was an NCDS cohort member. The data are more representative of children with teenaged mothers, and hence less educated mothers than a full cross-section of children. This relatively disadvantaged sample of women and children also more closely resembles the population that is most often targeted for public policy intervention, although comparison with the Office of National Statistics Longitudinal Study suggests that the teenage children of lone mothers are disproportionately involved in loss to follow-up. The sample is restricted to children resident in England and Wales in 1991.

In this paper we use performance on the Peabody Picture Vocabulary Test (PPVT) as an indicator of children's cognitive functioning (Dunn & Markwardt, 1970). The PPVT is an individually administered test of hearing vocabulary which contains 175 test items arranged in order of increasing difficulty. Each item has four simple, black and white illustrations arranged in a multiple choice format. The subject's task is to select the picture considered to illustrate best the meaning of a stimulus word presented orally by the examiner. The test is designed for persons between the ages of 2.5 and 40 years. It can be used as a scholastic aptitude test since vocabulary is a strong predictor of school success and literacy. Testing requires only 10 to 20 minutes, because the subject must answer only about 35 to 45 items of suitable difficulty. Items which are found to be far too easy or hard during an initial probing session are not administered. The PPVT was standardised

nationally (in USA) on a sample of 4200 children and adolescents and 828 adults. Raw scores are usually converted to age-referenced norms. We have however used raw scores in our analyses because of concern about the suitability of the available norms for our 'abnormal' sample of older children. The test score is calculated by dividing the highest correct score given by the child by the total number of items in the test. The test scores range between a minimum of 0.19 and a maximum of 0.98 and have a standard deviation of 0.12. We include age and age squared in the regressions to control for age, and we always also include a dummy variable for child gender. Measures of children's behavioural adjustment were also examined but are not discussed because the coefficients of the neighbourhood deprivation score were insignificant.

We examine the association of a range of indicators of socioeconomic position including indicators of material disadvantage with children's cognitive functioning. As an indicator of the family's economic status we include the current employment status of the mother interacted with the presence of a father. In our analyses we are unable to use family income for the year of interview as a measure of the family's economic resources because of the nonresponse of approximately one third of the cases. We therefore examine the association of the behavioural dimensions and two independent indicators of family poverty: living in social housing (i.e. rented from council or housing association) and having no access to a car. The latter is commonly used together with tenure as an indicator of deprivation (Townsend, Phillimore & Beattie, 1989) and both these measures are certainly related strongly to income (Davies, Joshi & Clarke, 1997)[2].

The link between family poverty and children's test scores appears to be mediated partly by the quality of children's home environments. The home environment refers both to how parents organise the physical environment in the home and to how parents interact with their children in the home; both the physical environment (e.g., books and other learning material in the home)

[2] We have not attempted to impute missing income on this occasion, though we have done so for another analyses (Joshi, Cooksey, Wiggins, McCulloch, Verropoulou & Clarke, 1999; McCulloch & Joshi, 1999). The latter suggested that car access and housing tenure were more systematically related to child outcomes than current family income per person.

and the social environment of the child (e.g., joint activities involving parents and children such as reading books together) are expected to influence the development of the child. As a direct assessment of mediating influences (Smith, Brooks-Gunn & Klebanov, 1997) we therefore also considered the rating of the quality of the child's home learning environment as assessed using the cognitive stimulation subscale from the short form of the HOME inventory (Sugland, Zaslow, Smith, Brooks-Gunn, Coates, Blumenthal et al. 1995). Each item on the HOME inventory is scored in a binary fashion; a score of 1 indicates the presence of a developmentally supportive aspect of the environment, and a score of 0 otherwise at the time of the assessment. The emotional support subscale from the HOME inventory, which measures the warmth of mother-child interactions, was not used because it has been found not to meet adequate internal consistency levels (Klebanov et al. 1997). Some factors that influence development indirectly, via parenting behaviour, may also have an effect on development that parenting practices do not mediate. For example, family poverty may influence the child's experiences in the home, but it may also influence the child's experiences in other contexts such as the neighbourhood and schools.

Factors other than material resources and home environment are likely to contribute to individual differences in children's achievement. The cohort member parents general ability test score at age 11 was included as a predictor of children's cognitive scores. We expected to find a strong relation between the cohort member's test score and children's achievement reflecting cultural or biosocial inheritance. We also wanted to explore the possibility that other contextual factors such as number of children, level of income, and mother's level of education would also be predictive of achievement test scores when home environment and maternal intellectual ability were controlled.

In this analysis the definition of neighbourhood is dictated by the geographical units for which data are available. Wards are the constituency for local government elections. Being based on political boundaries, it is arbitrary, but nevertheless represents a useful framework for analysis. Their average population is around 5500, but this varies considerably. They are on

average roughly the size that children are likely to think of and experience as their neighbourhood (Matthews 1987), but the boundaries of local communities do not necessarily coincide with those of wards. All else equal, studies of contextual effects are best conducted using data collected from participants living in very diverse contexts. In the case of neighbourhood variation, this argues for samples drawn from many diverse neighbourhoods. Because the NCDS is an unclustered sample, its design is close to optimal for estimating effect sizes via regression coefficients. The design provides however no information about variation within and between contexts.

