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A Model of the Determinants of Expenditure on Children's Personal Social Services

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A MODEL OF THE DETERMINANTS OF EXPENDITURE ON CHILDREN'S PERSONAL SOCIAL SERVICES

Results of a study commissioned by the Department of Health from a consortium comprising the University of York, MORI and the National Children's Bureau

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1. INTRODUCTION AND SUMMARY

Every year the United Kingdom central government assesses the relative spending needs of English local authorities in respect of the services for which it is responsible. This is done by estimating a Standard Spending Assessment (SSA) for each service, which is intended to indicate the spending requirements of an authority if it were to adopt a standard level of services, given the circumstances in its area. In practice, statistical methods are used to develop SSAs for most services. This report describes the findings of a study designed to review the methods for setting SSAs for a single service: personal social services (PSS) for children, which in 1995/96 accounted for about £1.8billion of expenditure (4.4% of total local government expenditure).

The study was commissioned by the Department of Health and undertaken by a consortium which comprised the University of York, MORI and the National Children's Bureau. The study was guided by a technical advisory group, comprising representatives from the local authority associations and the Department of Health. In seeking to limit the length of the report, the authors have necessarily omitted a great deal of the technical material produced in the course of the study. We understand that the Department of Health is willing to make this material and the data used in the study available to interested parties, subject to certain confidentiality restrictions.

Existing methodology for constructing SSAs has been the subject of some criticism, both in general and specifically in respect of children's PSS. This document reports the results of a study designed to apply a radically new statistical approach to estimating the SSA for children's PSS. Previous methods were based on statistical analysis of local authority aggregate data. In contrast, this study is based on an analysis of PSS spending in 1,036 small areas (with populations of about 10,000) within 25 local authorities. A relatively new statistical method known as multilevel modelling, which was originally developed in the educational sector, was used for this purpose.

Chapter 2 sets out the background to the study. It first outlines the statutory background to children's PSS and summarizes previous research. This indicates that the principal risk

factors associated with contact with PSS are broken families, poor housing conditions, receipt of welfare benefits, mixed ethnic origin, young mothers and large families. The criticisms of existing SSAs are then documented. In general, these reflect a tension between technical accuracy and operational simplicity.

The chapter goes on to describe the small area methods used in this study. These are designed to address four specific weaknesses associated with the SSA for children's PSS:

1. the fact that current SSA methods use *authority level data*, which are determined by numerous factors other than the local needs of children;
2. the current SSA for children's PSS is based on a *subset of relevant children* accounting for only 18% of all children in contact with social service departments;
3. the current SSA methodology involves a potentially *misleading distinction between expected numbers of children and their unit costs*;
4. the use of authority level data may give rise to what is known as the *ecological fallacy* - an observed link between needs and spending which is determined more by policy factors at the local authority level than needs factors at the local level.

Ideally our analysis would have been based on the smallest unit possible – that of the household or even the individual child - to overcome these problems. However relevant data are not available, and the small area analysis is therefore used as a practical alternative.

Chapter 3 describes the extensive dataset that was assembled for the purposes of the study. The core of this was a census of all children in contact with 25 of the 108 social service departments in England. Each child was assigned to one of six categories of care:

- being looked after: in residential care;
- being looked after: in foster care;
- being looked after: other (usually returned to family);
- not looked after: child protection register;
- not looked after: physically handicapped;
- not looked after: other.

The other data available were the child's age, sex and small area of residence on entering care. A total of 74,493 children were included in the survey.

The focus of attention in this study was the cost of children's PSS in each small area. However, relevant costing data are not collected routinely, so a sample of 1,971 of the children in the survey was drawn in order to identify the frequency of contact with social workers, to be used as a prime indicator of costs. Our analysis of paper files found that the most common activities associated with the children in the sample were phone calls (29.1 per child annually), home visits (11.3) and letter writing (7.4). A subsample of the files of 508 of the children was further analysed in conjunction with interviews with social workers in order to estimate the social work time associated with each activity. The intention was to obtain estimates of all use of social work time attributable directly or indirectly to individual children. On average, it was found that each child required 50 hours of attributable social work attention per year.

Every local authority has a budget for children's PSS. Local finance officers were asked to recommend a method of allocating the 1995/96 budget to each of the six categories of child noted above, where necessary using the social work contact time data. For each of the six categories this yielded unit cost data which were specific to each local authority. They enabled us to construct estimates of the costs of children's PSS in each small area using local cost estimates.

The intention was to seek to explain the small area variations in costs in terms of local socio-economic conditions. The methods used are described in Chapter 4. They entailed the construction of a large dataset of socio-economic variables describing the small areas, drawn mainly from the 1991 Census of Population. The specification of these potential explanatory factors was based principally on the determinants of PSS utilization identified in previous studies and the experience of social workers. Our technical advisors made numerous suggestions in this respect.

A statistical model was developed which sought to explain variations in costs in terms of the socio-economic data. The study team used multilevel modelling techniques, which are specifically designed to analyse hierarchically ordered data of the sort used in this study (small areas nested within local authorities). The intention was to identify intra-authority causes of variation, thereby removing the local authority effect, which may be the result of numerous factors other than needs. The model of utilization was required to be (i) plausible

(ii) parsimonious and (iii) statistically acceptable. In the event we succeeded in developing a robust model which in our judgement satisfied these criteria, and which contained the following variables:

- Proportion of children in lone parent families;
- Proportion of children living in flats;
- Proportion of children in families of Income Support claimants;
- Proportion of children with limiting long standing illness;
- Density of population (persons per hectare).

In seeking to implement the study methods, we encountered a number of difficulties, of which the most important were:

- constrained choice of local authorities - only 25 out of 108 were able to provide adequate data;
- incomplete coverage of children within local authorities - 14% of children had missing or inadequate post codes;
- absence of cost data for individual children - we were forced to use six broad categories of children when ideally we would have used actual costs for each child;
- the difficulty of modelling higher unit costs for certain children within a local authority - the use of an authority-wide average for each category of child may have masked systematically higher costs for certain types of children within a category;
- construction of unit costs - in practice some crude assumptions had to be made in apportioning local authority budgets to categories of child.

Any SSA methodology is likely to encounter difficulties of this sort, and we made exhaustive checks to ensure that these limitations did not lead to biased results. We were able to confirm that none appeared to compromise the validity of the study. Indeed any limitations appear very small when set beside the study's benefits, in particular overcoming the four weaknesses of current methods noted above. We believe that the study has achieved a good balance between what is practically achievable and what is theoretically correct.

We therefore recommend that, when used in conjunction with a suitable index of local authority social service cost variations, the model identified in this study is suitable for use as the basis for a SSA for children's PSS.

In undertaking this study we benefited from the assistance of numerous colleagues and advisors. The outcome was enhanced enormously by the detailed attention given to the study by our technical advisors from the local authority associations and government departments. In particular, we should like to acknowledge the tireless support of Richard Campbell, David Matthews and Danny Palnoch at the Department of Health and the advice from John Rowlands at the Social Services Inspectorate and Andrew Pressland at the Department of Environment, Transport and the Regions. Throughout the study we benefited from discussions with many colleagues, including Sally Baldwin, Jonathan Bradshaw, Harvey Goldstein and Ian Sinclair. Important contributions to the study were made by Trinh Tu (MORI) and Paul Fagg, Dale Lord, Di Wilson and Sal Wilson (University of York). Finally we should note the crucial contribution of the local government officers without whom we should not have been able to undertake this study. We therefore gratefully acknowledge the time, wisdom and effort contributed by of the scores of finance officers, social workers and computer specialists who participated in the study.

2. BACKGROUND

This chapter sets out the background to the study. Section 2.1 outlines the statutory framework and existing research relating the children's personal social services in England. Section 2.2 describes the current system of standard spending assessments (SSAs), section 2.3 examines SSAs for children's social services, and section 2.4 gives our assessment of current SSA methodology. The model used in this study is set out in section 2.5.

2.1 Children's Personal Social Services

The powers and duties of local authorities in relation to personal social services for children are set out in the 1989 Children Act (UK Government, 1989). Part III identifies the class of children who are the primary target of local authority functions, defined as "children in need". A child is in need if

a) he is unlikely to achieve or maintain, or to have the opportunity of achieving or maintaining, a reasonable standard of health or development without the provision for him of services by a local authority…;
b) his health or development is likely to be significantly impaired, or further impaired, without the provision for him of such services; or
c) he is disabled

(from section 17(11): throughout the masculine is used in the original).

The Act sets out the following principal duties for local authorities (Department of Health, 1989):

a) identification and assessment of potential children in need;
b) prevention of neglect and ill-treatment;
c) provision of family support for children in need who live with their families;
d) providing services for disabled children.

The principal modes of care are residential care, fostering, and day care.

One particular group of children in need are those who are "looked after" by the local authority. A child is looked after if he is under a care order (which gives the local authority

parental responsibility) or otherwise provided with accommodation by the local authority under its social service function for more than 24 hours. A second group of children comprises those subject to a supervision order, under which parental responsibility remains with the child's family, but the local authority assumes certain powers of supervision.

In 1995/96 local authorities in England spent £1,777million on children's personal social services (CIPFA, 1995). On average, according to local authority returns to the Chartered Institute of Public Finance and Accountancy, annual gross costs per child (excluding capital charges) were £47,922 for residential care, £8,268 for foster care, and £6,293 for day care. There are however major variations between authorities. For example, the London borough of Barnet spends on average of £82,795 per child in residential care, while the figure for nearby Waltham Forest is £19,618. Such variations may be the result of numerous factors, such as variations in the type of child in care, variations in local authority policy, variations in efficiency, or variations in accounting practice.

Similarly, there are large differences between authorities in the rates of children being admitted into care. There are at least four potential explanations for such differences:

- reasons for entry are associated with a child's circumstances and there are differences between areas in the circumstances of children in general;
- local authorities have different policies and may differ in their approach to certain needs;
- authorities adopt different strategies in their interpretation of the relevant Acts;
- authorities employ different data recording methods.

There is a small body of research which has sought to explain patterns of admission into care. Bebbington and Miles (1989) surveyed of 13 of the 108 social service authorities, including 2 Inner London Boroughs, 2 Outer London Boroughs, 4 Metropolitan Districts and 5 Shire Countries. Information on family backgrounds was sought for 2528 children in care. Information on the parental family was unavailable for 356, so the effective sample was 2165 cases. Their circumstances were compared with the characteristics of a sample of 5407 children aged under 17 and not in care drawn from the 1985 General Household Survey.

Bebbington and Miles estimated the effect of a wide range of factors on the probability of admission into care. The broad conclusions of their analysis were that children admitted into care come from atypical families. Table 2.1 summarizes the key factors identified.

	'Typical'	General Household Survey	'Children in Care'	Bebbington & Miles
Social Security	No dependence	76%	On income support	75%
Family composition	2-parent family	89%	Single adult	45%
Number of children	3 or less	91%	4 or more	24%
Ethnic group	White	94%	Mixed	6%
Tenure status	Owner occupied	67%	Privately rented	66%
Ratio persons:rooms	Under 1	93%	One or more	28%

Table 2.1: Comparison of "Typical" Children and Children in Care

(Source: Bebbington and Miles, 1989, Page 355)

Their analysis of relative risks yielded the following conclusions:

Broken Families Living with one adult only is the single greatest risk factor: nearly half of all children entering care were living with one adult only, compared with just 7% of other children.

Housing Conditions Living in crowded accommodation is the next most significant indicator: children living in such homes were 3½ times more likely to enter care than people living in home with more rooms than people.

Receipt of Benefits Children from homes where the head of household received supplementary benefit were three times more likely to come into care.

Ethnic Origin Single-race children from ethnic minorities are not over-represented amongst children entering care. On the other hand, a child of mixed race was 2½ times as likely to enter care as a white child.

Mothers Under 21 This doubles the odds that a child will enter care.

Large Family Coming from a family of 4+ children only has a comparatively small effect on the risk of entry, although it is associated with many factors that do raise the risk, like overcrowding.

Overall, Bebbington and Miles contrasted the 1 in 7,000 chance of a child from a 'typical' family being admitted into care with the 1 in 10 chance of a child with multiple 'poor' characteristics being admitted into care.

The 1987 results of Bebbington and Miles can be compared with an earlier survey carried out in 1962 by Packman *et al* (1986) of about 4500 cases. This suggests that:

- Entry into care was even more closely associated with 'deprived' families in 1987 than it was in 1962, despite the increase in the proportion of behaviourally disturbed and delinquent children groups, which are identified as having less than the average levels of deprivation associated with those entering care.
- The factor most highly correlated with entry had changed from unemployment in 1962 to broken (or 'non-nuclear') family in 1987; and there had been an increase in the proportion of children living in broken homes.

Children came into care at that time (before the 1989 Children Act) by one of three routes: voluntarily; following a criminal offence (mainly boys over 12); or compulsorily in the interests of their welfare (typically slightly younger children who were more likely to be girls). Bebbington and Miles (1989) document the characteristics of children admitted into care by each of these main routes and found that, whilst there were differences between the groups, they show a similar pattern of 'deprivation' (as measured by the variables discussed above).

	Children Entering Care			General Population
	Voluntary	Court Orders		
		Offenders	Others	
	%	%	%	%
Broken (Single Parent) Family	76	57	69	15
Household head gets income support (SB or unemployment benefit)	71	48	76	26
Not owner occupied home	80	68	85	28
Crowded home (one or more persons per room)	55	50	67	21
Mixed ethnic origin	6	5	5	1
(Sample size)	(1659)	(174)	(593)	(5274)

Table 2.2 Family characteristics of children by legal category on entering care, compared with all children
(Source: Bebbington and Miles, 1989, Page 355)

In a study of admission into care in Essex, Wedge and Mantle (1991) found that social workers cited disruptive family relationships as a contributory factor in over half of all admissions, and Bebbington and Miles (1989) noted that 'broken family' had replaced unemployment as the factor most highly correlated with entry into care. Parents' own deprivation or ill-health were each mentioned as contributing to about 15% of Essex admissions, but it is noteworthy that social workers seldom mentioned low income, poor housing, unemployment or cultural difficulties. A subsequent study by Stone (1990) of short term fostering in Newcastle reports that social workers considered that three fifths of the children of all ages in her sample had experienced abuse or neglect at some time. Research elsewhere demonstrates that the needs of many children admitted into the care system are related as much to material deprivation and lack of family support as much as wilful neglect or maltreatment. Compulsory separation of children from their families has in general been found to be harmful and only necessary in a minority of cases (Holman, 1980; Department of Health and Social Security, 1985; Packman, 1986; Parker and others, 1991; Department of Health, 1991).

There has been some analysis of the role of ethnicity in the risk of admission into care. Although Rowe *et al* (1989) find some ethnic minority groups over-represented in care, it is not clear whether this is because of ethnicity *per se* or because of deprivation amongst the ethnic groups. Bebbington and Miles (1989) sought to identify the impact of ethnicity independent of other factors, and found that children of mixed ethnic parentage exhibited remarkably high admission rates compared to other ethnic group, particularly amongst pre-school children. These findings were confirmed by Tizzard and Phoenix (1993).

Finally, Bebbington and Miles also carried out an analysis of 1981 Census data to construct a ward-based index of adverse social conditions for children. They included the following indicators in an index of deprivation:

- population density (persons per hectare)
- proportion of children in households not in self-contained accommodation
- proportion of children in households lacking basic amenities
- proportion of children in crowded households (1+ person per room)
- proportion of children in single parent households
- proportion of children where the household head was born in the New Commonwealth or Pakistan.

After confirming with principal components analysis that these six indicators could in conjunction reasonably be considered as forming a single dimension of deprivation, they constructed a deprivation index by summing the standardized score on each indicator. The highest scoring 1,689 (20%) local authority wards on this index were identified as 'poor' wards. More than one half of children admitted to care in the 13 local authorities came from 'poor' wards, although they contained only one third of all children in the population. In a subsequent paper (Bebbington and Miles 1988), they show that the rate of entry into care in areas with many poor wards is higher than would be predicted from family related social indicators alone. This implies that local social conditions as well as family circumstances might be important determinants of entry into care.