An important measurement issue in research on community and neighbourhood influences is whether to use measures of single neighbourhood characteristics or construct composite indices of underlying dimensions of neighbourhood organisation. In this paper we use the Townsend indicator of deprivation to bring a geographical dimension to the explanation of children's test scores. The Townsend index is composed of four components, each measured for the ward of residence at the 1991 census (Townsend et al., 1989). These components are (i) the proportion of the labour force unemployed, (ii) the proportion of households with no car access, (iii) the proportion of households with 1 person per room and over, and (iv) the proportion of households not owning their own home. The indicators for levels of unemployment and overcrowding were logged, and the index was standardised into Z-scores. For the purpose of analysis the score was categorised into quintile groups at a national level. Notwithstanding the debate about the various merits and demerits of these scores (Lee, 1999), they have the advantage of simplicity in allowing areas to be ranked against each other for statistical comparisons.

This paper is the first to use the area statistics from the 1991 Census in conjunction with the child test scores, and is among the relatively few data sources combining individual with ecological variables. The data contains 2290 children who come from 1532 families. We have not been able to study family effects because of the low numbers of children per family. The age of the child is strongly related to the child's family structure (Table 1). Children aged 10 and over are more likely than children aged 4 to 5 years or 6 to 9

years to have been born outside partnerships or to have experienced a change in the family situation (Clarke, Di Salvo, Joshi & Wright, 1997). Table 1 shows that children in older age groups are more likely than younger children to have a cohort member parent with low educational qualifications, to have low family incomes or to live in social housing (i.e. rented from council or housing association). There are also differences in home environment between children of different age. Children aged 10 to 18 years are more likely than younger children to live in homes lacking cognitive stimulation. Children aged 10 to 18 years are also more likely than younger children to live in neighbourhoods having higher deprivation scores. These findings may be due to the nature of the NCDS sample. Older children were more likely to be born to younger mothers with fewer years of education and thus to be reared in more disadvantaged circumstances. All indicators of individual material and social deprivation increased in prevalence from the lowest to the highest ward deprivation score quintile (Table 2). Different aspects of social and economic deprivation tend to co-exist in a geographically concentrated way. Poor families are more likely to live in neighbourhoods with other poor families. Poor children may be disadvantaged in large part because of their communities of residence, not just because of their family situations.

RESULTS

The results from estimating ordinary least squares regression models for different predictors are presented in Tables 3 to 5. The analyses were organised as follows. First, analyses were conducted in order to look at the effect of neighbourhood deprivation in predicting child and adolescent outcomes also controlling for child age and gender. Then, regressions with family-level variables added were run, to see whether neighbourhood effects were independent of these family-level variables. Finally an additional set of analyses was run in order to look at whether any of the observed neighbourhood or family effects operated through the home environment. The comparison of results from this sequence of models allows us to see how far PPVT scores are associated with neighbourhood deprivation. It also allows us

to see how far any association might be accounted for, or mediated by the social and human capital available to the child, the material disadvantage associated with the child's family circumstances, and the mode of parenting such resources may permit.

We find that the index of neighbourhood deprivation is associated with lower cognitive test scores among children between the ages of 4 and 5 years controlling for child age and gender (Table 3). Children with higher test scores were more likely to be resident in an affluent neighbourhood than children with lower test scores. The coefficients are of a modest order of magnitude: children living in the topmost quintile of deprived neighbourhoods show a decrease of 6 percentage points in their test scores compared to children living in the bottom quintile of deprived neighbourhoods. This is not large in comparison with the age-adjusted standard deviation of PPVT at 23 percentage points. For children between the ages of 6 and 9 years the statistically significant impact of neighbourhood deprivation on test scores is restricted to the three most deprived quintiles. 6 to 9 year old children in the most deprived quintile of deprived neighbourhoods have test scores 3 to 4 percentage points lower than children in the least deprived quintile of neighbourhoods. This extreme move in neighbourhood deprivation is equivalent to a quarter of an age standardised standard deviation in PPVT. In children aged 10 to 18 years the neighbourhood deprivation coefficients are statistically insignificant. The total amount of variance accounted for by the models ranges from 27% for children aged 10 to 18 years to 44% for children aged 6 to 9 years.

In children aged 4 to 5 years the introduction of terms describing the structure of the family, the mothers employment and family poverty confine the statistically significant difference in neighbourhood deprivation to a comparison between the most and least deprived quintile. In children aged 6 to 9 years the neighbourhood deprivation coefficients are statistically insignificant. The 2nd most deprived quintile of the neighbourhood deprivation score is positively related to test scores in children between 10 and 18 years. The coefficients of the neighbourhood deprivation score are somewhat attenuated for all age groups in comparison to the previous model.

The model terms for the structure and number of earners in the family do not predict much systematic advantage to having two natural parents, nor to having mother in employment. Children aged between 6 and 9 years in step-families are at a disadvantage if the mother is employed, but children aged between 6 and 9 years in lone mother families are at a disadvantage if the mother does not work. The measures of more permanent living standards and social status – educational qualifications, social housing, car access and age of the cohort member at first birth – show that children of all ages from deprived circumstances are at a disadvantage compared to children from more affluent backgrounds. Both the cohort member's general ability at age 11 and highest educational qualification were consistently related to children's achievement. The coefficients are sizeable. The correlation of the test scores of cohort members and their children lies in the range between 0.2 and 0.3 , suggesting considerable immobility, or that children's chances for success depend in a significant way on the success of their parents. The amount of variance the models accounted for ranged from 39 to 53%.

The addition of the cognitive stimulation sub-scale from the HOME inventory to the model (Table 5) results in little change in sign or statistical significance in the coefficients of the neighbourhood deprivation score in comparison to the previous model. In all age groups investigated, the quality of the home environment - its opportunities for learning and the physical condition of the home - is positively associated with test scores. Children between the ages of 4 and 5 in the most deprived neighbourhoods do worse for a given level of learning experience in the home than children in more affluent neighbourhoods. The addition of the HOME cognitive stimulation sub-scale to the model results in some changes in statistical significance in the coefficients in comparison to the previous model. The introduction of the cognitive stimulation scale attenuates the coefficient of the social housing indicator which is now statistically insignificant for children aged 10 to 18 years. Among children between the ages of 6 and 9 years and 10 and 18 years maternal qualifications were not related to children's achievement when the quality of the home environment was controlled. The remaining statistically significant associations between family poverty and test scores

are still present. Overall, the predictor variables accounted for between 42 and 53% of the variance in the achievement scores of children.

To investigate whether the weak relationships between PPVT test scores and neighbourhood deprivation was the result of a strong correlation between individual residence in council housing and area deprivation characteristics, the models were estimated omitting the social housing indicator. The coefficient of the Townsend score remained unchanged strengthening the conclusion of a weak relationship between children's PPVT test scores and area deprivation. To investigate differences in average PPVT test scores by ward deprivation, residuals from the regressions of test scores on the child and family predictors in Table 4 but omitting the Townsend score are broken down by Townsend quintile in Table 6. Nonzero values indicate the presence of systematic error in the estimates. Positive values indicate PPVT scores that on average were underestimated by the predictor variables, and negative values show the categories where overestimates were made. The discrepancy between actual and predicted test scores is modest indicating that average test scores are only weakly related to ward deprivation. Children aged 4 to 5 years living in the most deprived quintile of wards have test scores which are higher than might be expected from measures of deprivation as is also the case for children aged 10 to 18 years living in the least deprived quintile wards. No evidence of significant underestimation of PPVT test scores was found although mean predicted PPVT test scores of children aged 10 to 18 years living in the 2nd quintile of ward deprivation were lower than actual values but only by 1 to 2%.

To test the hypothesis that neighbourhood deprivation and family poverty operate through psychological as well as family interaction dimensions, the HOME cognitive stimulation subscale was regressed on neighbourhood and family variables. It was expected that mothers would provide higher quality home environments if they had higher levels of education. Adolescent mothers were expected to provide lower quality home environments for their children than were mothers who delayed childbearing. Many factors that put adolescents at risk for early childbearing (e.g. poor family relationships, poor school performance) could also put them at risk for

providing relatively unsupportive home environments. A large number of children were expected to contribute to higher levels of stress and consequently less supportive home environments.

Table 7 presents the results of separate regression analyses of the HOME cognitive stimulation score for each age group. The percentage of variance in HOME scores accounted for by the models ranged from 21 to 23%. Consistent with expectations, mothers who provided better quality home environments, were older at the time of their first births, were more highly educated and scored higher on the test of general ability at age 11. Moreover, as shown in Table 5, the regression controlling for the home environment resulted in a reduction of the effect of highest educational qualification on PPVT test scores (among children aged between 6 and 9 and 10 and 18 years), whereas the home environment was associated with higher PPVT test scores. Thus, the association between highest educational qualification and test scores appears to be mediated by the home environment. The gender of the child made a modest unique contribution to predicting HOME scores. Girls appear to have more cognitively stimulating home environments than do boys. Children's home environments were however only weekly associated with neighbourhood deprivation. At the neighbourhood level, local characteristics were only associated with less cognitively stimulating homes net of all other effects in the case of children 4-5 years living in the most deprived neighbourhoods. The Townsend score of the neighbourhood of residence does not appear to influence socialization and norms for parenting (Wilson 1991; Sampson, Raudenbush & Earls, 1997) independently of family poverty, family structure and mother's employment. The contextual factors that contributed uniquely to home scores were presence of spouse or partner in the home among children between 4 and 5 years of age and residence in social housing among children aged 6 to 9 years and 10 to 18 years. Mothers who lived in better quality accomodation and a spouse or partner in the home provided more supportive environments.

DISCUSSION

Bearing caution in mind, we arrive at the following general conclusions. First, the presence of concentrated poverty in the neighbourhood seemed to be associated with poor child outcomes for at least some children between the ages of 4 and 5 years. Children from more deprived neighbourhoods have lower test scores than children from more affluent neighbourhoods, suggesting that the effects of neighbourhood deprivation are not accounted for by the number of other risk factors present in our analyses. Second, the size of the estimated effects of neighbourhood conditions was usually much smaller than the estimated effects of family level conditions. For example, family-level measures such as residence in social housing and maternal schooling were almost always fairly powerful predictors of children's cognitive development. In contrast, both the size and statistical significance of coefficients on the neighbourhood measures were usually smaller than those of family-level measures. Thus, it appears that families still should be viewed as the key agents in promoting positive development in children.

This paper can be viewed as outlining a framework regarding potential neighbourhood influences on young children. Further work should be conducted in order to understand the extent to which neighbourhood variables are proxies for ongoing neighbourhood-level processes. While one conclusion to draw from our results is that family effects on children overshadow neighbourhood effects, the potential remains for uses of neighbourhood variables that are different from the factors presented here or based on different neighbourhood boundaries and for examining additional area characteristics more pertinent to children, such as quality of health services or school quality, that may moderate neighbourhood effects. In addition in depth knowledge of neighbourhood characteristics either from ethnographic studies or from the refined observational methods of developmental psychology is needed not only to understand mechanisms of neighbourhood influences but also to pursue the bidirectional influences between families and their neighbours. Since the neighbourhood effects net

of family characteristics are modest in this paper, a future emphasis on variation within neighbourhoods is suggested.