The main theme emerging from previous work is clear: that factors such as broken homes, overcrowding and poverty are unambiguous risk factors associated with the use of children's

PSS. The role of ethnicity is complex because the limited research that exists suggests that it is mixed-race families rather than families in any one ethnic group that are more likely to require services. However, all the studies described here predated the 1989 Children Act, which considerably extended the role of social service departments. In particular, it might be expected that, in addition to the deprivation factors identified in previous studies and discussed above, the prevalence of "children in need" would be extended to embrace factors associated with the health of the child and its family, and the prospects for the child's development.

2.2 Standard Spending Assessments

The financial autonomy of English local government has been progressively enfeebled by central government attempts to reduce the volume of local government expenditure, culminating in the Poll Tax disaster of the early 1990s (Butler, Adonis and Travers, 1994). Although central:local relations are now less fraught, the legacy of that era is profound. In particular, the central government now sets strict annual expenditure limits for all local authorities, and about 80% of local government expenditure is financed from central government funds (in the form of Revenue Support Grant and the National Business Rate). The local residential property tax (the Council Tax) is the only significant source of local revenue, other than a small volume of fees and charges for some services.

Although the proportion of local government expenditure currently financed by central government is unprecedented, there has been a long history of more modest transfers of funds from central to local government, in the form of general grants in aid (Travers, 1986). The objectives of such grants have been to seek to compensate authorities for (a) differences in their tax bases and (b) differences in their spending needs. The pursuit of some concept of equity is therefore the central principle underlying the grants. Since 1980 a key starting point for distributing such grants has been the construction for each authority of an assessment of "spending needs". These assessments are central government estimates of how much an authority should spend if it were to deliver some "common" or "standard" level of services, given the demographic, social, economic, meteorological and geographical characteristics of the area. Until 1990 needs assessments in England were known as Grant-Related

Expenditure Assessments (Association of County Councils, 1989). Coinciding with the advent of the poll tax in 1990, some methodological changes were implemented and the assessments were renamed Standard Spending Assessments (SSAs), but the broad principles remained unchanged (Senior, 1994; Association of County Councils, 1990).

Originally SSAs were intended "to represent the amount of revenue expenditure which it would be appropriate for the authority to incur in that year to provide a standard level of service consistent with the Secretary of State's view of the amount of revenue expenditure which it would be appropriate for all local authorities to incur" (Association of County Councils, 1990). In a recent change, the Government has redefined the SSA to be "the amount which the Government considers appropriate for each authority to calculate as its budget requirement ... consistent with the amount the Government considers it would be appropriate for all authorities to incur" (Department of the Environment, 1995). This latter definition explicitly omits mention of "standard" levels of service. However, the notion of some “common” level of service continues to be implicit in the methodologies adopted.

Standard Spending Assessments are calculated as follows. First the central government determines a total expenditure level which it deems appropriate for English local government as a whole to adopt in the year in question. This total is then split into 7 expenditure headings. The figures for 1996/97 are shown for the 7 services in Table 2.1. For each service a working group made up of central and local government representatives then seeks to develop a methodology for distributing the national control total between local authorities on the basis of some concept of relative need. For most services this entails a further disaggregation into more detailed categories of service. A variety of distributional methods have been adopted, but most rely on a regression of local authority expenditure on certain socio-economic characteristics at the local authority level thought to be associated with the need to spend (Department of the Environment, 1995).

SERVICE	*Control Total (£Billion)*
Education	17.764
Personal Social Services	6.909
Police	3.001
Fire	1.185
Highway Maintenance	1.759
All Other Services	7.397
Capital Financing	2.142
TOTAL	**40.157**

Table 2.1: SSA Control Totals by Service, 1995/96

The chosen distribution methods yield a series of service SSAs for each local authority. These are then aggregated to form the total SSA for the authority. This forms the basis for (a) the authority's central government grant in aid (known as Revenue Support Grant) and (b) the authority's expenditure limit. In addition, some of the service SSAs have been used for a variety of other purposes (such as the distribution of finance for Community Care). It must be emphasized that local authorities are not constrained to spending their budget in line with the individual service SSAs calculated by the government. In particular, they free to set their own PSS budgets, subject to fulfilling their statutory obligations and restraining total expenditure within government spending limits.

Clearly the concept of "need" is crucial to SSAs. Many authors have sought to develop meaningful definitions of need (Bradshaw, 1972; Doyal and Gough, 1991; Culyer, 1995). None has so far proved to be entirely satisfactory. However the notion of need underlying SSAs is relatively straightforward. It can be summarized as being equivalent to a local authority's spending requirements if it applies to its population a standard set of policies and practices at a standard level of efficiency. Of course this definition begs a number of questions, of which the most important relates to the definition of the "standard". In practice, by using conventional statistical methods, the UK government is implicitly assuming that the national average response to the chosen indicators of need should form the standard.

SSAs therefore seek to estimate the relative need to spend, and not some absolute concept of need. The chosen methodologies for constructing SSAs use existing behaviour of local authorities as a benchmark. Thus SSAs are intrinsically conservative, in the sense that they reflect current policies. A potential criticism of such spending assessments is therefore that they do not capture need which is not currently met. If it is indeed the case that certain social needs are perceived to be unmet, it is always open to the central government to adopt a methodology which allocates additional funds on the basis of some measure of unmet need. However, for obvious reasons, existing spending patterns cannot be used as the sole basis for such allocations. More generally, there is no intrinsic reason why actual spending patterns should be used as the basis for SSAs. However, any alternative is likely to be open to the criticism that it is arbitrary and biased.

Finally, it is important to keep in mind why statistical analysis is needed to develop SSAs, as some commentators might argue that an authority's actual spending would be a better measure of its need than a statistical construct. The use of actual spending would not be satisfactory for two reasons: first, SSAs would not be based on a consistent set of policies; and second it would give local authorities an incentive to inflate expenditure levels in order to attract more grant.

SSAs have been the subject of wide-ranging criticism from the Audit Commission (1993), the House of Commons Environment Committee (1994) and academics (Goldstein, 1994; Flowerdew *et al*, 1994; Duncan and Smith, 1995; Hall, Preston and Smith, 1996; Thomas and Warren, 1997). Amongst the most important criticisms of SSAs have been:

- they are difficult to understand, and lack openness and transparency;
- they are inflexible and lack sensitivity to certain issues;
- they lack stability;
- they are susceptible to ministerial discretion;
- they are being used for purposes such as expenditure limitation ("capping") and school funding for which they were not originally designed;
- their importance leads to a confusion of accountability between central and local government;
- the use of past expenditure as a basis for SSAs leads to a "circularity", in the sense that expenditure follows SSAs rather than *vice versa*;

- there is a lack of adequate research on which to base SSA methodology;
- many of the data used in SSAs are out of date;
- the special circumstances of London are not properly accommodated within SSAs;
- the validity of certain needs indices is open to question;
- the validity of some of the statistical models on which SSAs are based is open to question.

Many of these criticisms reflect tension between the conflicting objectives of technical accuracy and operational simplicity.

2.3 SSA for Children's Social Services

For the purposes of SSAs, children's Personal Social Services fall within the PSS service block. As shown in Table 2.2, in 1995 they accounted for £1.755billion, or 25.4% of the PSS control total.

SERVICE	*Control Total (£Billion)*
Children	1.755
Elderly residential care	2.200
Elderly domiciliary care	1.537
Other PSS	1.417
TOTAL	**6.909**

Table 2.2: Control Totals for Services within PSS SSA, 1995/96

In common with most other Standard Spending Assessments, the distribution of the children's personal social services SSA is currently based on a statistical regression analysis at the local authority level. Two regression equations are used (Department of the Environment, 1995). The first uses numbers of children "at risk" in a local authority as the dependent variable and a selection of needs indicators as the explanatory variables. This model yields a prediction of the expected numbers of children at risk in each local authority. A second regression analysis then seeks to explain variations in unit costs (costs per child) as a function of a different set of needs variables.

A statistical model of *expected* children in need is considered to be necessary because there is no universally accepted, objective measure of the *actual* number of children in need within a local authority. The "Children in Need" index currently in use was therefore developed as follows. First, a set of three risk factors influencing the level of children in need was chosen on the basis of academic research into the characteristics of such children compared to all children in the population, using data from the 1987 General Household Survey. The risk factors were:

- the proportion of children living in a lone parent household;
- the proportion of children living in rented accommodation;
- the proportion of children in households receiving Income Support.

To these three, a fourth has been added on the basis of judgement, comprising:

- the number of households with children accepted as a housing priority need, as a proportion of residents aged under 18 years.

Note that the values adopted by these variables are independent of the size of the local authority, as each is expressed as a proportion. Each of these indicators is standardized by subtracting the mean and dividing by the standard deviation. The resulting standardized variables then have a mean of zero and a standard deviation of 1. To each standardized variable is then attached a weight, which "broadly" reflects the relative importance of the variable, as indicated by the research. The chosen weights are 3:1:1:1. The four weighted variables are then summed to yield the “Children in Need” index.

At this stage the value of the children in need index is in abstract units which do not have a simple interpretation. To give the index a concrete meaning, a regression is undertaken in which the dependent variable is the proportion of children “at risk” - defined as in care, subject to a supervision order or on the child protection register. The explanatory variable is the children in need index. The observations are 94 of the principal 107 English local authorities responsible for social services, and each observation is weighted by the total number of residents aged under 18. Thirteen local authorities (7 London boroughs, 4 metropolitan districts and 2 non-metropolitan counties) were omitted from the regression

because reliable data for the dependent variable were not available. The regression equation is:

$$PROP\_IN\_CARE = 0.01016 + 0.0006057 * INDEX$$

where PROP_IN_CARE is the proportion in care as defined above, and INDEX is the children in need index.

The regression indicates the expected *proportion* of children in care, subject to a supervision order or on the child protection register in a local authority if the authority were to apply national average response to need at the local authority level (as measured by the children in need index). It explains 68% of the variance in the dependent variable. The estimated *number* of children in the three need categories is derived by multiplying the prediction from the regression equation by the total number of residents aged under 18.

The second stage of the construction of the SSA entails the estimation of a further regression equation which seeks to explain variations in the cost per child (unit costs). The dependent variable is local authority estimates of the net expenditure in 1990/91 on children's personal social services per child at risk (defined as above), adjusted for variations in area costs. The two explanatory variables, chosen on the basis of previous research findings and statistical experimentation, are the proportion of children in shared (non-self-contained) accommodation and the proportion of children in non-white ethnic groups. The regression equation, based on the same 94 authorities as the children in need regression, is as follows:

$$UNIT\_COST = 9.5110 + 11.8062 * ETHNIC + 19.8136 * SHARED$$

It explains 46% of the variance in unit costs.

The final stage in the calculation of the SSA is the application of an area cost adjustment, intended to account for variations in the *general* costs of inputs required to provide a common level of service independently of PSS unit costs. It mainly reflects estimated differences in labour costs, but also makes some allowance for differences in business rates. The labour element of the adjustment is based principally on data from the New Earnings Survey. The area cost adjustment applies only to authorities in the south east of the country.

In 1995/96 it implied that, compared with authorities outside the south east of England, costs were 24.70% higher in inner London and 12.56% higher in outer London.

2.4 Assessment of current methods

We take it as given that the SSA should in some sense reflect the spending needs of local communities independent of local policy factors, such as the current level of provision. Furthermore, we acknowledge that in practice it is probably infeasible to base SSAs on anything other than local authorities' actual spending patterns. However the current methods are theoretically and practically inadequate for a number of reasons, of which the most important are:

- local authority spending is a function of many factors as well as needs, such as local preferences and income, competition from other services, central government spending limits, central government grant, the local tax base, and local policies;

- the "children in need" regression is based on only a part of the entire services for children provided by social service departments;

- the split between client numbers and unit costs is artificial as the two are not independent: for example, areas that choose to admit relatively low dependency children into residential accommodation may exhibit high client numbers and low unit costs;

- the use of local authorities as the unit of analysis may lead to the "ecological fallacy", in that a relationship identified at the local authority level may reflect differences in local authority policy rather than differences in responses to needs on the ground.

These issues are examined in more detail below.

Multiplicity of determinants of expenditure

Duncan and Smith (1995) show how it is exceedingly difficult to disentangle needs effects from other determinants of variations in local authority spending. For example, one must accommodate the complications that local authority expenditure is capped by the central government, that levels of central government grant may affect spending, and that previous levels of spending may in turn have influenced current government grants and spending limits. Moreover, one should in principal recognize that variations in pressures from other local authority services, and the local quality of other statutory and voluntary providers, may also influence variations in spending. The Department of the Environment's have claimed that the regressions for individual services remain valid even when spending on total expenditure is capped (Department of the Environment, 1994). So far as we are aware, this claim is untested, and we find it difficult to believe that it is true, given the apparently profound impact of overall expenditure limits on individual service budgets (Audit Commission, 1993).

Incompleteness

In principle, any statistical analysis should include all local authority spending that is relevant to children's personal social services. Currently only children in care, subject to a supervision order or on the child protection register are included. These comprise only about 18% of all children known to social service departments. This weakness is particularly important given the broader orientation of the 1989 Children Act.

Splitting client numbers and costs

Notwithstanding the recent change in definition, if it is to have any meaning at all, the SSA should reflect the resource consequences of delivering some standard level of service to clients. Local authorities may choose to deliver particular services in a variety of ways. For example, there may be a substitution effect between residential and non-residential services. Therefore, using any particular measure of client numbers is fraught with danger. Furthermore, the current adjustment for unit costs appears to be based on fragile research evidence. Thus the preferred option must be to use the *costs* of children's personal social services as the dependent variable. In this way, variations in care policies and accounting methodologies can be subsumed into a measure of utilization which is consistent within a local authority.

The ecological fallacy

The ecological fallacy can be illustrated with reference to a diagram (Figure 1). In this example there are three local authorities. The numbers in the diagram refer to small areas (wards) within each authority. Needs are measured using Census or similar data. The expenditure responses of each authority to variations in needs are roughly similar, as shown by the slopes of the regression lines for each authority. However, authority LA1 devotes a higher level of resources to the services than LA2, which in turn devotes more than LA3. The *average* needs and costs of each authority are indicated by the black circles. If these are used in a regression, the thick regression line SS may result. This line bears no relation to actual responses to needs within local authorities, and is mainly determined by variations in expenditure policy between local authorities.