Our results are similar to those of Brooks-Gunn et al. (1997). In both studies neighbourhood conditions are significant predictors of developmental outcomes around the time of transition to school. We had assumed that the scope for neighbourhood effects would grow as children pass from early to middle childhood and from middle childhood to adolescence. Implicit in this view is the assumption that neighbourhood influences are direct and that they depend on the amount of time children spend away from parents and homes. Theoretical discussion points to potentially important indirect effects of neighbourhood contexts on young children through daycare; the safety and stimulation of parks, playgrounds, and other neighbourhood resources and the parenting practices within children's homes. Even throughout the school years, when hypothesised indirect effects of neighbourhoods are thought to operate through peers and schools, parents still supervise much of older children's and adolescents' time. The educational attainment of parents also has a very significant impact on children's own achievements. The size of this intergenerational transmission is large. It demonstrates that an important part of an individual's achievements is shaped by the achievements of their parents (Dearden, Machin & Reed, 1997).

In our analyses the effects of neighbourhood deprivation did not appear to be mediated by the home environment. HOME scores did mediate the effects of family poverty and cohort member educational qualifications on child test scores in children aged 10 and over. Families with young children living in better standard accomodation and with more educated cohort member parents were associated with better home environments, which in turn are associated with higher test scores. The mediation effect is not due to the HOME scores being correlated with other family factors, such as maternal education or teenage motherhood. It is likely that poor parents, given the stresses in their lives, spend less time in provision of so-called learning experiences. Other aspects of parental behaviour, such as responsiveness, control and harshness, may also mediate the relationship between family

poverty and child test scores (Conger, Elder, Lorenz, Conger, Simons, Whitbeck et al., 1990).

The effect of family poverty on the test scores of children in early childhood, with children from more deprived families doing worse on tests, may be attributed in part to the effects of poverty on parental behaviour which may then have an effect on children. Our results showed that the home learning environment played a mediating role. Other theoretically driven measures of process – for example, paternal supervision or monitoring, family organisation, consistency in routines, parental self-efficacy – were not available in our data set, preventing us from estimating the mediated models needed to provide a convincing explanation of how neighbourhood effects work. This research joins the existing literature suggesting that family characteristics matter most to child development. This research supports continued efforts to develop new forms of family level and individual level intervention that are likely to help low income children who live in urban neighbourhoods. This research does not suggest any reasons to cease neighbourhood oriented (or community oriented) programmes that help low-income children who live in deprived neighbourhoods. The significant linkages found between family poverty and the home environment and between the home environment and children's test scores suggest policies to improve parenting and relieve family poverty would improve the test scores of children. One might argue that priority should be given to factors that are likely to have multiple benefits, particularly if they influence child development from an early age. One feature of early life worthy of serious consideration is preschool care and education, which could be justified on the grounds that preschool child development programmes are associated, in particular, with improved school readiness, from which other benefits follow, including improved adolescent socioemotional functioning, and thereafter educational achievement and adult social position.

Our study has several limitations. Most significantly we are unable to distinguish non-random selection processes from genuine neighbourhood effects. Sociologists have worried about the fact that the family-level variables often measured in neighbourhood studies do not control for unmeasured

differences in families who reside in one neighbourhood versus another thus neighbourhood effects may simply be a reflection of the families who come to live in certain neighbourhoods (Tienda, 1991; Duncan et al. 1997). If important unmeasured characteristics of individuals lead them both to choose certain kinds of neighbourhoods and to have different outcomes, then the apparent effects of neighbourhoods that we estimate in our models could either over- or understate true effects. It is difficult to predict the likely direction in which the selection process might bias estimates of neighbourhood influences. However, individuals especially ill-equipped to handle bad neighbourhoods probably are most likely to live in them because these individuals lack the (partly unmeasured) wherewithal to move to better neighbourhoods. In this case, the coincidence of a poor neighbourhood and individuals poor outcomes results from the inability to avoid either, thus leading to an overestimation of current neighbourhood conditions' effects. Conversely neighbourhood choices may be dominated by considerations of economic and social consequences. If this capacity is not captured in measured characteristics, then the coincidence of positive outcomes and living in a better neighbourhood would be misattributed to current neighbourhood conditions and lead to an overestimation of neighbourhood effects.

Another limitation of the analyses is that the neighbourhood characteristics are not those considered most relevant to neighbourhood effects on individuals by most researchers investigating neighbourhood effects. Although the decennial census provides a detailed characterisation of the sociodemographic characteristics of electoral wards, these characteristics bear weak relations to the theoretical concepts of interest (Duncan et al., 1997). For example, there are no measures of the social capital that binds neighbourhoods together or other key neighbourhood compositional factors such as the level of violence and substance abuse in the neighbourhood. As far as teenagers are concerned the electoral ward may be a poor substitute for measurements on school and peer groups. Given these concerns, we must be cautious about drawing firm conclusions regarding the size and nature of neighbourhood effects. Despite these limitations, the study provides

useful information on the determinants of parenting and child outcomes, which earlier studies with smaller samples could not provide.

REFERENCES

Aber, J.L., Gephart, M., Brooks-Gunn, J., Connell, J. Spencer, M.B. (1997). Neighborhood, family and individual processes as they influence child and adolescent outcomes. In J. Brooks-Gunn, G. Duncan and J.L. Aber (Eds.), Neighbourhood Poverty: Context and Consequences for Development (pp. 44-61). New York: Russell Sage Foundation.

Blos, H., Huston, A., Granger, R., Duncan, G.J., Brock, T. and McLoyd, V. (1999). Can anti-poverty programs improve family functioning and enhance children's well-being. Joint Centre for Poverty Research, Northwestern University, Working Paper 103.

Brooks-Gunn, J., Duncan, G.J., Klebanov, P.K. and Sealand, N. (1993). Do neighborhoods affect child and adolescent development? American Journal of Sociology, 99, 353-395.

Brooks-Gunn, J., Duncan, G. and Aber, J.L. (Eds.) (1997). Neighborhood Poverty: Context and Consequences for Development. New York: Russell Sage Foundation.

Chase-Lansdale, P.L., Gordon, R., Brooks-Gunn, J. and Klebanov, P.K. (1997). Neighborhood and family influences on the intellectual and behavioural competence of preschool and early school-age children. In J. Brooks-Gunn, G. Duncan and J.L. Aber (Eds.), Neighborhood Poverty: Context and Consequences for Development (pp. 79-118). New York: Russell Sage Foundation.

Clarke, L., Di Salvo, P., Joshi, H. and Wright, J. (1997). Stability and instability in children's lives: longitudinal evidence from Great Britain, Research Paper 97-1, Centre for Population Studies, London School of Hygiene and Tropical Sciences.

Coleman, J. (1988). Social capital in the creation of human capital. American Journal of Sociology 94 (Supplement), S95-S120.

Conger, R.D., Elder, G.H., Lorenz, F.O., Conger, K.J., Simons, R.L., Whitbeck, L.B., Huck, S. and Melby, J.N. (1990). Linking economic hardship to marital quality and instability. Journal of Marriage and the Family, 52, 643-656.

Davies, H., Joshi, H. and Clarke, L. (1997). Is it cash the deprived are short of? Journal of the Royal Statistical Society, Series A, 160, 107-126.

Dearden, L., Machin, S. and Reed, H. (1997). Intergenerational mobility in Britain. Economic Journal, 107, 47-66.

Duncan. G.J., Connell. J.P. and Klebanov, P.K. (1997). Conceptual and methodological issues in estimating causal effects of neighborhoods and family conditions on individual development. In J. Brooks-Gunn, G. Duncan and J.L. Aber (Eds.), Neighborhood Poverty: Context and Consequences for Development (pp. 219-250). New York: Russell Sage Foundation.

Dunn, L. and Markwardt, C. (1970). Peabody Individual Achievement Test Manual. Circle Pine, Minnesota, American Guidance Service.

Evans, W.N., Oates, W.E. and Schwab, R.M. (1992). Measuring peer group effects: a study of teenage behaviour. Journal of Political Economy, 100, 966-991.

Ferri, E. (1993). Life at 33: the Fifth Follow-up of the National Child Development Study, National Children's Bureau, London.

Glass, N. (1999). Sure Start: the development of an early intervention programme for young children in the United Kingdom. Children and Society, 13, 257-264.

Glennester, H., Lupton, R., Noden, P. and Power, A. (1999). Poverty, Social Exclusion and Neighbourhood: Studying the area bases of social exclusion. CASEPaper 22, Centre for the Analysis of Social Exclusion, London School of Economics.

Graber, J.A. and Brooks-Gunn, J. (1996). Transitions and turning points. Navigating the passage from childhood through adolescence. Developmental Psychology, 32, 768-776.

Green, A. (1996). Aspects of the changing geography of poverty and wealth. In: J. Hills (Ed.) New Inequalities: The Changing Distribution of Income and Wealth in the United Kingdom. Cambridge: Cambridge University Press.

Hills, J. (1996). New Inequalities: The Changing Distribution of Income and Wealth in the United Kingdom. Cambridge: Cambridge University Press.

Joshi, H., Cooksey, E., Wiggins, R.D., McCulloch, A., Verropoulou, G. and Clarke, L. (1999). Diverse family living situations and child development: a multi-level analysis comparing longitudinal evidence from Britain and the United States. International Journal of Law, Policy and the Family, 13, 292-314.

Klebanov, P.K., Brooks-Gunn, J., and Duncan, G.J. (1994). Does neighborhood and family poverty affect mothers' parenting, mental health and social support? Journal of Marriage and the Family, 56, 441-455.

Klebanov, P.K., Brooks-Gunn, J., Chase-Landsdale, P.L. and Gordon, R.A. (1997). Are neighborhood effects on young children mediated by features of the home environment ? In J. Brooks-Gunn, G. Duncan and J.L. Aber (Eds.), Neighbourhood Poverty: Context and Consequences for Development (pp. 119-145). New York: Russell Sage Foundation.

Klebanov, P.K., Brooks-Gunn, J., McCarton, C. and McCormick, M.C. (1998). The contribution of neighborhood and family income to developmental test scores over the first three years of life. Child Development, 69, 1420-1436.

Lee, P. (1999) Where are the deprived ? Measuring deprivation in cities and regions. In D. Dorling and S. Simpson (Eds.), Statistics in Society : The Arithmetic of Politics (pp. 172-180). London. Arnold.