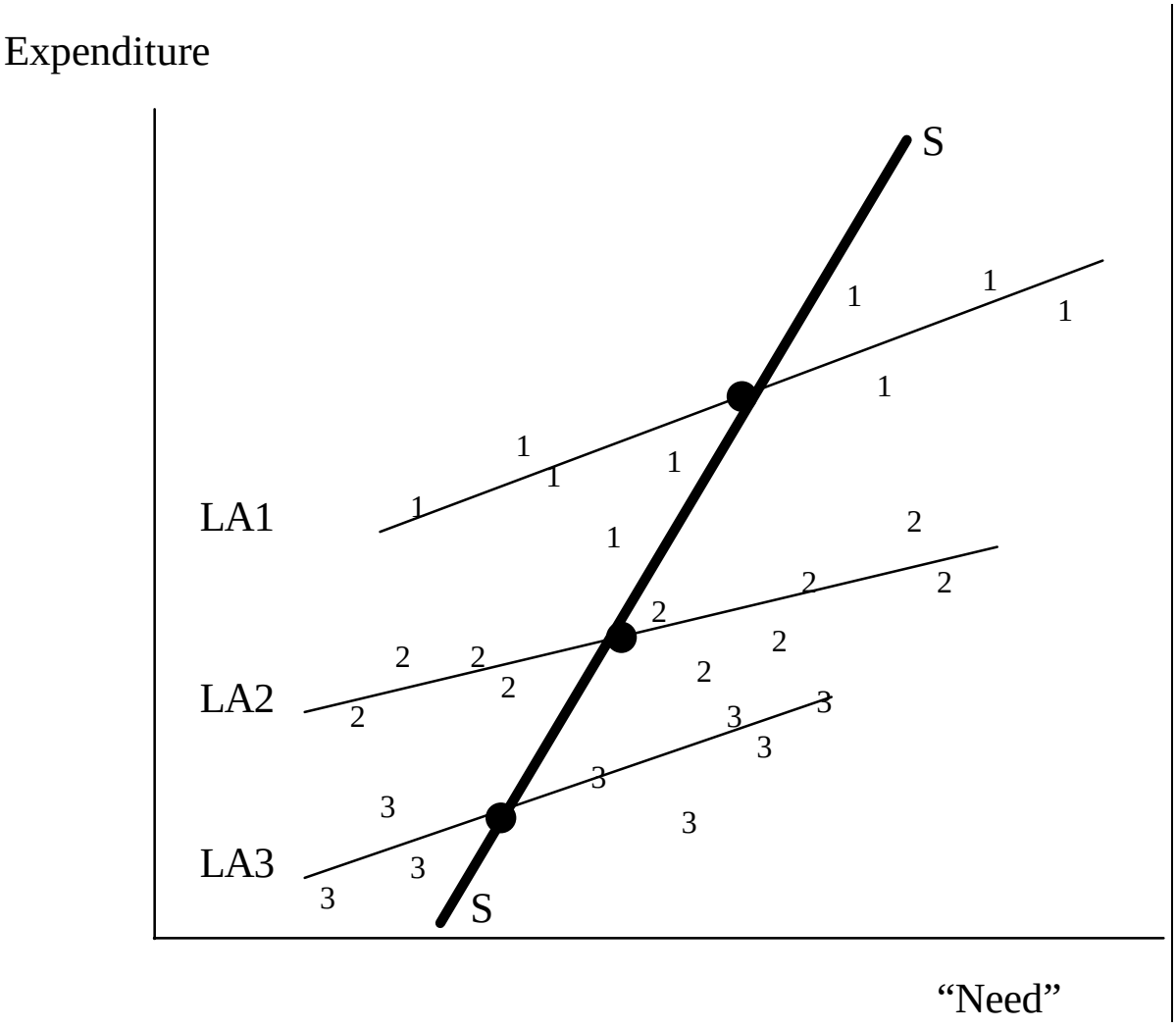


Figure 1: The "ecological fallacy" explained

If phenomena of this sort exist, the use of aggregate local authority expenditure data in a regression analysis may be principally capturing historical spending variations between local authorities rather than genuine responses to needs. If we are searching for some "standard" response to needs, we should be seeking to identify the individual slopes of the sort LA1, LA2 LA3. The government then has to select a particular slope as the "standard". Implicit in its methods is the assumption that the national average of individual authority slopes should be favoured. As noted above, this is most emphatically *not* achieved by using aggregate data. Instead, it is necessary to identify the average of the slopes found *within* local authorities.

In many respects, the commissioning of this review indicates that some of these criticisms are acknowledged to have *prima facie* validity. In particular, we note that because of universal expenditure limitation in place since 1992, the central government has felt unable to use expenditure data from years after 1991/92. There will soon come a point when use of such a distant point of reference is likely to be unacceptable.

2.5 This study

This study is designed to provide empirical evidence which seeks to address each of the four problems outlined above. The study is pioneering, in the sense that it uses multilevel statistical methods which are new to British local government finance. These methods have been successfully applied in the National Health Service (Carr-Hill *et al*, 1994). However they require data at a small area level which have not hitherto been available on a widespread basis in local government. The study is therefore in a sense experimental.

The underlying model used in the study is as follows. Social factors pertaining to the individual household and to the broader community give rise to children in need of social services. In seeking to meet those needs, local authorities incur costs. For a child with given needs characteristics, reported unit costs may vary between authorities because of policy variations, data recording differences, and area cost variations (brought about by differences in costs of labour, accommodation and other relevant factors). In principle, this gives rise to the following theoretical model:

$$EXP_{ijk} = f(n_i, s_j, a_k)$$

Expected expenditure EXP_{ijk} on child i living in small area j within local authority k depends on the circumstances of the child's household n_i, the broader characteristics of the local area s_j and local authority factors a_k.

The intention is to build a statistical model consistent with the theoretical model, and the implication is that we should in principle be basing the analysis on individual level data. Unfortunately there are very few relevant data available in the UK which pertain directly to individuals in receipt of services (a more extended discussion of this issue can be found in chapter 5). Instead, most socio-economic data relate to areas. In particular, the lowest level of presentation of Census data is the enumeration district. Furthermore, population estimates are prepared only at the level of local authority wards, which have average populations of about 7,000.

We are therefore unable to model the individual needs in the model, and instead must use *average* individual characteristics within a small area as a proxy for individual household data. The basic unit of analysis for this study is therefore the small area. For most local authority areas, these small areas are wards. However, in more rural areas wards can be very small. We therefore aggregated a relatively small number of wards with contiguous areas so that no small area had a population of less than 5,000. The model to be applied must therefore be amended as follows:

$$EXP_{jk} = f(n_j, s_j, a_k)$$

The dependent variable is now expenditure *per capita* (of children aged 0-18) in small area j within local authority k. This is assumed to depend both on *average* household characteristics of children n_j as well as the broader characteristics of the local area s_j.

In practice, we do not know which small area variables n_j and s_j should be used in the model, although - on the basis of research evidence and practical knowledge - it is possible to propose a range of potential candidates. The principal purpose of the analytic part of the study was therefore first to identify relevant variables for inclusion in the model, and then to quantify their relationship with per capita expenditure. The local authority effect a_k was not of direct interest in this study (although - as we explain in chapter 4 - for SSA purposes the model we derive must be used in conjunction with an index of local authority cost

variations). It was nevertheless important that the chosen methodology modelled the local authority effect, as it may have contaminated the analysis of the small area effects. This was achieved using multilevel modelling techniques, as described in section 4.2.

3. ESTIMATING SMALL AREA COSTS OF CHILDREN'S PERSONAL SOCIAL SERVICES

An essential requirement for the study was to estimate the costs of PSS for children arising in small areas. A fundamental problem which has hitherto precluded studies of this sort in the local government sector is that local authorities do not as a matter of routine maintain databases which link service expenditure to small areas (or indeed individuals). In order to derive small area costs it was necessary to undertake special surveys of local authorities to identify key information relating to small area costs. This chapter describes those surveys under the following headings:

- local authority databases of children in contact with PSS;
- a special survey of type and frequency of contacts with children;
- a special survey of duration of contacts;
- local authority budget data.

3.1. Database of all children in contact with Social Service Departments

The fundamental unit of PSS expenditure is the child. The child's home address should therefore act as the indicator of the small area to which the associated expenditure should be attached. For children in residential or foster care, the originating address (rather than the address of the carer or caring institution) is required. In principle, it should be possible to attach a child (and the associated costs) to a small area using the postcode recorded in the local authority's computerized records. In practice, as we shall explain, this was not always straightforward. A postal survey of all English Social Service Departments was undertaken to ascertain the method of data storage and the suitability and willingness of the authority to be involved in the analysis stage of the study. After reminders and follow-up, responses were obtained from 86 out of 108 local authorities (80%). Four generic computer databases were identified, accounting for 55% of local authorities.

Local authorities do not routinely record expenditure associated with a child. Even contact data are rarely available in readily accessible form, the predominant method of recording being paper files. Thus, even if client numbers can be attached to a small area, it is in general

not possible to estimate directly the associated costs. However, variations in costs between different types of child are expected to vary substantially, according to the child's needs. The study team therefore had to resort to indirect methods to estimate costs. The approach taken was to seek to identify various categories of care amongst the children known to social service departments, and to derive local costs of children in each category.

Numerous alternative categorizations of children in need currently used in local authorities were identified in the postal questionnaire, some of which refer to modes of care, others to reasons for requiring the support of social services. Appendix A gives a full description of the categories used by the surveyed social service departments. The following list summarizes the main headings identified:

- Children looked after
- Children at risk of being looked after
- Children in receipt of after care services
- Children subject to other Court/Supervision Orders
- Children on the Child Protection Register (CPR) & not looked after
- Children in need of protection (& not looked after)
- Children with disabilities (& not looked after)
- Children receiving family support services (& not looked after)
- Juvenile offenders (& not looked after)
- Young people with mental health problems (& not looked after)
- Young carers
- Adoption services
- Private fostering
- Homeless young people
- Children assessed as being 'in need'
- Children using day care / family centres
- Others

These categories are not exhaustive and are not in use in all authorities (Rowlands *et al*, 1996). We were therefore forced to distill the categories into a list that was common to all

authorities. This resulted in a choice of just six categories of care for the purposes of this study, as follows:

- being looked after: in residential care;
- being looked after: in foster care;
- being looked after: other (usually returned to family);
- not looked after: child protection register;
- not looked after: physically handicapped;
- not looked after: other.

A child was placed in one and only one category of care, depending on his or her status on a given survey date on which the local authority client list was produced (in most cases a date in early 1996). The intention was to attach a local authority-specific cost to each of the categories, as described below. Clearly we should have preferred to have used more categories. Indeed the ideal would have been to use costs specific to each child, thereby obviating the need for any categorization. However, a lack of uniformity in data recording practices precluded any finer gradation.

The main data extraction exercise involved obtaining a list of all clients (aged under 21) on the project survey date, containing the following details on each client:

-to which of the six categories the child belonged;

- age and sex;

- 1991 ward code of residence (for children being looked after, their address prior to the first placement).

Most of the local authorities had some difficulties providing this information, especially the ward codes. Those that were unable to supply ward codes were asked for postcodes. These were converted to ward codes using the national postcode register, a task made more complex by the need to retain individual confidentiality at each stage. The extent and accuracy of postcoding was uneven and the study team provided support with some coding. Initially 27 authorities supplied data, and of the 91,462 cases retained after checking for duplicates in the lists supplied by the local authorities, 12,593 (13.8%) could not be assigned a valid 1991 ward code. Three authorities were subsequently discarded due to lack of confidence in the

data provided, while a 28th authority was subsequently able to provide the necessary data. This left a total of 25 authorities and 74,493 valid cases in the sample.

There are two major concerns in respect of the cases not included in the survey:

(1) that they may cause the data to be geographically biased;

(2) that they cause over-representation of certain client groups.

The proportion of missing ward information varies considerable between local authorities, from 0% to just under 34% (the average was 13.8%). Providing the missing cases are randomly distributed across a local authority, this variability is not serious from the point of view of the study, as the analysis concentrates on *within* authority variations. The study team undertook extensive analysis to ascertain whether there was any systematic pattern to the missing data, as follows:

- interviews with local service managers to ascertain whether they believed there was the potential for bias amongst missing cases;
- a statistical check as to whether certain categories of child were over- or under-represented amongst the missing cases;
- a more general examination of differences in data recording mechanisms between authorities;
- a detailed check in one authority of the distribution of missing cases amongst wards.

The detailed results of these checks were documented (Dixon, 1997) and are available for scrutiny. None of the checks indicated that there was any reason to suggest that the missing cases were a serious source of bias in our results.

The 25 local authorities used in the study comprised 8 London boroughs, 11 metropolitan districts and 6 non-metropolitan counties, and are listed in Appendix B. Every effort was made to ensure that the sample was as representative as possible of all local authorities. Table 3.1 compares the characteristics of the sampled authorities with those of England as a whole. The most notable feature is the relatively low level of ethnic minority populations in the sample. More detailed analysis suggests that the principal under-representation is amongst children of Asian origin (Dixon, 1997). Strenuous efforts were made to include authorities with larger ethnic minority populations in the survey, but none was able to

participate. While not satisfactory, there is no reason why this under-representation should compromise the results, as we believe that there were adequate numbers of small areas with large ethnic populations in the analysis.

	Sample	England
Small areas	1,036	4,985
Children	2,465,617	12,214,988
Percentage of all dependent children in households with:		
Lone parents	14	13
Overcrowding	10	10
Owner occupied	69	69
No cars	25	21
White ethnic	93	90
Manual class	51	48

Table 3.1: Comparison of sample with all England

Table 3.2 summarizes the characteristics of the children aged 0-19 identified in the study. The five year age bands were chosen to coincide with the age bands used for national population estimates. Over two thirds (69.9%) of the cases fell into the sixth "residual" category; 11.2% were handicapped but not Being Looked After, 5.9% on the Child Protection Register but not Being Looked After, 7.9% fostered, 2.7% in residential and 2.4% other categories of Being Looked After. When combined with population figures, these data allow us to calculate the rates of contact per 1,000 children, as shown in the last column. The variations amongst age/sex groups are not great, but there does tend to be a lower rate of contact amongst younger children and amongst girls, especially for residential care.

	Looked After			Not looked after			Total	Rates per 1,000
	Resid-ential	Foster	Other	CPR	Handi-cap	Other		
Male 0-4	28	591	221	814	670	7102	9426	28.07
Female 0-4	28	533	211	764	427	5909	7872	24.70
Male 5-9	101	766	237	718	1555	7225	10602	33.51
Female 5-9	55	664	213	667	973	5901	8473	28.33
Male 10-14	525	977	196	547	1456	6697	10398	35.24
Female10-14	248	849	188	526	969	5144	7924	28.35
Male 15-19	599	728	289	160	1310	7718	10804	33.87
Female15-19	400	784	250	210	970	6380	8994	29.74
Male	1253	3062	943	2239	4991	28742	41230	32.56
Female	731	2830	862	2167	3339	23334	33263	27.73
TOTAL	1984	5892	1805	4406	8330	52076	74493	30.21
Percent	2.66	7.91	2.42	5.91	11.18	69.91	100.00	-

Table 3.2: Categories of children by age and sex

3.2 Social Work Contact Frequency data

The study methodology required that costs should be estimated for each of the six categories of child. A great part of the costs arising from cases is associated with social work time. Therefore the study team undertook a detailed retrospective analysis of the social work tasks undertaken in a year for a sample of about 2,000 cases, stratified by the six care categories, as defined above. The sampling frame was the list of all clients described above, and the sources were the paper case notes maintained by the local authority. A pilot study indicated that these would contain adequate details of the type and frequency of contacts, but not of their duration. A separate exercise was therefore undertaken to elicit duration data (see section 3.3).

Complete data were collected for a random sample of 1,971 children in 27 local authorities with the sampling fractions varying according to the category of case so as to give roughly equally numbers. Table 3.3 gives the intended distribution of the 75 target number of cases drawn from each local authority.

Looked after			Not looked after		
Resident	Foster	Other	C.P.R.	Disabled	Other
10	15	10	10	10	20

Table 3.3: Target sample size in each authority

For each case we recorded numbers of contacts over the course of the year 1 January 1995 to 31 December 1995 for each of 12 different types of activity. Table 3.4 gives the average number of contacts per year for each of the categories of case, and an average weighted by the distribution of children identified in Table 3.2. Note that the "other" category has a weight of 70% in constructing this weighted average.

	Resid-ential	**Foster**	**Other looked after**	**CPR**	**Dis-abled**	**Other**	**ALL CASES**
Telephone	58.0	41.6	35.3	43.4	18.6	26.9	29.1
Home visit	16.5	15.7	19.2	18.8	6.2	10.5	11.3
Letter	12.9	11.7	11.3	12.3	5.5	6.5	7.4
Network meeting	3.4	2.2	2.9	3.8	1.1	1.6	1.8
Office meeting	2.2	2.3	2.4	2.6	0.3	3.0	2.6
Internal support	6.6	6.4	3.5	7.2	2.0	4.2	4.4
Case conference	1.0	0.9	1.2	2.0	0.3	0.5	0.6
Assessment	0.7	0.9	1.0	0.7	0.6	0.3	0.4
Court hearing	1.3	0.5	0.6	0.7	0.0	0.8	0.7
Court report	0.4	0.3	0.2	0.3	0.0	0.2	0.2
Witness report	0.2	0.2	0.3	0.4	0.1	0.1	0.1
Monitoring	0.3	0.2	0.2	0.5	0.3	0.1	0.2

Table 3.4: Average Number of Different Types of Contact Per Year According to Case Category (based on 1,971 cases)

Phone calls were by far the most frequent type of activity, with an average of 29.1 recorded per year, followed by home visits and letters. On average, each case generated annually 1.8

network meetings and 2.5 office meetings, with 0.6 case conferences. There is no clear trend between the six categories of case, although there is a tendency for disability and "other" cases to involve fewer activities on the part of social workers than the other four categories.