Leventhal, T. and Brooks-Gunn, J. (2000). The neighborhoods they live in: the effects of neighborhood residence on child and adolescent outcomes. Psychological Bulletin, 126, 309-337.

Ludwig, J., Duncan, G.J. and Hirschfield, P. (1998). Urban poverty and juvenile crime: evidence from a randomized housing-mobility experiment. Joint Centre for Poverty Research, Northwestern University, Working Paper 55.

Macintyre, S., Maciver, S. and Sooman, A. (1993). Area, class and health: should we be focusing on places or people. Journal of Social Policy, 22, 213-234.

Matthews, M. (1987). Gender, home range and environmental cognition. Transactions Institute of British Geographers, 12, 43-56.

McCulloch, A. and Joshi, H. (1999). Child development and family resources: an exploration of evidence from the second generation of the 1958 British birth cohort. Institute of Social and Economic Research, University of Essex, Working Paper 99-15.

Noble, M. and Smith, G. (1996). Changing patterns of income and wealth in two contrasting areas. In: Hills, J. (Ed.) New Inequalities: The Changing Distribution of Income and Wealth in the United Kingdom. CUP.

Parke, R.D. and Bhavnagri, N.P. (1989). Parents as managers of children's peer relationships. In: Belle, D. (Ed.) Children's Social Networks and Social Supports pp. 241-259 New York, John Wiley & Sons.

Peeples, F. and Loeber, R. (1994). Do individual factors and neighborhood context explain ethnic differences in juvenile delinquency? Journal of Quantitative Criminology, 10, 141-157.

Raudenbush, S.W. and Willms, J.D. (1995). The estimation of school effects. Journal of Educational and Behavioural Statistics, 20, 307-335.

Rutter, M. (1983). School effects on pupil progress: Research findings and policy implications. Child Development, 54, 1-29.

Sampson, R.J. (1992). Family management and child development: Insights from social disorganization theory. In: McCord, J. (Ed.) Facts, Frameworks and Forecasts: Advances in Criminological Theory Vol. 3 pp. 63-93 New Bruswick, NJ: Transaction Publishers.

Sampson, R.J. and Groves, W.B. (1989). Community structure and crime: Testing the social disorganization theory. American Journal of Sociology, 94, 774-802.

Sampson, R.J., Raudenbush, S.W. and Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. Science, 277, 918-924.

Smith, J.R., Brooks-Gunn, J. and Klebanov. P.K. (1997). Consequences of living in poverty for Young Children's cognitive and verbal ability and early school achievement. In Duncan and Brooks-Gunn (Eds.) Consequences of growing up poor (pp. 132-189). New York, Russell Sage Foundation.

South, S.J. and Crowder, K.D. (1999). Neighborhood effects on family formation: concentrated poverty and beyond. American Sociological Review, 64, 113-132.

Sugland, B., Zaslow, M., Smith, J., Brooks-Gunn, J., Coates, D., Blumenthal, C., Moore, K., Griffin, T. and Bradley, R. (1995). The early childhood HOME Inventory and HOME Short Form in differing racial/ethnic groups: are there differences in underlying structure, internal consistency of subscales, and patterns of prediction. Journal of Family Issues, 16, 632-663.

Tienda, M. (1991). Poor people and poor places: Deciphering neighborhood effects on poverty outcomes. In Huber, J (Ed.) Macro-micro linkages in sociology (pp. 244-267). Thousand Oaks, CA: Sage.

Townsend, P., Phillimore, P. and Beattie, A. (1989). Health and Deprivation. London: Routledge.

Wilson, W.J. (1987). The Truly Disadvantaged: the Inner City, the Underclass, and Public Policy. Chicago: Chicago University Press.

Wilson, W.J. (1991). Studying inner-city social dislocations: The challenge of public agenda research. American Sociological Review, 56, 1-14.

Table 1. Means of variables for children of different age groups.

	CHILD AGE		
	4-5 YEARS	6-9 YEARS	10+ YEARS
CHILD AGE (MONTHS)	59.41	94.25	146.18
GIRL	0.50	0.52	0.51
NUMBER OF CHILDREN	2.30	2.33	2.44
AGE FIRST BIRTH (YEARS)	26.01	23.84	20.27
[1]COHORT MEMBERS HIGHEST QUALIFICATION	2.53	2.23	1.54
SOCIAL HOUSING	0.14	0.22	0.39
CAR ACCESS	0.88	0.88	0.81
HOME: COGNITIVE STIMULATION	12.84	10.89	9.90
PPVT TEST SCORE	0.32	0.51	0.66
TOWNSEND DEPRIVATION SCORE	-0.03	0.28	1.42
[2]NET HOUSEHOLD INCOME / MONTH	321.35	309.50	279.64
COHORT MEMBERS GENERAL ABILITY AGE 11	47.06	44.73	39.84
COHORT MEMBERS PARENTS SEPARATED	0.14	0.16	0.24
INTACT FAMILY + NON WORKING MOTHER	0.46	0.38	0.28
INTACT FAMILY + WORKING MOTHER	0.49	0.49	0.39
STEP FAMILY + NON WORKING MOTHER	0.004	0.02	0.08
STEP FAMILY + WORKING MOTHER	0.008	0.04	0.13
LONE MOTHER + NON WORKING	0.02	0.03	0.04
LONE MOTHER + WORKING	0.02	0.04	0.07
NUMBER OF CASES	609	1057	760

[1]Cohort members's highest educational qualification: 0 = none to 5 = degree.