3.3 Social work contact duration data.

The social work contact frequency data give no information about the relative *duration* of each type of contact, so there is no way of judging the total social work effort attached to each category of child from Table 3.4. Duration data were not generally available from case notes. As a result, it was decided to ask social workers directly to estimate the time they spent on the 12 tasks described above for a random sample of 1 in 4 of the 1,971 cases for which frequency data were abstracted. Social workers were contacted either face to face or by telephone, and were made aware of the data abstracted from the case notes. Where more than one social worker was involved in a contact, the total social work time of all involved was recorded. Travel time was included when appropriate.

Complete data on contact duration were collected in this way for 508 children in 24 local authorities. Table 3.5 gives the average duration of contacts for all children in this sample, disaggregated by category (note that some of these detailed averages are based on small numbers of cases).

	Cases (with at least one contact)	Resid-ential	Foster	Other looked after	CPR	Disabled	Other	ALL CASES
Phone call	460	14.4	13.2	12.5	15.8	10.8	14.4	13.9
Home visit	465	143.4	118.5	91.4	106.9	91.6	100.6	102.3
Letter	393	13.7	18.6	16.9	16.0	26.0	15.9	17.2
Network meeting	289	122.7	106.6	106.4	85.8	85.7	86.3	89.3
Office meeting	220	56.0	54.5	43.0	51.5	53.3	60.5	58.1
Internal support	253	68.2	42.0	39.7	36.6	36.1	35.2	36.9
Case conference	216	159.2	105.5	134.7	113.3	150.0	116.6	120.8
Assessment	215	286.9	378.4	367.2	183.1	375.1	255.2	277.6
Court hearing	131	752.4	375.4	395.0	409.5		316.0	304.4
Court report	88	550.9	1526.0	1046.7	636.7		595.2	614.4
Witness report	25	210.0	1776.0	1590.0	275.5	180.0	570.0	619.4
Monitoring	20	480.0	510.0	75.0	198.9		840.0	653.9

Table 3.5: Average Duration in Minutes of Different Types of Contact According to Case Category

As expected, the rarer types of contact tend to be the most demanding in terms of social work time, most especially those associated with court proceedings. For example, each court hearing involves an average of over 5 hours of social work time. Phone calls, on the other hand, although frequent, entail on average only 14 minutes' time.

By multiplying the frequency data by the duration data it is possible to obtain estimates of the average amount of time spent annually by social workers in work directly related to an individual client, as shown in Table 3.6. For each category of child in each local authority an expected annual contact time was calculated by multiplying the frequency data by the duration data for each type of contact. For those who prefer algebra, the average annual social work contact time was calculated as $s_{ck} = \sum_{t=1}^{12} f_{tck} d_{tc}$ where s_{ck} is the average time spent on child category c in local authority k; f_{tck} is the average number of contacts type t for child category c in local authority k and d_{tc} is the average duration of contacts type t for category c in the total sample. Note that because of small numbers we used total sample (rather than local authority specific) duration data.

Table 3.6 summarizes the annual time spent on the twelve activities on all cases, weighted by the relative frequencies of the cases. Note that home visits occupy 39.5% of social work time directly associated with clients, and that court hearings account for 8.2% of such time.

TASK	Time (mins)	Time (%)
Telephone	410.1	13.8
Home visit	1173.3	39.5
Letter	126.4	4.3
Network meeting	163.5	5.5
Office meeting	152.3	5.1
Internal support	163.6	5.5
Case conference	77.0	2.6
Assessment	127.7	4.3
Court hearing	243.1	8.2
Court report	154.8	5.2
Witness report	80.3	2.7
Monitoring	101.4	3.4
TOTAL	**2973.4**	**100.0**

Table 3.6: Annual social work contact time (minutes)

On average, the survey suggests that the average annual social work time attributable per child is 2,973 minutes, or about 50 hours. Table 3.7 shows that this varied from 1,364 minutes for disabled children to 6,121 minutes for children in residential care.

Looked after			Not looked after			TOTAL
Resident	Foster	Other	C.P.R.	Disabled	Other	
6121	4770	4263	4598	1364	2726	2973

Table 3.7: Average annual social work time for each case category (minutes)

3.4 Local Authority Budget data

Central to the study was a desire to use local data as the basis for unit costs. To that end the study team sought detailed information from local authority finance officers. This comprised a telephone interview with an appropriate officer - usually the senior finance officer with overall responsibility for the children's services budget - and an analysis of the local budget for children's social services.

The fundamental objective of the finance interview was to elicit information which could be used in each authority to develop locally sensitive costings of various categories of children in need. It was important that a separate costing exercise was undertaken in each local authority for three reasons:

- variations in local care policies
- variations in local costs
- variations in local accounting procedures.

Variations in policy were important because different areas may have different practices in categorizing children in need, and may provide different packages of care for children in a particular category. For example, Authority A may have a policy of minimizing the number of children in residential care, while Authority B uses residential care more frequently. This may result in Authority B having a higher ratio of lower dependency children, and therefore lower unit costs in residential care. It is then important to use local costs. Similarly, there may be considerable variations in local costs of items such as labour, supplies and capital. And accounting procedures are subject to substantial local variation.

The questions which were asked in the finance interviews were developed in consultation with two local authority members of the Steering Group and after a pilot exercise in an authority which did not form part of the eventual study sample. Before the interview the nominated officer was sent a letter outlining the methodology of the study. In addition they were asked to forward details relating to the budget and unit costs for children's services, along with information relating to the number and costs associated with the following groups:

- Homeless children
- Juvenile offenders
- Unaccompanied asylum seekers

The interview was divided into two broad sections. The first assessed the feasibility of using locally derived children's services budgets to apportion costs to the various needs groups. The second explored a variety of background factors which were useful in interpreting the cost data. The questions which were asked in the second section are outlined below:

1. On what basis is the children's services budget allocated between patches?
2. Are unit costs available for specific services?
3. To what extent do children's social services in the authority provide services that are usually provided by different departments (e.g. education, housing) in other local authorities?
4. Alternatively, what children's services are not provided by the SSD, which in other areas are generally provided by the SSD?
5. To what extent is the authority a net importer of children requiring specific services (e.g. homeless, young offenders or refugees)?
6. Do you bill or invoice other local authorities for the cost of these services?
7. What is the cost of services used by children who are not on any official register (e.g. youth clubs)?
8. Can the cost of these services be apportioned to specific patches?
9. Are there any local factors (e.g. high land rent) that increase or decrease children's services costs significantly?

No general conclusions could be drawn from the responses to these questions. However they were important in determining the methodology that was used for apportioning the local budget for children's social services.

All the authorities in the survey had available a budget for children's PSS in 1995/96, which was disaggregated under both objective and subjective headings. The requirement for this study was to apportion the budget between the six care categories. The following procedure was adopted.

1. Any expenditure not associated with the six care categories was deleted from the budget. In practice, this adjustment was usually minimal.
2. Any expenditure directly attributable to a particular care category was assigned to that category.
3. The remainder of the budget was to be apportioned between the 6 care categories on the basis of the local finance officer's advice. In practice authorities chose to apportion only a small part of the residual budget using client numbers, and instead used predominantly the estimates of social work time, as calculated above.

Table 3.8 summarizes the outcome of this exercise.

CATEGORY OF EXPENDITURE		Before Apportionment (£Million)	After Apportionment (£Million)
Looked after	Residential	114.184	121.201
	Foster	65.343	84.038
	Other	1.384	6.218
Not looked after	CPR	11.781	26.230
	Disabled	18.271	27.018
	Other	29.583	109.144
To be apportioned on the basis of:	Client numbers	13.786	
	Social work time	119.516	
TOTAL EXPENDITURE		373.849	373.849

Table 3.8: Breakdown of budgets for children's social services by finance officers across 25 authorities

The implications of this analysis was a set of unit costs for each category of child in each local authority. Table 3.9 shows the average unit costs per child across all authorities in £ per year, obtained by dividing the apportioned totals in Table 3.8 by the client numbers in Table 3.2. It indicates that on average a child in contact with social services costs £5,019. Of course, there are substantial variations between categories of child. It may be tempting to compare the results in Table 3.9 with the unit costs of £47,922 for residential care and £8,268 for foster care reported by CIPFA (1995). However, that routine source is strictly not comparable because of differences in definition and methodology, most notably arising from the cases with missing addresses omitted from our survey. The important issue from the perspective of this study is the *relativity* between costs of care groups, and in this respect we appear to apportion more expenditure than CIPFA to foster care relative to residential care.

Looked after			Not looked after			TOTAL
Resident	Foster	Other	C.P.R.	Disabled	Other	
61089	14263	3445	5953	3243	2096	5019

Table 3.9: Average annual costs per child for each category of care

We constructed a separate set of unit costs for each of the 25 authorities included in this study. The relevant unit costs were then attached to all children included in the analysis to obtain estimates of total costs of children's PSS in each area.

4. ANALYSIS OF COSTS OF CHILDREN'S PERSONAL SOCIAL SERVICES

This chapter describes the results of the statistical analysis of the data described in chapter 3. First the construction of the dataset is described. The statistical analysis is then described, and section 4.3 describes the results.

4.1 Constructing the database

The procedures described in Chapter 3 enabled us to estimate the costs of Children's PSS in each small area, which comprised an electoral ward or aggregation of a small number of wards. National population data are prepared using 5 year age bands, so the dependent variable chosen for use in the study was the costs of Children's PSS per head of total population aged 0-19. The purpose of the statistical analysis is to seek to explain variations in this variable. Before any analytic work was undertaken, the dependent variable was deflated by the appropriate 1995/96 Area Cost Adjustment, which seeks to explain unavoidable variations in general cost levels in the south east of the country. This scaling exercise is unlikely to have a major impact on the results, as the multilevel analysis seeks to adjust for such local authority-wide effects. However, deflating by the Area cost Adjustment enables residuals from any statistical analysis to be considered on a roughly comparable basis. The distribution of the resulting dependent variable amongst the 1,036 small areas used in the study is shown in Figure 4.1. Mean estimated cost of PSS per head was £140.8 with a standard deviation of £122.1, suggesting wide variations amongst the small areas. The average number of clients in each small area was 72, or 3.0% of all children aged 0-19.

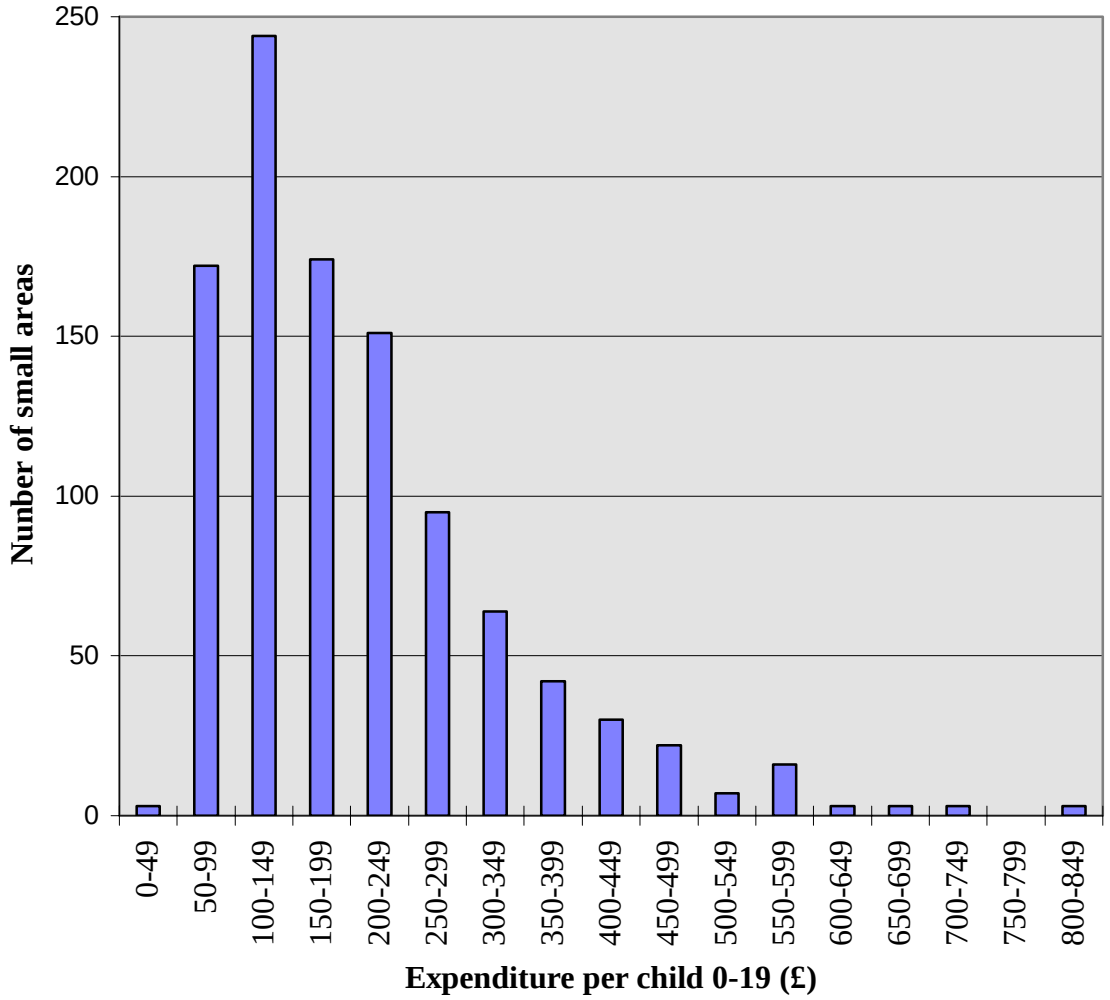


Figure 4.1: Distribution of Costs of PSS per child aged 0-19

The study sought to explain variations in the costs of children's PSS in terms of socio-economic conditions. Therefore a large database was created of socio-economic data for the small areas used in the study. Many of the data were derived from the 1991 Census of Population, but important other sources were available, relating to issues such as mortality, low birth weight, Income Support and population sparsity. This database was created under the guidance of the study Steering Group, which offered a large number of suggestions for alternative variables, resulting in a total of 122 potential explanatory variables. Appendix C gives full details. In summary, the principal issues covered by the Census variables were:

- lone parent families;
- home ownership status;
- non-earning households;

- overcrowding;
- housing facilities;
- car ownership;
- ethnicity;
- social class;
- unemployment.

In addition, an important new data source indicating children in families in receipt of Income Support was made available to us at the small area level. Numerous variants and combinations of variables were created, as detailed in Appendix C.

Table 4.1 gives the descriptive statistics for some of the key "child" census variables and some of the more general socio-economic variables for the 1,036 small areas in this study. Note that some of the variables used in the study - particularly those indicating multiple dimensions of poverty - have means near zero. Such variables can cause difficulties in the statistical analysis as they may be unstable, and susceptible to peculiarities in local circumstances.

Variable	Description	Mean	StdDev	Raw Correl-ation	Partial correl-ation	Min	Max
COSTS	Per person aged 0-19	140.8	122.1	-	-	3.7	1148
C1	Long term illness	0.02	0.01	0.439	0.497	0.00	0.06
ALBW	Low birth weight	0.07	0.02	0.299	0.332	0.01	0.16
IS1	Income support	0.26	0.16	0.554	0.577	0.03	0.85
ALG1	Living in flats	0.09	0.16	0.544	0.376	0.00	0.97
C4A	Lone parent households	0.14	0.08	0.623	0.586	0.02	0.46
C5	Over 1.5 persons per room	0.02	0.02	0.398	0.228	0.00	0.18
C6	Over 1 persons per room	0.10	0.07	0.490	0.409	0.01	0.56
C7	Lacking facilities	0.00	0.01	0.166	0.082	0.00	0.06
C8	No central heating	0.16	0.13	0.191	0.309	0.00	0.85
C9	Lacking facilities & CH	0.16	0.13	0.196	0.310	0.00	0.85
C10	Not self-contained accom.	0.00	0.01	0.190	-0.013	0.00	0.14
C11	Owner occupied accomm.	0.70	0.20	-0.569	-0.528	0.06	0.99
C12	Privately rented accomm.	0.04	0.04	0.167	-0.081	0.00	0.39
V10	Concealed families	0.01	0.01	0.204	0.148	0.00	0.09
SPARS	Sparsity of population	0.09	0.18	-0.292	-0.242	0.00	1.00
DENS	Density of population	27.9	28.2	0.495	0.255	0.15	202.7
C15	White ethnic head of h/h	0.93	0.13	-0.366	-0.202	0.11	1.00
C16	Black ethnic head of h/h	0.02	0.06	0.398	0.274	0.00	0.43
C17	S. Asian ethnic head of h/h	0.03	0.08	0.160	0.112	0.00	0.87
C18	Head of h/h born New Comm.	0.06	0.10	0.287	0.144	0.00	0.84
AA121	Unemployment rate	0.10	0.06	0.491	0.510	0.02	0.41
C21	Manual social class	0.50	0.17	0.148	0.394	0.01	0.90
C30C	No car household	0.24	0.17	0.581	0.583	0.01	0.82

Table 4.1: Descriptive statistics and correlations with costs variable

The starting point for the analysis is shown in the column of Table 4.1 which shows the raw correlation of each of these variables with the utilization measure (costs per head). These figures demonstrate that there are very strong correlations with many of the "usual suspects", including lone parent families; housing tenure; crowded accommodation; and unemployment. However, although they give useful indications, the correlation coefficients cannot give a clear picture of the dominant factors associated with utilization, first because local authority costs and policies may affect the correlations; and secondly, because the explanatory variables themselves are strongly intercorrelated. The first issue can be addressed by preparing partial correlation coefficients which control for any local authority effects (using 24 local authority dummy variables as the controlling variables). In general, Table 4.1 shows that a similar picture emerges on inspection of the partial correlation coefficients, although values for some variables change dramatically. For example, variable C21 (head of household in manual social class) has a small raw correlation (0.148) with costs. However, after local authority effects have been removed, the partial correlation coefficient of 0.394 suggests a much stronger relationship.

4.2 Developing a statistical model

The issue of intercorrelation between potential explanatory variables can only be satisfactorily addressed by undertaking a multivariate statistical analysis which seeks to control for such complications. We therefore sought to develop an empirical model consistent with the theoretical model set out in Section 2.5 which sought to capture the influence of a) the circumstances of individual children, b) broader local social circumstances, and c) authority-wide effects on the relative costs of children's PSS.

The chosen methodology was based on multilevel statistical methods which were originally developed for the educational sector as a means of disentangling the effects of pupil, teacher and school on individual educational outcome (Goldstein, 1995). Similar methods were used to develop the indices used for distributing hospital and community health services within the English National Health Service (NHS Executive, 1994). Multilevel models are similar to conventional regression models, except that variability

at the upper levels in the hierarchy (in this case local authorities) is explicitly modelled.

Multilevel techniques are essential for modelling the data collected in this study because they exhibit a very clear hierarchy - small areas are nested within social service authorities. Each authority may have unique spending and care policies, data recording mechanisms and costing procedures and authorities may face different costs. These factors are in general likely to apply to an entire local authority area, and if so will affect all observations within an area. The purpose of the multilevel technique is to abstract from these "authority level" effects, leaving us with an average response to needs within authorities.

The model used in this study can be summarized as follows. Costs of children's PSS in small area j within local authority k depend on a vector of small area social circumstances $\mathbf{x_{jk}}$.

$$EXP_{jk} = \alpha + \beta x_{jk} + \varepsilon_{jk} + \nu_k$$

The model contains two error terms, e_{jk} and n_k. The former represents the small area residual, the latter the local authority residual, which applies to all small areas within authority k. The vector $\mathbf{x_{jk}}$ comprises the PSS needs indicators, which have yet to be identified. The coefficients α and β are to be estimated.

The problem is then to select a suitable multivariate model from the innumerable potential candidates. This entails selecting appropriate components of $\mathbf{x_{jk}}$. In this respect, it is not sufficient to be guided by univariate correlations. Instead we must apply a *modelling strategy*. The development of the models must be based partly on the basis of known relationships between social circumstances and PSS use and partly on statistical criteria. We required a strategy for selecting among variables for three reasons:

- given the high intercorrelations between variables, it would be possible to develop a wide range of models containing different variables but with roughly similar statistical properties;
- a formula with too many variables would be unwieldy;
- it is important that the variables are widely accepted as being reasonable indicators of PSS needs.

The general approach adopted in the light of these criteria and the earlier discussion is as follows:

- preference was given to indicators based on the circumstances of children rather than those of the more general population;
- indicators based on large proportions of the population were preferred to those based on relatively rare events, although the latter may have been necessary to refine the model;
- we gave priority to those variables which are most germane to the phenomena and processes which might be generating the different rates of take-up of children's social services, and sought to avoid variables which are rather distant proxies.

We therefore chose to develop a hierarchy of variables reflecting the *a priori* desirability of inclusion in the model. The chosen prioritization was based on expert judgement from team members, the literature review and on feedback from members of the Steering Group. We have to emphasize that some of the advice given conflicted, so that we eventually had to make our own judgement on several variables. The chosen categorization of variables can be summarized as follows.

Primary Child Social Deprivation Variables (Class A)

Certain variables were chosen as reflecting primary poverty impact because they either refer to low earning power, to poor housing, or to child specific deprivation. Variables that refer to only a small proportion of children were omitted from category A because they were likely to be unreliable at a small area level.

Secondary Child Social Deprivation Variables (Class B)

Class B variables are possible proxies for poverty amongst children either because they reflect (lack of) wealth, dependency, poor housing in general rather than specifically, or are loosely related to earning power. However, we should note again that several of the variables in this category - in particular the multiple indicators of deprivation - are determined at the small area level by very small numbers of affected children.

Other Social Deprivation Variables (Class C)

There are a number of variables which reflect various aspects of children's circumstances, but which on their own are unlikely to be very strongly related to PSS usage. These relate to car ownership, ethnicity, migration and large families. Also included in this category were some of the more general poverty indicators which are not specific to children.

Multivariate Analysis

Preliminary examination showed that there were six observations (out of 1,036) which exhibited marked deviation from any reasonable model of utilization. These six observations were therefore omitted in the initial search for a model specification, as they would have exercised undue influence on the national average intra-authority needs gradients which we were attempting to identify.

The specific selection routine used to identify a set of explanatory variables in the final model is documented in Appendix D; briefly, it was as follows:

- All possible variables were included in the multilevel regression model
- Variables with both counter-intuitive signs and standard errors greater than their respective coefficients were eliminated. In the initial stages, due to the large number of variables, two or three variables were deleted at each re-estimation of the model.
- Variables with counter-intuitive signs irrespective of their significance level were rejected.
- Where two variables from different classes competed, that from the higher class was chosen.

- Variables with intuitively correct signs were rejected on the basis of lack of statistical significance (selection criteria: $p>0.05$). At each re-estimation of the model any variables resulting in counter-intuitive signs were eliminated prior to searching for non-significant variables.

The full methods used in arriving at our favoured methods were documented in an "audit trail", available for inspection by interested parties. Throughout, each observation was weighted by the total number of children in the small area. Although we undertook some experiments with a non-linear functional form, we chose to concentrate on a linear regression model as such models are simple to implement and in the event performed well.

Careful checks were made to ensure that the statistical model was well specified. Full details are given in Appendix D. The specification of a regression model consists of a formulation of the regression equation and of statements or assumptions concerning the regressors and the disturbance term. A "specification error" in the broad sense occurs whenever the formulation of the regression equation or one of the underlying assumptions is incorrect. Specification errors can occur for various reasons:

- omission of a relevant explanatory variable
- inclusion of an irrelevant explanatory variable
- incorrect mathematical form of the regression equation
- incorrect specification of the way in which the disturbance term enters the regression equation.

Only well-specified models were considered acceptable, as measured by the widely recognized "reset" test for specification. The intention of the modelling procedure was therefore to derive a model of utilization which was (i) plausible (ii) parsimonious and (iii) statistically acceptable.

4.3 Results

The modelling process described above resulted in reduction to a "short list" of 15 variables. These were then deleted singly on the basis of lack of statistical significance (at the 5% level) or perverse sign, until a model containing the following variables was derived:

C4A Proportion of dependent children aged 0-18 in lone parent families

IS1	Dependants of income support claimants as proportion of all children
ALG1	Proportion of dependent children living in flats
C1	Proportion of children 0-17 with limiting long-standing illness
DENS	Persons per hectare

The model based on these variables reflects the commonly accepted risk factors associated with children's PSS as discussed above. Family breakdown, a key indicator of the likelihood of being in receipt of care, is represented by C4A. Poverty is strongly captured by the Income Support variable IS1, which is newly available at a small area level. In the past, the impact of housing on need has often been captured using a measure of overcrowding. However, this analysis suggests that a more specific measure of housing need – children living in flats (ALG1) – may be more relevant to PSS. The presence of C1 appears to capture the remaining widely accepted dimension of need for PSS – long-standing childhood illness.

The inclusion of density (DENS) in the model offers evidence that, other things being equal, urban areas give rise to more utilization than rural areas. Without further research, we cannot say whether this is a demand effect or a supply effect. It is a demand effect if urban areas give rise to systematically higher needs than rural areas, all other factors being equal. It is a supply effect if, for whatever reason, authorities direct more resources to urban areas than rural areas with the same underlying need. This research nevertheless indicates that – for whatever reason – more resources are currently directed to urban than to rural areas. Our remit was to model national average patterns of response to social conditions, and therefore we recommend retention of density in the model.

The model based on the above variables is presented in Table 4.2. It is statistically well specified, as tested by the RESET test ($t = 1.92$). The residuals (or unexplained deviations) from this model were examined in some detail. Visual inspection confirmed that they appear to exhibit the desired normal distribution, with no manifest outliers or skewness.

Variable	Coefficient	Standard error
Constant	-6.702	13.42
ALG1	124.9	28.76
C1	1123	449.2
IS1	177.4	37.05
C4A	362	78.96
DENS	0.3055	0.1294
Variance level 2	2462	752
Variance level 1	5054	225
Reset test	1.92	

Table 4.2: Preferred model

In statistical terms, the model based on these five variables is therefore statistically well specified and accounts for 45% of the variation in costs (a remarkable high figure with over 1,000 observations). As expected, the variation between local authorities is substantial. Even after controlling for the five explanatory variables, which themselves vary widely between authorities, over one third of the remaining unexplained variance is at the local authority level. (It should be noted that in multilevel analysis of school performance, where the technique was developed, the comparable school effect is of the order of 10%.)

Correlations of the level 1 residuals with potential explanatory variables not included in the model were examined to determine whether there was *prima facie* evidence to include further variables. The strongest coefficients were found to be with variables associated with housing tenure, migration and housing conditions. Some examples of the correlation coefficients with the residuals are shown below:

C12	Dependent children 0-18 in private rental	-.09430
V3	Dependent children in private rented accom	-.09500
C10	Dependent children 0-18 in not self-contained accom	-.08580
AA12	Persons in private rental	-.07860

V10	Dependent children in concealed families	-.07450
AA23	Households in non-self-contained accommodation	.07070
AA101	Residents moved from outside LA in last year	-.06120

The correlations are quite weak, and in most cases counter-intuitive. For example, the negative sign on C12 suggests that, other things being equal, the preferred model *overestimates* needs in areas with high numbers of children in private rented accommodation. The implications of including some of the above variables in potential variants of the core model were nevertheless tested, as described below.

4.4 Sensitivity analysis

The core model shown in Table 4.2 was subjected to extensive sensitivity analysis, as follows:

- including a selection of other potential explanatory variables;
- including the six outliers in the model, singly and in combination;
- including the intermediate “patch” level in the analysis;
- including the “patch” level in the analysis;
- excluding individual authorities;
- running the model on London boroughs only;
- running the model on metropolitan districts only;
- running the model on non-metropolitan counties only;
- including only on children being looked after (categories 1 to 3);
- excluding the "other" category of child (category 6);
- including only the "other" category of child (category 6);
- using crude numbers of children in contact as a proportion of all children as the dependent variable;
- using national average costing data in every authority for the six categories of care.

Full presentation of the results of the sensitivity analysis is infeasible. We therefore summarize some of the more salient results below. We must emphasize that any changes in

the coefficients obtained under alternative specifications must be viewed with some caution. For the purposes of SSAs, what is important are the *predictions* arising from the alternative models, and the consequent implications for revenue distribution. Because of the high level of colinearity between variables, large changes in coefficient estimates do not necessarily imply large changes in predictions.

Inclusion of additional variables

Table 4.3 reports the effect of including additional variables into the preferred model. As suggested by the correlations with residuals described above, there are a small number of variables which can be entered into the model according to our criterion of statistical significance, most notably concealed families (V10) and private rented housing (V3). In both cases the extra variable enters with a negative sign, which may lead to difficulties on the grounds of plausibility. However, there is no statistical reason for rejecting either of these models. Their omission from the model is likely slightly to favour areas with high levels in the omitted variable. We believe that statistical improvement brought about by the inclusion of such variables is small, and recommend rejection of models including the variables on the grounds of plausibility.

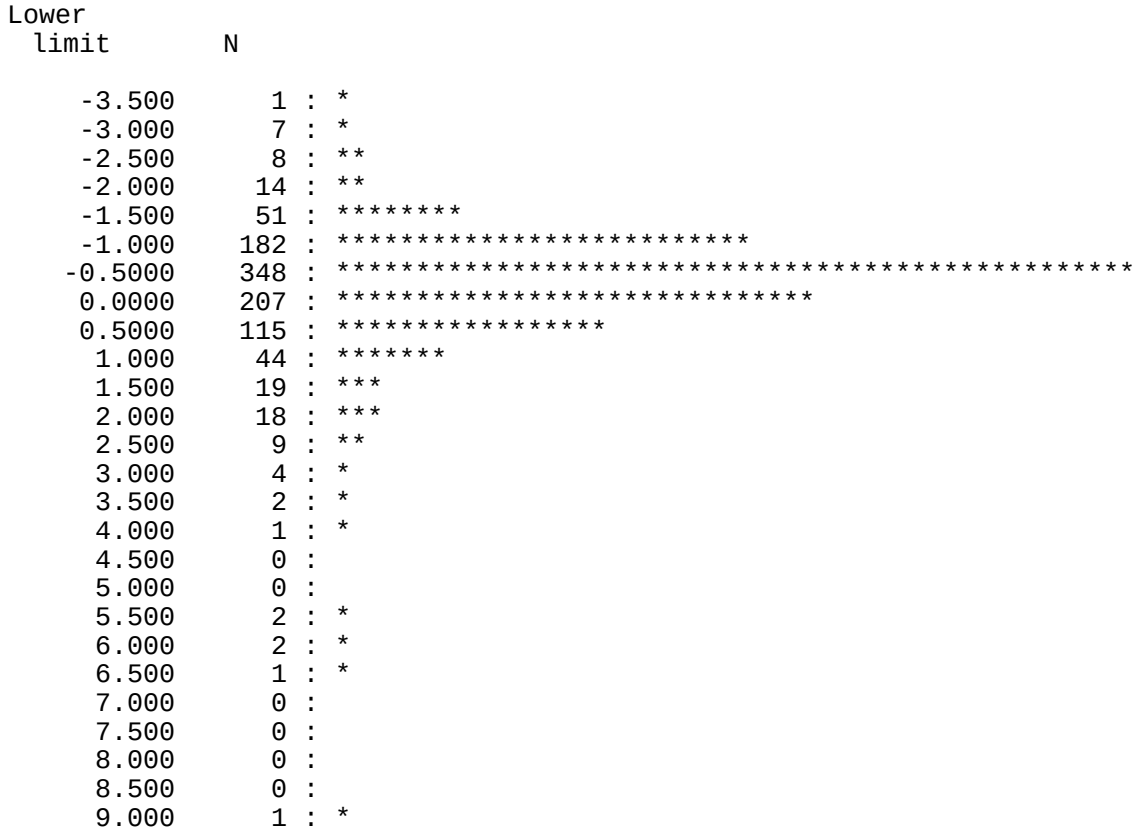
	V3		V10		AA102		CC6		C34		V4		C13		E1	
	Children in private rental		Children in "concealed" families		Persons migrated in last year		Children in households > 1 person / room		Households with 3+ dependent children		Children in social rented housing		Children in no car households		Children in non-white ethnic groups	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Cons	1.901	14.1	-1.762	13	6.993	16	-7.432	13	10.22	16	-4.13	13	-7.17	13.7	-7.278	13
ALG1	165.4	30	130.1	28	147	31	125.7	29	119.1	28	134.8	28	126.6	28	132.5	30
C1	977.7	431	1059	430	978	453	1010	437	1094	435	948.4	436	1012	437	1013	441
DENS	.347	.125	.3327	.124	.3601	.13	.3167	.13	.328	.125	.361	.128	.3182	.13	.3413	.13
IS1	197.4	35.7	218.5	37.3	193.4	37	180.5	46	200.5	40	165.8	38	182.4	46	195.2	39
C4A	316.5	76.7	330.6	76	378.6	80	369.1	83	335.1	78	286.9	91	362.7	91	346	82
New Variable	-258.9	66.2	-579.8	197.5	-209.3	95	7.458	60	-145.7	70	45.77	29	2.881	57	-21.24	29
Variance L 2	2908	873.9	2492	756	2774	838	2493	757	2503	760	2491	756	2489	756	2478	753
Variance L 1	4633	206.7	4680	209	4684	209	4720	211	499	210	4709	210	4721	211	4719	211
Reset test	0.819		1.958		1.480		1.947		1.728		2.103		1.956		1.628	

Table 4.3: Impact of including an additional variable in the preferred model (coefficients and standard errors)

Inclusion of six outliers

Although all five explanatory variables remain statistically significant, inclusion of the six outliers leads to a severely misspecified model (RESET test t=4.77). The six outliers continue to exhibit clear divergence from the established model, with residuals equal to at least 5.5 standard errors, as illustrated in Figure 4.2. This result suggests that the six outliers cannot be captured within the model estimated for the remaining 1,030 small areas. Standard spending assessment methodology requires that a single model is estimated for the entire country, which indicates the national average response to the chosen needs indicators. Under these circumstances we feel that there is no alternative to recommending use of the model excluding the six outliers as the basis of an SSA, as inclusion of the outliers renders the linear model statistically inadmissible. It should be noted that the outliers continue to exhibit such behaviour under a logarithmic model.