[2]Number of cases for which net income is available are respectively: 440, 752 and 556.

Table 2. Means of variables for quintiles of Townsend deprivation score (I least deprived to V most deprived).

	TOWNSEND QUINTILE				
	I	II	III	IV	V
CHILD AGE (MONTHS)	91.07	98.07	102.30	106.28	112.25
GIRL	0.50	0.49	0.50	0.53	0.51
NUMBER OF CHILDREN	2.24	2.29	2.47	2.27	2.51
AGE FIRST BIRTH (YEARS)	24.53	23.69	22.98	22.96	22.00
COHORT MEMBERS HIGHEST QUALIFICATION	2.59	2.30	1.93	1.96	1.56
SOCIAL HOUSING	0.07	0.18	0.24	0.24	0.43
CAR ACCESS	0.96	0.91	0.88	0.84	0.74
HOME: COGNITIVE STIMULATION	11.66	11.27	11.04	10.86	10.25
PPVT TEST SCORE	0.49	0.51	0.51	0.52	0.52
[1]NET INCOME	364.64	317.35	298.52	286.61	255.12
COHORT MEMBERS GENERAL ABILITY AGE 11	48.20	47.25	43.33	40.50	37.84
COHORT MEMBERS PARENTS SEPARATED	0.15	0.19	0.19	0.19	0.20
INTACT FAMILY + NON WORKING MOTHER	0.42	0.44	0.37	0.36	0.34
INTACT FAMILY + WORKING MOTHER	0.51	0.44	0.51	0.45	0.43
STEP FAMILY + NON WORKING MOTHER	0.02	0.01	0.02	0.04	0.05
STEP FAMILY + WORKING MOTHER	0.02	0.04	0.05	0.07	0.06
LONE MOTHER + NON WORKING	0.01	0.03	0.02	0.03	0.07
LONE MOTHER + WORKING	0.02	0.04	0.03	0.05	0.06
NUMBER OF CASES	437	449	479	479	483

[1]Number of cases for which net income is available are respectively: 305, 306, 344, 358, 356.

Table 3: Regression results. Regression coefficients and t-statistics of factors predicting children's PPVT scores.

	4-5 YEARS		6-9 YEARS		10+YEARS	
	β	t	β	t	β	t
CONSTANT	-2.70	-1.02	-2.78	-2.19	3.19	2.03
AGE (months)	0.14	1.54	0.13	4.74	0.02	1.18
AGE-SQUARED/100	-0.06	-0.77	-0.04	-3.08	-0.00	-0.03
GIRL	0.04	0.52	-0.12	-2.48	0.00	0.01
NEIGHBOURHOOD DEPRIVATION QUINTILE						
II	-0.27	-2.68	0.04	0.54	0.19	1.61
III	-0.35	-3.26	-0.15	-1.95	0.01	0.09
IV	-0.30	-2.70	-0.22	-2.91	-0.10	-0.84
V	-0.60	-5.37	-0.44	-5.48	-0.21	-1.90
R^2	0.29		0.44		0.27	

Table 4: Regression Results.

	4-5 YEARS		6-9 YEARS		10+YEARS	
	β	t	β	t	β	t
CONSTANT	-3.09	-1.11	-5.29	-3.95	-2.15	-1.21
AGE (months)	0.10	1.09	0.14	5.31	0.05	2.41
AGE-SQUARED/100	-0.03	-0.36	-0.05	-3.52	-0.01	-0.81
GIRL	0.05	0.68	-0.10	-2.02	0.02	0.39
NEIGHBOURHOOD DEPRIVATION QUINTILE						
II	-0.18	-1.77	0.08	1.12	0.28	2.39
III	-0.17	-1.48	0.00	-0.02	0.17	1.48
IV	-0.08	-0.72	-0.05	-0.70	0.13	1.14
V	-0.32	-2.66	-0.07	-0.81	0.15	1.34
INTACT FAMILY + WORKING MOTHER	0.08	1.06	-0.01	-0.19	0.10	1.26
STEP FAMILY + NON WORKING MOTHER	–	–	0.22	1.34	0.13	1.06
STEP FAMILY + WORKING MOTHER	–	–	-0.35	-2.61	-0.07	-0.66
LONE MOTHER + NON WORKING	0.16	0.56	-0.37	-2.27	0.09	0.61
LONE MOTHER + WORKING	0.15	0.49	-0.09	-0.59	0.17	1.24
COHORT MEMBERS HIGHEST QUALIFICATION	0.09	2.81	0.05	2.44	0.08	2.47
COHORT MEMBERS GENERAL ABILITY AGE 11	0.01	2.89	0.01	6.02	0.01	5.51
NUMBER OF CHILDREN	0.03	0.64	-0.01	-0.52	-0.03	-1.12
AGE FIRST BIRTH (YEARS)	0.03	1.64	0.04	2.98	0.10	3.65
SOCIAL HOUSING	-0.39	-3.01	-0.12	-1.72	-0.14	-2.08
CAR ACCESS	-0.01	-0.05	0.11	1.32	0.13	1.44
COHORT MEMBERS PARENTS SEPARATED	-0.05	-0.46	-0.07	-1.14	0.10	1.39
R^2	0.39		0.53		0.41	

Table 5: Regression Results.