Figure 4.2: Histogram of level 1 residuals from re-estimated model with six outliers included



Inclusion of the "patch" level

All the models reported to date assume just two levels in the organization of children's PSS – the small area and the local authority. In fact, local authorities usually organize their children's services into geographical "patches", which are in general devolved organizational units in which local managers have a certain amount of autonomy about the way they meet needs arising within their area. Thus, in the same way that we have hypothesized (and detected) a local authority effect, there might also be a patch effect within a local authority.

In practice, a variety of models of geographical devolution of services exist within English local government, both in the size of the devolved units and in the autonomy they enjoy. We were told that in some authorities there was substantial devolution of material responsibility, while in others such devolution was little more than a paper exercise, and in a few authorities the patch model had been abandoned. This heterogeneity suggests variations in the potential for a patch effect in different authorities. It nevertheless seemed important to test for such an effect. This test was undertaken by asking each local authority to identify the patches to which each small area within their boundaries was allocated.

The median number of patches in each local authority was four. The model specification was then altered to incorporate three rather than two levels: the small area, the patch and the local authority. The results are shown in Table 4.4. This suggests that there is a small patch effect which is statistically significant at the 5% level. The patch effect accounts for only about 8% of the unexplained variation in utilization, and has only a modest impact on the fixed coefficients at the small area level, which are the focus of our analysis.

Variable	Coefficient	Standard error
Constant	-3.662	13.99
ALG1	127.1	29.21
C1	1136	442
IS1	174	37.57
C4A	364.8	78.31
DENS	0.2645	0.1298
Variance level 3 (auth)	2705	867
Variance level 2 (patch)	604	188
Variance level 1 (area)	4627	219
Reset test	1.44	

Table 4.4: Preferred model with patch level included

The relatively small impact of the effect, and the difficulty of placing an interpretation on the results, given the heterogeneity of organizational models found in local authorities, led us to recommend rejection of this model as the basis for the SSA. Nevertheless, the results do suggest that there may be a small but detectable patch effect which may be stronger in some authorities than in others, and which may merit further study.

Running the model on groups of local authorities

We report the implications of running the model on London authorities, metropolitan districts and shire counties in Table 4.4. The models for metropolitan and shire authorities are statistically misspecified. Only income support (IS1) remains statistically significant in all models. The Shires model is misspecified. Thus the preferred model appears to vary between classes of authority. This finding is perfectly understandable, given the wide range of policies and priorities legitimately found in local government. Again it must be emphasized that we are seeking a national average model, and the fact that responses to needs vary between authorities or even between classes of authority does not preclude the use of such a national average model for SSA purposes.

	London Boroughs Only		Metropolitan Districts Only		Shire Counties Only	
	8 local auths.	164 small areas	11 local auths.	240 small areas	6 local auths.	626 small areas
	Coeff	SE	Coeff	SE	Coeff	SE
Constant	-69.9	52	4.513	18	3.065	9.7
ALG1	92.9	73	97	52	60.4	63
C1	1641	1528	719	801	1019	531
DENS	.3474	.328	.08894	.247	.5154	.18
IS1	249.4	101	321.2	66	101.1	48
C4A	548.6	270	124.1	130	457.8	100
VarianceL2	9123	4767	1211	582	34.9	44.7
VarianceL1	7552	855	3256	304	4301	244
Reset test	1.34		-0.25		-3.39	
Likelihood	1792		2406		6391	

Table 4.4: Model run on three classes of authority (coefficients and standard errors)

Using alternative dependent variables

A variety of alternative dependent variables were tested, using the five preferred explanatory variables. These entailed omission of some categories of children and alternative costing assumptions. The variables tested were:

COSTS The preferred revised utilization variable;

UTIL1_3 As for COSTS, omitting child categories 4-6 (that is, "looked after" children only);

UTIL1_5 As for COSTS, omitting child category 6;

UTIL4_6 As for COSTS, omitting child categories 1-3 (that is, *not* looked after children only);

UTIL6 As for COSTS, omitting child categories 1-5 (that is, the large "other" category);

UCRUDE Numbers of clients as a proportion of all children;

UNATAV As for COSTS, using national average unit cost data instead of local cost data.

In general, these alternatives are strongly positively correlated, as the following correlations with COSTS demonstrate:

UTIL1_3	0.930
UTIL1_5	0.943
UTIL4_6	0.777
UTIL6	0.665
UCRUDE	0.602
UNATAV	0.798

Table 4.5 reports the results of running the model on different dependent variables. The model appears to be fairly robust to the alternative assumptions, with most of the variables remaining statistically significant.

Table 4.5: Effects of using alternative measures of utilization (coefficients and standard errors)

Dependent variable >	COSTS	UTIL1_3	UTIL1_5	UTIL4_6
Indep var				
ALG1	126.5 (28)	70.23 (23.5)	85.39 (26)	44.02 (11)
C1	1016 (441)	576.1 (388)	733.3 (412)	527.8 (157)
DENS	.3192 (.13)	.2613 (.11)	.2489 (.118)	.0202 (.0464)
IS1	184.2 (36)	67.45 (31.9)	109.2 (34)	114.9 (13)
C4A	364.8 (78)	291.7 (67.8)	298.4 (72)	76.47 (28)
CONS	-7.404 (13)	-9.982 (9.8)	-8.856 (11.7)	3.744 (7.7)
Variance L2	2495 (758)	857.6 (280.2)	1559 (484)	1232 (335.3)
Variance L1	4720 (211)	3481 (155.3)	3897 (174)	621.8 (27.7)
Reset test	1.915	-0.221	0.533	3.892

Dependent variable >	COSTS	UTIL6	National Average costs	Client numbers
Indep var				
ALG1	126.5 (28)	34.94 (8.6)	41.05 (28)	9.173 (4)
C1	1016 (441)	328 (126)	807.2 (433)	70.12 (59)
DENS	.3192 (.13)	.04765 (.037)	0.16 (.125)	.0303 (.017)
IS1	184.2 (36)	76.54 (10.4)	241.9 (35.7)	63.34 (4.9)
C4A	364.8 (78)	64.33 (22.3)	339.7 (76)	43.5 (10.4)
CONS	-7.404 (13)	2.053 (6.3)	-3.933 (13)	-.4314 (2.6)
Variance L2	2495 (758)	831.5 (239.7)	2288 (696)	183.3 (40.09)
Variance L1	4720 (211)	400.5 (17.86)	4280 (191)	87.75 (3.91)
Reset test	1.915	4.099	-3.530	4.290

Other sensitivity issues

Two issues that exercised our advisors were the issues of homelessness and children of mixed race parents. Reliable data are not available on either phenomenon at a small area level. We therefore tested the implications of including statutory homelessness and mixed race children at the local authority level in the model. These variables proved statistically insignificant, offering some *prima facie* evidence that the five variable model already adequately captures any impact either of these issues might have on PSS use, even though the model does not include an explicit measure of either.

A third issue that concerned our advisers was the influence of children of refugees and asylum seekers on PSS costs. Our study sought to exclude such children from the analysis, on the grounds that – although a potentially important determinant of additional costs in some areas – the need for such expenditure was likely to be driven more by proximity to ports of entry and to certain parts of London than by socio-economic conditions. It is an expenditure item that is therefore best treated outside the SSA methodology, perhaps by means of specific grants.

Thus the preferred model was subjected to extensive sensitivity analysis. The principal purpose of this part of the work was to enable the Department of Health to test the sensitivity of the SSA calculations to assumptions made within the study methodology. In the event, the exemplifications presented by the Department of the Environment as part of the consultation process with local authorities were based on the preferred model shown in Table 4.2.

5. DISCUSSION

The study described in this report was designed to yield a formula for identifying the relative spending requirements of local authorities on personal social services for children. In principle, the objective was to identify the national average response to social and economic circumstances, assuming some common set of care policies and a common level of efficiency. This was achieved using an analysis of data from 1,036 small areas, covering about a quarter of the country. This chapter discusses the implications of the study under four headings:

- improvement in SSA methodology;
- improvement in SSA for children's personal social services;
- insights into the factors underlying the need for children's personal social services;
- implications for the future.

Improvement in SSA methodology

In Chapter 2 we documented a large number of criticisms of current SSA methodology. In particular, the majority are currently calculated using some variant of regression analysis in which the units of observation are local authority aggregate figures. We have argued that - for personal services such as PSS - this method may be deeply flawed. The ecological fallacy means that the regression equations identified in this way may be dominated by variations in historical spending levels, policy choices and efficiency levels rather than underlying social needs. Furthermore, by focusing on intra-authority variations rather than inter-authority variations, the method overcomes the problem that the aggregate expenditure of most local authorities is constrained by central government spending limits. The method assumes that, subject to an aggregate budget constraint, local authorities are likely to allocate resources to small areas within their boundaries more consistently on the basis of need.

Ideally we would have replaced existing SSA methods with a *household* based model, using the results of a bespoke sample survey. The method of *contingency tables* would use the characteristics of the population identified in the survey to infer the expected costs of children in each of a number of categories. (It is important to note that such a survey would require a sample of *all* children, not just those known to social service departments.)

Important "risk factors" affecting the chances of a child requiring PSS services would first be identified from the survey using appropriate statistical methods. Suppose these are found to be (say) a) living in a flat b) living in a single parent family and c) number of children in the household. Then the survey could be used to create a contingency table of the sort shown in Table 6.1, in which each cell contains average costs per child. The 12 cells in the contingency table can be thought of as indicating national responses to relevant risk factors. The table can then be used in conjunction with Census data to infer the expected costs of care in an area if those national average responses to needs were applied to that area.

Number of children in family	Not single parent family		Single parent family	
	Living in flat	Not in flat	Living in flat	Not in flat
1-2				
3				
4 or more				

Table 6.1: Example of a "needs" contingency table for children's PSS

A very simple form of this method is currently used in English personal social services for the elderly. Just three categories of the elderly are defined: residents aged 65-74; residents aged 75-84; and residents aged 85 and over. On the basis of national expenditure data these three groups are weighted in the ratio 1:5:21 to yield a weighted elderly population.

The contingency table method has some merits. It is transparent, and if necessary any gaps or discrepancies in the data can be readily accommodated by judicious (and readily understood) manual intervention, or by more formal methods such as statistical smoothing (Bishop *et al*, 1975). Moreover the method is not subject to the methodological difficulties that may afflict more sophisticated statistical methods.

However, the contingency table approach has many drawbacks. Most importantly, it requires a sample survey in which the risk characteristics of clients are recorded in a manner consistent with universally available data, such as the Census. The categories of population

used are often crude. The sample must nevertheless be large enough to be able to generate reliable risk rates for a large number of categories. Even the simple example above requires the estimation of risk rates for 12 categories of child, some of which may be very sparse. More realistic applications might involve hundreds of categories for each of which estimates of costs would be required. It may be for these reasons that the method has rarely been used in Britain.

A more realistic approach is to use what are known as *synthetic estimation* methods (Benzeval and Judge, 1994). These might apply logistic regression methods to the sample survey, which are similar to conventional regression methods, and allow the use of continuous as well as categorical risk factors. Instead of a continuous dependent variable, a logistic model uses a "dichotomous" variable, which can only take a value of one (if a subject is a client) or zero (if not). The probability that a child with a given risk profile is a client can then be calculated using the model. The model can be applied to a local population for which the risk characteristics are known to estimate that population's expected number of clients. Some methodological refinements would be needed if client costs, rather than clients, were the dependent variable. The main advantages of such methods are that they allow the statistical significance of risk factors to be tested, and they require a smaller sample size than the categorical approach. However, they are less easy to understand, and suffer from the usual difficulties of ensuring that a statistical model is well-specified. Moreover, substantial biases may arise when applying models estimated at the individual level to area level data.

In practice, adequate household-based data to implement the methods described above are currently unavailable. We have therefore adopted a small area analysis. We argue that this level of analysis is likely to offer the best compromise between the unrealistic data demands of a household-based approach and the profound flaws underlying the local authority approach. It offers a rich, reliable source of data, and is likely to overcome all but a residual element of the ecological fallacy (Carr-Hill, 1987; 1988). The approach has become well-established in the health care field, and we believe that it is applicable to much of local government.

The principal technical difficulty associated with our method is nevertheless its data requirements, even though it is less demanding in this respect than a household based

approach. Local authorities do not routinely keep comprehensive data on the costs associated with each small area, and we have indicated the great efforts needed to estimate such costs for a single service. However, the rapid advances in information technology mean that authorities are increasingly able to associate clients with small areas. Attaching to such clients the sort of rudimentary cost data needed for SSA purposes should not be an impossible task. In particular, it is possible to envisage further applications of the method to education, police, and other personal social services.

A subsidiary technical difficulty associated with the method is that it does not account for variations in price levels between local authorities. Any formulae developed using these methods will therefore have to be used in conjunction with a relative price index which would operate in the same way as the current Area Cost Adjustment. However, as noted in Chapter 4, it may be important that such an index is specifically tailored to price variations in the service under scrutiny rather than just to general price variations.

Two important presentational difficulties are raised by the method. The first is that the novelty of the statistical methods used may lead to some resistance in accepting its results. Although multilevel modelling is a well-developed statistical technique which is entirely appropriate to the hierarchically ordered data used in small area analysis, its details are not widely known in local or central government. Many local government officers and civil servants feel more comfortable with conventional regression techniques. However, the multilevel techniques are the correct approach to analysing small area data. We would maintain that it is completely reasonable to expect that anyone capable of understanding ordinary regression methods can be persuaded of the merits of multilevel modelling.

The second presentational difficulty is that the multilevel approach may yield very different results to existing SSA methods, not least because current methods may to a large extent be modelling historical spending patterns rather than needs. This implies that it may be necessary to implement formulae based on multilevel methods gradually, converging to the new SSAs over a number of years.

The methods here nevertheless offer a promising new avenue for revolutionizing SSA methodology. Indeed we would argue that, in the continued presence of strict expenditure

limitation, they may offer the *only* viable approach to deriving SSAs for the foreseeable future. And we further maintain that - even in the absence of expenditure limitation - small area methods offer a vast improvement on existing methodology.

Improvement in SSA for children's personal social services

In seeking to implement the study methods we encountered a number of difficulties, of which the most important were:

- constrained choice of local authorities - only 25 out of 108 were able to provide adequate data;
- incomplete coverage of children within local authorities - 14% of children had missing or inadequate post codes;
- absence of cost data for individual children - we were forced to use six broad categories of children when ideally we would have used actual costs for each child;
- the difficulty of modelling higher unit costs for certain children within a local authority - the use of an authority-wide average for each category of child may have masked systematically higher costs for certain types of children within a category;
- construction of unit costs - in practice some crude assumptions had to be made in apportioning local authority budgets to categories of child.

Any SSA methodology is likely to encounter difficulties of this sort, and we believe that we have achieved a good balance between what is practically achievable and what is theoretically correct. In particular:

- the method does not necessarily require complete coverage of all local authorities, providing that a representative mix of small areas has been found, and we believe this to be the case;
- we undertook extensive analysis to determine whether "missing" cases might bias the results and could find no evidence whatsoever to that effect;
- the use of six broad categories of child was determined by the need to be consistent across all authorities, and is a vast improvement on the one category currently in use;

- it is possible that we may have failed to identify systematic intra-authority variations in unit costs, but would judge that these are not likely to be a major source of bias;
- we believe that the authority-specific unit costs used are the best practical tool for indicating the relative costs of each category of child.

The study sought to address four fundamental flaws in existing methods for calculating the SSA for children's PSS:

- the multiplicity of determinants of local authority expenditure (in addition to needs);
- basing the SSA on only a subset (about 18%) of children known to social services departments;
- the potential distortions caused by using separate models for client numbers and unit costs;
- the potential distortions caused by the ecological fallacy.

To a large extent all of these have been addressed. The faulty local authority regression methods was replaced with a theoretically sound alternative. So far as has been feasible, all children receiving PSS were included in the study. Client numbers and unit costs have been combined into a single model of costs. And the small area analysis goes a long way to addressing the ecological problem. In summary, we feel that none of the admitted limitations compromises the validity of the study. Indeed they appear very small when set beside its benefits.

Furthermore, it transpired that the study identified a satisfactory model of PSS costs which was plausible (containing variables with intuitive appeal), was parsimonious and which passed all the necessary statistical tests. We therefore have no hesitating in recommending that it could form the basis of a new SSA for children's PSS. The major additional information required to implement the model is an index of local authority price variations. We have noted that the current Area Cost Adjustment may not be suitable for this purpose, as it does not consider price variations specific to children's PSS. We note that the current adjustment appears to indicate inter-authority cost variations which are markedly different to

the variations implied by the equivalent index used in the health sector (Institute for Employment Research, 1996). This issue, which is beyond the remit of this study, may merit further investigation.

Factors underlying the need for children's personal social services

The principal aim of the study was to develop a plausible and practical formula with which to construct the children's PSS SSA. In doing so we explored in some depth the association of a large number of socio-economic variables with expenditure on children's PSS. The study therefore casts important light on the social circumstances that are (and are not) associated with the need for PSS. In examining the study results it is important to bear in mind two important issues. First, the study examined actual expenditure on children's PSS. It can therefore offer little insight into need that is systematically not being met at present by social service departments.

Second, it is important to bear in mind that - even if a variable does not appear in our model - it may nevertheless be strongly associated with the need for children's PSS. The missing variable may be strongly correlated with another variable which *does* appear in the model. Therefore the need associated with the missing variable may have been "pre-empted" by the variable chosen within the model. This phenomenon is caused by the strong levels of inter-correlation between potential needs variables, and is also a reason for viewing with caution the coefficients attached to the variables included in the model. Other researchers may therefore find it possible to identify alternative models of need which are as satisfactory as the one we recommend. This should not be interpreted as a weakness of the study, as we are confident that any such models will yield predictions of costs - the focus of the SSA - which are very similar to those resulting from our chosen model. However the inter-correlation of variables does call for a certain amount of caution in interpreting our results as they relate to the potential causes of PSS utilization by children.

Nevertheless, the variables found in our recommended model do bear out to a remarkable extent the principal risk factors associated with children's PSS. In summary:

- *Children in lone parent families* - an indicator of broken families appears in virtually all possible variants of the model, and is clearly a prime determinant of expenditure.
- *Children in families on Income Support* - this variable has only recently become available at small area level and is a clear indicator of poverty which appears to have a stronger association with expenditure than any Census-based proxies for poverty.
- *Children with limiting long-standing illness* – childhood illness may have a direct impact on local authority workload, particularly in relation to the physically handicapped and those with learning disabilities. Furthermore, high levels of childhood illness may be a more general indicator of local deprivation.
- *Children living in flats* - this variable was chosen in preference to indicators of housing tenure or overcrowding, suggesting that the specific problems associated with flat dwelling may give rise to increased levels of PSS expenditure.
- *Density* - the inclusion of this variable suggests that - even after all other feasible indicators of deprivation have been included - children in urban areas receive more PSS expenditure than their counterparts in rural areas, other things being equal. Whether this effect reflects a relative lack of provision in more rural areas, a lack of alternative sources of support in urban areas, or a generally heightened intensity of need associated with urban circumstances is a matter for conjecture. It is nevertheless noteworthy that it mirrors the established importance of density as an explanatory variable in explaining the prevalence of lone parent families (Bradshaw *et al*, 1996).

Once the above variables had been included in the model, it was found unnecessary to enter into the model any of the many other variables constructed in the course of the study. Thus any variability in expenditure associated with the omitted variables was already captured by the five variables discussed above. Of the omissions from the model, the most noteworthy are indicators of family size, unemployment and ethnicity.

We were somewhat surprised to find no need to include any indicator of family size in the chosen model, but can only report that it was not necessary, casting some doubt on the

importance of this characteristic as a risk factor. Unemployment and non-earning households have long been prime indicators of poverty. However this study suggests that - for the purposes of children's PSS - the more specific indicator of children in families in receipt of Income Support is a more sensitive indicator of need.

So far as ethnicity is concerned, the study team tested carefully numerous indicators of ethnic mix and could find none that added significantly to the chosen model of expenditure. In this respect, however, we should note that an indicator of children from mixed ethnic backgrounds is not available at a small area level, and so we were unable to rule out the possibility that there may be some increased expenditure associated with mixed ethnicity. We undertook a special examination of the social work contact data described in Chapter 3 to determine whether there was any *prima facie* evidence of increased contacts or increased duration of contacts associated with children of non-white or mixed ethnic background, and could find no systematic evidence of such an effect. There is nevertheless scope for further study on this issue.

The study has therefore confirmed many of the important dimensions of need identified by previous research, most notably relating to poverty, broken families, flat dwelling and low birth weight. It also suggests increased expenditure in urban areas. Once these issues have been taken into account, there appear to be no extra expenditure needs associated with housing tenure, overcrowding, family size, unemployment or ethnicity.

Implications for the future

We believe that this study has unequivocally demonstrated that it is possible to develop an SSA for children's PSS based on empirical data which overcomes many of the difficulties associated with current methods. The methods described in this report have yielded a plausible and robust formula that is suitable for the purpose of indicating the relative costs of delivering a common level of service. Most importantly, we have no reason to suppose that the formula favours one class of authorities at the expense of another. In short, the model indicates the average response to needs indicators in the 25 authorities surveyed, and we recommend that it should be used as the basis for an SSA in preference to the existing formulae.

Clearly there is room for further refinement. In particular, it would be desirable to include a larger number of local authorities, and to use more accurate estimates of the costs associated with each child. Future developments in local authority information systems are likely to yield some fruit in this respect, and we would hope that the designers of such systems can be encouraged to incorporate the facilities needed to abstract the data required for this sort of study.

The methods used here have enjoyed widespread acceptance in the National Health Service, and we believe that the principles underlying this study can be applied to certain other services for which SSAs are required. In this respect, we would highlight other personal social services, school education and police as potential candidates. Looking beyond local government, it is possible to envisage other areas of public policy for which relative needs assessments are required within the context of an aggregate budget constraint, and where these methods may be applicable. Two examples possibly worth further examination are the further education sector (administered by the Further Education Funding Council) and the Social Fund (administered by the Benefits Agency).

We have noted that, although they answer many of the problems raised by current methods, the small area methods used here are to some extent a compromise, and that ideally SSA allocations and other such needs assessments should be based on the results of surveys of individuals and households. It is undeniably the case that any such survey of the general population will be expensive, particularly if it has to be sure of capturing a large number of categories of household, of securing a high response rate, and of tracing the use of public services over an extended period. However, the amounts of money now distributed using needs assessment formulae are now enormous, accounting for possibly 20% of gross domestic product. In the long run, the establishment of a well-designed general survey may be a small price to pay to ensure that these funds are distributed fairly and efficiently.

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APPENDIX A: CATEGORIES OF CHILDREN IN NEED USED BY LOCAL AUTHORITIES

- **Children 'looked after'**

- Subject to Care Orders
- Accommodated
- No one is exercising parental responsibility
- Detained/at risk of detention in secure accommodation/custody
- In long-term accommodation
- Having Shared Care
- Children with foster carers
- Children in residential care

- **Children at risk of being 'Looked After'**

- Lost/abandoned
- Homeless/run-away
- May be eligible for accommodation under Section 17
- Children whose parents are unable to care for them for whatever reasons
- Young people whose welfare would be seriously prejudiced if they were not provided with accommodation i.e. those otherwise homeless/physically or sexually abused/neglected at home

- **After care services**

- Young people leaving care, boarding/special schools
- Young people requiring after care services/support
- Continuing care
- Support under S.24

- **Children subject to other Court / Supervision Orders**

- Subject to Court Orders
- Subject to a statutory order specifying the authority's involvement
- Subject to Supervision Orders
- Subject to Section 8/Family Assistance Orders

- **Young carers**

- Children with inappropriate caring duties which significantly impair their normal health and development

- **Adoption services**

- **Private fostering**

- Children in private fostering placements/requiring assessment prior to

placement beginning

- **Children on C.P.R. (& not 'looked after')**

- **Children in need of protection (& not 'looked after')**

- At risk of being accommodated because of family difficulties
- Have/likely to suffer significant harm
- Suffering/likely to suffer physical, sexual, emotional abuse/neglect and who are in need of protection
- Subject to Child Protection Assessment
- At risk of meeting the requirement for registration on the CPR
- Children referred under S 47
- Children whose normal level of health/development has/will be significant impaired due to lack of care/social/cultural isolation
- Children where welfare issues are indicated
- Children who face a risk of family breakdown which is likely to lead to significant emotional, physical/developmental impairment
- Children suffering as a result of their physical, material/social environment
- Young people aged 16-18 whose welfare is seriously prejudiced

- **Children with Disabilities (& not 'looked after')**

- Physical, learning, sensory disabilities
- Chronic/terminal illness
- LT illness, including HIV/Aids
- Multiple impairments
- Respite care
- With a statement of special educational needs under the Education Act 1993/ where the statement process has been initiated
- 'Looked after' by the LA/educational authority in a special residential school
- Resident in NHS/Educational establishments
- Children subject to assessment under 1981 Education Act

- **Children receiving family support services (& not 'looked after')**

- Children receiving financial assistance +/other services under S17
- Families in receipt of social work support where there is no statutory involvement
- Children with other family/personal related problems
- Children and families having Home Care Services
- Children and families having advice and guidance
- Children where there is a strong risk of family breakdown
- Children in high mobility families
- Children of parents whose abilities/circumstances are seriously limiting their capacity to offer adequate care for their children without the support of services of the LA

- Children whose parents have alcohol/drug related problems
- Children whose parents/other carers are HIV positive
- Children in families where there is domestic violence
- Children whose parents have a mental health problem
- Children whose parents divorced/separated and whom are in need of support/advice counselling
- Children in family where adult members have basic educational needs
- Children living in families where the parents/carers have severe/persistent parental conflicts
- Children in families who are homeless
- Children of families living in temporary accommodation of a hostel type provided by statutory/voluntary agencies
- Children of school age parents
- Children experiencing bereavement and loss
- Children living away from home and need help in family contract
- Children involved in private law cases and (where Court has specified LA assessment/supervision)

- **Juvenile Offenders (& not 'looked after')**

- At risk of offending
- Taken to Court for criminal offences
- Guilty of committing offences
- In police custody requiring an appropriate adult
- In police custody/released from custody on post-custody supervision
- Receiving Youth Justice Services
- Referred to Youth Court Team
- Remained by Courts/bailed with conditions
- Committed criminal offences where there is evidence of home circumstances having direct effect on the offence
- Child witness going to Court

- **Young people with mental health problems (& not 'looked after')**

- Suffer from emotional/psychiatric problems
- Drug, solvent, alcohol dependent
- Serious behavioural problems/out of control
- Children whose behaviour presents a danger to themselves and others
- Children with special educational needs/serious school attendance and behavioural difficulties/requiring intervention of Local Education Authority Psychology and welfare services in order to avoid significant harm to/impairment of their health and development
- Children allocated to Education welfare-officers and probation officers

- **Homeless Young People**

- 16-17 year old without accommodation
- Children living with parents under temporary arrangements

- Young Person (16+) where their welfare is prejudiced and have no accommodation

- **Day care & Family Centres**

- **Children assessed as being 'in need'**

- Children who do no meet specific criteria set out but whose needs/circumstances are assessed to fall within the definition of 'in need' contained in S.17 (II); S31(9); S31(10) of Act
- Children having an assessment as being 'in need'.
- On the basis of referral by schools, Health visitors and any other source; and following assessment and decision by SSD as to whether they fall within definition 'in need' in S17 (10)
- Children whose health is subject to special monitoring by the health authority through health visitors, pre-school and school health service etc. for reasons such as developmental delay, parental illness, parenting difficulties
- Pregnant school girls
- Teenage parents of unborn children considered to be at risk of harm/in need of support during pregnancy

- **Others**

- Therapeutic services
- Consultation services
- Sponsorship
- Community development
- Schooling of children on CPR/on a Care Order
- Children not adequately supervised out of school
- Refugee children
- Children who are otherwise disadvantaged through deprivation/discrimination
- All young people living in areas who need information about LA and other statutory/ non statutory services
- Children in hospital for more than 3 months

- **Census**

- Children living in a family on low income
- Children living in a family with one parent
- Children in a family where parents - unemployed
- LT illness children
- LT illness family member
- Children in area of urban depravation
- Families eligible for/in receipt of free school meals
- Families eligible for/in receipt of family credit/income support
- Families eligible for/in receipt of council tax rebates
- Children from black/minority ethnic communities
- Children in poverty/substandard housing/grossly overcrowded house
- Children living in particular geographical communities

- Families who are without basic essentials for living and/where gas/electricity/water have been disconnected

APPENDIX B: AUTHORITES PARTICIPATING IN THE SURVEY

London Boroughs

Barking and Dagenham
Hackney
Haringey
Havering
Kensington and Chelsea
Merton
Richmond
Wandsworth

Metropolitan Districts

Doncaster
Knowsley
Newcastle
North Tyneside
Rotherham
St Helens
Sefton
Sheffield
South Tyneside
Tameside
Wirral