	4-5 YEARS		6-9 YEARS		10+YEARS	
	β	t	β	t	β	t
CONSTANT	-3.22	-1.18	-5.09	-3.82	-2.35	-1.35
AGE (months)	0.07	0.81	0.13	4.97	0.05	2.34
AGE-SQUARED/100	-0.01	-0.07	-0.04	-3.20	0.00	-0.70
GIRL	0.02	0.32	-0.11	-2.31	-0.01	-0.18
NEIGHBOURHOOD DEPRIVATION QUINTILE						
II	-0.18	-1.82	0.08	1.12	0.29	2.50
III	-0.18	-1.62	-0.01	-0.18	0.15	1.28
IV	-0.09	-0.80	-0.06	-0.77	0.11	1.04
V	-0.29	-2.50	-0.07	-0.87	0.15	1.39
INTACT FAMILY + WORKING MOTHER	0.10	1.40	-0.01	-0.20	0.08	1.06
STEP FAMILY + NON WORKING MOTHER	–	–	0.22	1.36	0.11	0.94
STEP FAMILY + WORKING MOTHER	–	–	-0.31	-2.35	-0.10	-0.92
LONE MOTHER + NON WORKING	0.27	0.94	-0.36	-2.18	0.17	1.16
LONE MOTHER + WORKING	0.32	1.06	-0.07	-0.48	0.17	1.29
COHORT MEMBERS HIGHEST QUALIFICATION	0.07	2.22	0.04	1.92	0.05	1.66
COHORT MEMBERS GENERAL ABILITY AGE 11	0.01	2.46	0.01	5.71	0.01	5.27
NUMBER OF CHILDREN	0.03	0.73	-0.01	-0.35	-0.02	-0.86
AGE FIRST BIRTH (YEARS)	0.02	1.30	0.04	2.64	0.08	3.01
SOCIAL HOUSING	-0.37	-2.88	-0.11	-1.50	-0.09	-1.36
CAR ACCESS	-0.03	-0.22	0.09	1.03	0.14	1.50
COHORT MEMBERS PARENTS SEPARATED	-0.03	-0.30	-0.07	-1.04	0.09	1.28
HOME: COGNITIVE STIMULATION	0.10	4.24	0.04	2.78	0.08	5.04
R^2	0.42		0.53		0.43	

Table 6: Mean observed minus predicted values and 95% confidence limits for children's PPVT scores by quintile of Townsend deprivation score.

	4-5 YEARS		6-9 YEARS		10+ YEARS	
TOWNSEND QUINTILE	MEAN	95% CONFIDENCE INTERVAL	MEAN	95% CONFIDENCE INTERVAL	MEAN	95% CONFIDENCE INTERVAL
I	0.9	-0.5 – 2.3	0.1	-0.9 – 1.2	-1.5	-3.3 – 0.4
II	-0.6	-2.0 – 0.7	0.9	-0.1 – 1.9	1.3	-0.1 – 2.6
III	-0.6	-2.4 – 1.2	0.0	-1.0 – 1.1	0.2	-1.2 – 1.6
IV	0.5	-1.1 – 2.0	-0.4	-1.3 – 0.5	-0.2	-1.5 – 1.0
V	-1.8	-3.7 – 0.1	-0.6	-1.8 – 0.6	-0.0	-1.1 – 1.1

Table 7: Regression Results. Regression coefficients and t-statistics of factors predicting HOME Cognitive Stimulation scores.

	4-5 YEARS		6-9 YEARS		10+YEARS	
	β	t	β	t	β	t
CONSTANT	80.91	4.03	-51.08	-1.45	39.16	0.84
AGE (months)	0.75	1.12	2.31	3.31	0.18	0.34
AGE-SQUARED/100	-0.57	-0.91	-1.16	-3.16	-0.07	-0.42
GIRL	2.19	1.83	3.65	2.90	4.66	2.91
NEIGHBOURHOOD DEPRIVATION QUINTILE						
II	-0.38	-0.22	0.16	0.08	-0.31	-0.10
III	-0.15	-0.08	3.21	1.66	3.80	1.25
IV	-0.94	-0.50	1.47	0.76	0.87	0.30
V	-4.24	-2.15	1.18	0.54	0.16	0.05
INTACT FAMILY + WORKING MOTHER	-2.33	-1.91	0.17	0.12	1.45	0.73
STEP FAMILY + NON WORKING MOTHER	–	–	-0.62	-0.15	2.13	0.69
STEP FAMILY + WORKING MOTHER	–	–	-8.76	-2.54	1.85	0.66
LONE MOTHER + NON WORKING	-12.89	-2.59	-3.97	-0.91	-9.62	-2.50
LONE MOTHER + WORKING	-14.10	-2.77	-4.24	-1.11	-0.51	-0.15
COHORT MEMBERS HIGHEST QUALIFICATION	2.29	4.62	2.79	4.94	3.28	4.14
COHORT MEMBERS GENERAL ABILITY AGE 11	0.16	3.30	0.15	3.05	0.07	1.23
NUMBER OF CHILDREN	-0.97	-1.46	-1.12	-1.68	-0.90	-1.33
AGE FIRST BIRTH	0.53	1.97	1.33	3.35	2.04	2.84
SOCIAL HOUSING	-2.95	-1.26	-4.02	-2.18	-6.66	-3.70
CAR ACCESS	1.13	0.50	6.37	2.85	-0.92	-0.38
COHORT MEMBERS PARENTS SEPARATED	-0.56	-0.34	-1.78	-1.04	0.65	0.34
R^2	0.23		0.21		0.21	