Non-Metropolitan Counties

Cheshire
Cumbria
Lancashire
Nottinghamshire
Shropshire
Staffordshire

APPENDIX C: SOCIO-ECONOMIC VARIABLES DERIVED FROM CENSUS

Variable		Table	Definition
Illness			
C1	Proportion of children aged 0-17 with limiting long-term illness	12,13	(12:4+12:7+12:10+13:11+13:12+13:15+13:16+13:19 +13:20+13:23+13:24+13:27+13:28+13:31+13:32) /
AA111	Proportion of total population with limiting long term illness	12,13	(12:1+13:3+13:4+13:7+13.8)/total pop
A111A	Residents in households w/ long standing illness	12,35	12:1/35:1
A111B	Residents aged <45 in households w/ long standing illness	12,35	12:(4+7+10+13+16)/35:(12+23+34+45+56+67)
AA81	Proportion of residents of working age permanently sick	08	(210-491-492-493-756-757-758-759)/ (1-282-283-284-547-548-549-550)
AA82	Proportion of adult population permanently sick	08	210/1
AA83	Age standardized permanently sick ratio (SSR)	08	Indirect, based on working age groups
Earning			
C2	Proportion of dependent children in non-earning lone parent households	36	(12+18)/66
C3	Proportion of dependent children in non-earning households	36	(6+12+18+30+36+48)/66
Lone parents			
C4	Proportion of dependent children in lone parent households	46	61/(61+169)
C4A	Dependent children 0-18 in lone parent families	46	97/(97+205)
C4B	Dependent children 0-18 in lone parent families	46,87	87:188/46:(97+205)*46(61+169)/86:309
C4C	Lone parent concealed families w/ dependent children	88	25/(25 + 57 + 89)
C25	Proportion of child h/h with children 0-15 with lone parent 16-24	36,37	(37:5+37:6)/(36:63+36:64+36:65)
CC25	Lone parents aged 16-24 w/ children aged 0-15	37	(5+6)/(1+2)
Housing			
C4D	All concealed families w/ dependent children	88	(25 + 57)/(25 + 57 + 89)
C5	Proportion of dependent children aged 0-18 over 1.5 persons per room	42	195/193
V1	Dependent children 0-18 in households > 1.5 person / room	46	(99+207)/(97+205)
C6	Proportion of dependent children aged 0-18 over 1 person per room	42	(194+195)/193
CC6	Dependent children 0-18 in households > 1 person / room	46	(98+99+206+207)/(97+205)
C10	Proportion of dependent children 0-18 not self-contained accomm.	42	199/193
ALG1	Dependent children in flats	59	(243 to 252) / 239
AA41	Proportion in households in crowded accommodation (> 1 per room)	49	(183+196)/170
AA151	Proportion of families that are "concealed"	88	113/105

Facilities

C7	Proportion of dependent children aged 0-18 lacking/sharing bath/wc		42	196/193
C8	Proportion of dependent children aged 0-18 no central heating	42	197/193	
C9	Prop. of dependent children 0-18 lacking/sharing bath/wc & no CH		42	198/193
AA21	Proportion in households lacking bath/shower & inside WC		49	209/170
AA22	Proportion in households lacking central heating		49	222/170
AA23	Proportion in households in non-self-contained accommodation		49	235/170

Tenure

C11	Proportion of dependent children aged 0-18 owner occupied		42	(200+201)/193
V2	Dependent children 0-18 in owner occupied accomodation		46	(103+211)/(97+205)
C12	Proportion of dependent children aged 0-18 privately rented		42	(202+203)/193
V3	Dependent children 0-18 in private rented accomodation		46	(104+212)/(97+205)
V4	Dependent children 0-18 in social rented accomodation		46	(105+106+213+214)/(97+205)
C28	Proportion of dependent children aged 0-18 social rented housing		42	(205+206)/193
AA11	Proportion of persons in permanent buildings owner occupied.	20	(412+413)/411	
AA12	Proportions of persons in private rented		20	(414+415)/411

Car ownership

C13	Proportion of dependent children aged 0-18 in no-car household		42	207/193
C14	Proportion of dependent children aged 0-18 in 2+ car household		42	208/193
AA31	Proportion in households with no car		49	248/170
C30C	Proportion of dependent children aged 0-18 in no-car household		46	(107+215)/(97+205)

Ethnicity

C15	Proportion of dependent children aged 0-18 with white ethnic hoh		43	170/169
C16	Proportion of dependent children aged 0-18 with black ethnic hoh		43	(171+172+173)/169
C17	Proportion of dependent children aged 0-18 with S. Asian ethnic hoh		43	(174+175+176)/169
C18	Proportion of children aged 0-15 with hoh born in New Commonwealth		50	(148+149+150+151)/(4+5+6+7)
E1	All non-white ethnic residents aged <18		6	(25+37+49+61+73+26+38+50+62+74+277+289+301+313+325+278+290+302+314+326) / (25+37+49+61+73+277+289+301+313+325)
E2	Black residents aged <18		6	(27+28+29+39+40+41+51+52+53+63+64+65+75+76+77+279+280+281+291+292+293+303+304+305+315+316+317+327+328+329) / (25+37+49+61+73+277+289+301+313+325)
E3	Black other residents aged <18		6	(29+41+53+65+77+281+293+305+317+329) / (25+37+49+61+73+277+289+301+313+325)

E4	Other ethnic groups residents aged <18		6	(35+47+59+71+83+287+299+311+323+335) / (25+37+49+61+73+277+289+301+313+325)
AA51	Proportion in households with head born in New Commonwealth		49	181/170
AA52	Proportion in non-white ethnic groups		06	{1} - 2/1
AA53	Proportion born in New Commonwealth		07	55/1
AA54	Proportion in Black ethnic groups		06	(3+4+5)/1
AA55	Proportion in Indian, Pakistani and Bangladeshi groups		06	(6+7+8)/1

Economic

C19	Proportion of dependent children with migrant hoh in last year	59	254/239	
C20	Proportion of persons 0-15 with hoh in social class I or II		90	(8+13)/3
C21	Proportion of persons 0-15 with hoh in manual social class		90	(23+28+33)/3
C26	Proportion of economically active 16-17 unemployed		8	(135+136)/(21+22)
C27	Proportion of economically active 18-29 unemployed		8	(137 to 141)/(23 to 27)
C32	Proportion of persons aged 0-15 with hoh class IV or V or govt scheme		90	(28+33+43)/3
C35	Proportion of persons aged 0-15 with hoh manual/scheme/inactive/other		90	(28+33+43+48+58)/3
IS1	Children of income support claimants	-	Estimated children (DSS) / Population aged 0-17	
ALG2	Households with children		31	(39 to 43 + 63 to 67) / (1+2)
AA91	Proportion of 17 year olds who are students		08	193/3
AA92	Proportion of working age population who are students		08	(191-472-473-474-737-738-739-740)/
AA101	Proportion of residents moving from outside l.a. district in last year		15	(1-4-5-6-7)/total population
AA102	Proportion of residents with different address to one year ago		15	1/total population
AA131	Proportion of persons aged 18+ with some qualification		84	4/1
AA121	Proportion of economically active unemployed		08	134/20
AA141	Proportion of persons in households with head in class 1 or 2		90	(7+12)/2
AA142	Proportion of persons in households with head in manual classes		90	(22+27+32)/2
AA143	Proportion of economically active in managerial/professional SEG		92	(9+10+17+18+25+26+33+34+41+42+49+50+57+58+129+130+137+138)/(1+2)
AA144	Proportion of economically active in manual SEG		92	(81+82+89+90+97+98+105+106+113+114+121+122+145+146)/(1+2)
AA145	Proportion of economically active in non-manual SEG	92	(9+10+17+18+25+26+33+34+41+42+49+50+57+58+65+66+73+74+129+130+137+138) /(1+2)	

Multiple

C22	Proportion of dep. children 0-15 (a) with lone parent and (b) illness		44,46	(44:56+44:57+44:58+44:59)/ (46:73+46:85)
C23	Proportion of child h/h with (a) 3+ children (b) lone parent		36	(11+17+23)/(63+64+65)
C24	Proportion of child h/h with (a) 3+ children (b) non-earning lone parent	36	(11+17)/(63+64+65)	

C29	Proportion of child h/h with (a) lone parent and (b) social housing	36,42	(42:61+42:62)/(36:63+36:64+36:65)
C30	Proportion of persons in permanent h/h (a) rented and (b) no car	20	(814 to 818)/411
C30B	Proportion of dependent children 0-18 (a) lone parent and (b) no car	46	107/(97+205)
C31	Proportion of dep. children in h/h with (a) lone parent and (b) no car	46	71/(61+169)
C33	Proportion of h/h with dep. children (a) 3+ dep children (b) >1 pp room	46	(218+219)/1
C34	Proportion of h/h with dep. children with 3+ dependent children	46	217/1
C36	Proportion of child h/h with (a) 3+ children (b) non-earning	36	(5+11+17+29+35+47)/(63+64+65)
V5	Dependent children 0-18 in h/h w/ 1 adult, rented housing	46	(104+105+106)/(97+205)
V6	Dependent children 0-18 in h/h w/ 1 adult, social rented housing	46	(105+106)/(97+205)
V7	Dependent children 0-18 w/ lone parent & private rented housing	46,86,87	87:191/46:(97+205)*46:(68+176)/86:312
V8	Dependent children 0-18 w/ lone parent & social rented housing	46,86,87	87:(192+193)/46:(97+205)*46:(69+170+177+178)/86:313+31
V9	Dependent children 0-18 w/ lone parent & rented housing	46,86,87	87:(191+192+193)/46:(97+205)*46:(68 to 170+176 to 178)/86:313+31

Sparsity

SPAR1	Population living in ED with < 0.5 persons per hectare	-	As provided by DoE
SPAR2	Population living in ED with > 0.5 and < 4 persons per hectare	-	As provided by DoE
SPARS	Population living in ED with < 4 persons per hectare	-	As provided by DoE

AA171 Ratio of persons to area 0164 Hectare

APPENDIX D: MODELLING METHODOLOGY

The early development of multilevel models has been almost entirely motivated by statistical educationalists and accordingly it is in this area that some of the best applications and examples of the potential benefits of these methods can be found (see Goldstein, 1995; Longford, 1993; Bryk and Raudenbush, 1992). However more recently the techniques have been applied to areas as diverse as criminology (Herbert, 1994), sociology (Di Prete, 1994), geography (Jones, 1991), epidemiology (Von Korff *et al*, 1992) and health (Humphreys and Carr-Hill, 1991; Congden, 1995; Duncan *et al*, 1993, 1996). In particular, multilevel models have a great deal to offer health and health services research (Rice and Leyland, 1996).

Multilevel models can be viewed as an extension and generalisation of classical regression models, and their appropriateness in any application depends on the validity of the assumptions driving the modelling process. Fundamental to this study was the belief that children resident in the same ward and local authority share common experiences and influences. These can be summarized as being contextual and correlated effects. Contextual effects relate to exogenous factors, such as relevant polices operating in an area, whilst correlated effects relate to factors such as homelessness, single parent families and so on that may cluster in particular areas. Both contextual and correlated effects impose an overall correlation structure on the data that invalidates classical assumptions of ordinary least squares (leading to underestimates of standard errors and thus underestimates of the size of confidence intervals). The key motivation behind using multilevel techniques is to model explicitly the clustering and correlation effects defined above, and where appropriate to explore in further detail the characteristics of the correlations (by the use of random coefficients). In this study we were concerned with accounting for both the correlated effects (obtaining correct standard errors) and the authority level mean effects whilst estimating the individual socio-economic 'needs' drivers of SSA resource use.

The underlying rationale for defining an appropriate area measure is that it should encompass groupings of individuals that are likely to exhibit shared behavioural traits, or are, in some sense, under the same administrative and socio-economic influences. Although, it is not being claimed that electoral wards are 'natural communities' they have usually been historically

defined in this way and often exhibit shared socio-economic characteristics, whilst, of course, authorities implement local policies which are likely to be reasonably uniform within their boundaries. The chosen modelling strategy sought to capture both these types of influences. In this respect, we acknowledge that a ward definition of an area does not capture the differential correlations that may exist between wards within authorities due to distance effects. However, given the limitations of the data made available to us and the extensive use of ward data in other applications of social research, we feel it is a suitable proxy. Further, although it is generally accepted that the lower the level of aggregation the better in terms of the ability to draw inferences about individuals (and overcome the ecological fallacy), there is little evidence to suggest that the use of much smaller enumeration districts is an improvement on the use of wards (Carr-Hill and Rice, 1995).

The software MLn was used to perform the multilevel analysis.

The multilevel model applied in this study was the most 'basic', consisting of two levels: wards within authorities. This simple hierarchy was at one stage extended to including three levels when examining the role of 'patch effects'. However, the patch level did not contribute significantly to the total variation observed in the response. More complicated specifications including random coefficients (random-slope forms) could also have been examined. However, random coefficients are principally used to explore the random part of the multilevel specification, that is, they are used as a descriptive aid in exploring the relationship of higher level effects - in this case local authorities - and how they may be related to characteristics of the wards clustered within the authorities. Random coefficients describe but do not explain variation and therefore in the context of developing a resource allocation formula are of little practical use, since it would be wholly inappropriate to use them for predictive purposes. For this reason, and for transparency random coefficients were not included in the final models.

The econometrics literature, particularly the panel data analysis literature, has long debated the use of fixed or random effects in accounting for individual specific effects (see for example, Judge *et al*, 1980; Hsiao, 1986; Baltagi, 1995). For fixed effects specifications (that is, including dummy variables to represent local authority levels) the estimation procedures condition on the effects whilst estimating the regression parameters associated with the set of

explanatory variables of interest. Random effects estimation differs in that the estimation procedure does not condition on the random effects, but accounts for their effects in the estimation of the parameters of the set of explanatory variables via the construction of the covariance matrix (that is, the correlations that exist within authorities) in a generalised least squares estimation. An important difference between the two estimation procedures is where one or more of the explanatory variables is correlated with the higher level effects (correlations between ward level variables and authorities). In such circumstances the estimation procedures will produce different parameter estimates. However, when the within higher group sample sizes are large, both methods produce parameter estimates with desirable statistical properties, in particular they are both consistent, and are, in fact, approximately equivalent (Baltagi**,** 1995, p150; Blundell and Windmeijer, 1996). Indeed, recent research suggests that the within authority sample size can be as low as 27 for both estimators to be approximately equivalent (Blundell and Windmeijer, 1996).

Clearly, an essential property of any resource allocation model is its ability to successfully predict allocations. In order to test the robustness of the random effects model by re-estimating its parameters using a fixed effects specification. The predictions obtained from the re-estimated fixed effects model were compared to the predictions obtained from the multilevel specification. The comparisons were based on the root average squared prediction error, which provides an indication of the average unsigned deviation of predicted from actual cost, defined as

$$\text{RASPE} = \sqrt{\frac{\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2}{n}}\Bigg|_0$$

where $Y_i|_0$ represents the actual observed cost per 1000 children and $\hat{Y}_i|_0$ the predicted cost per 1000 children from the model. Although the differences were marginal, the multilevel estimates 'outperformed' the fixed effects estimates not only for the full data set including all authorities, but also when the data set is partitioned into metropolitan, shire and London authorities.

A further consideration in choosing the estimation technique was the possibility that patch areas may have represented a significant area effect and as such would have been required to be included in the modelling procedure. If this was the case, then the hierarchy of wards within patches within authorities could be specified quite comfortable within the framework of a multilevel model. However, this would have been much more unwieldy in a fixed effects specification and would have resulted in the greater loss of degrees of freedom since it would have been necessary to estimate many more parameters. For hierarchical data sets with more than two levels, a multilevel approach is likely to be most fruitfull.

It is very important that any statistical model is correctly specified. The specification of a regression model consists of a formulation of the regression equation and of statements or assumptions concerning the regressors and the disturbance term. A "specification error" in the broad sense occurs whenever the formulation of the regression equation or one of the underlying assumptions is incorrect. Specification errors can occur for various reasons:

1. Omission of a relevant explanatory variable
2. Inclusion of an irrelevant explanatory variable
3. Incorrect mathematical form of the regression equation
4. Incorrect specification of the way in which the disturbance term enters the regression equation.

Tests for misspecification can be applied by using Ramsey's method (termed a RESET test; Gujarati 1988) which includes calculating the predicted values from the regression equation, obtaining from these $\hat{y}^2, \hat{y}^3, \hat{y}^4$ to $\hat{y}^n$ and re-running the regression model with these terms inserted. The null hypothesis of $H_0: \hat{y}^2, \hat{y}^3, \hat{y}^4$ to $\hat{y}^n = 0$ can be tested using the F statistics. If the null hypothesis is not rejected then the model may be assumed to be well specified. Often a simpler version of including only $\hat{y}^2$ in the model and observing its significance using the t-test is sufficient.

The basic idea behind the RESET test is that if there is exists an association between the predicted values (expressed as powers, e.g. $\hat{y}^2$) and the residuals from a particular model, then this suggests that including the predicted values in the regression equation will result in

an increased R^2. If the increase in R^2 is statistically significant, it suggests that the linear function was misspecified and alternative models should be investigated.

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