

SECTION 6

A SELECTION OF INDEXES OF MULTIPLE DEPRIVATION

6.1 Indexes from Census or Administrative Data?

This section introduces most of the better-known indexes of multiple deprivation, divided into those that are exclusively census-based and those that also incorporate other sources. In [Section 5](#), it was noted that the current trend is to move from purely Census-based indicators to those using both of Census and administrative data. Over the past few years there has been considerable lobbying for greater use of non-Census sources, especially from large urban and metropolitan areas. High population mobility and economic pressures can lead to major and rapid social change such that measures of deprivation based on data from the Decennial Censuses fail to identify areas with new problems. This lobbying has been inspired by the increased use of deprivation scores in targeting regeneration and other strategic funds and the release of small area means-tested and other benefits data, including unemployment claimant counts – the closest we have to a national measure of poverty.

In England and Wales, the ‘Oxford Group’ at The Social Disadvantage Research Centre at the University of Oxford is a major developer of the new generation of indexes. They are responsible for the IMD 2000/2004 and the Welsh IMD and were commissioned, jointly with the South East Public Health Observatory, to produce the Health Poverty Index (HPI).

In Scotland, Kearns et al. [\[200\]](#) have developed an index mainly based on non-Census data. A number of resource allocation formulae for the NHS already use unemployment and income support data.

The release of the 2001 Census results may revive the interest in using Census variables since it provides new and highly flexible low level OAs and powerful mapping capabilities. At the same time, there will be problems for some of the long-established instruments, such as the Jarman Index, as these use variables that did not have precise equivalents in the 2001 Census.

It will be interesting to see whether the enthusiasm for up-to-the-minute data for resource allocation begins to wane when it becomes a major

determinant of annual funding. At present, most of the equations using these data direct the allocations of relatively small amounts of health and local authority expenditure. When large proportions of the allocations are determined by current data allocations may vary so greatly from year to year that it becomes difficult to maintain core services. Although the need for some services may be directly related to short-term fluctuations in levels of unemployment or levels of benefit claims, it may not be as relevant for many health and other public services.

Many of the causes of expressed morbidity are not always contemporaneous but are often the consequence of lifetime exposure. The health and disease status of an individual of 60 is the result of a lifelong exposure to environmental, lifestyle and genetic factors. Therefore, data reflecting the conditions of the area 10 years ago may conceivably be a better proxy for health than current data, at least for those who stay in the area. The advantage of recent data is that it is more likely to refer to the current residents rather than that it is more relevant to the measurement of their need for healthcare.

There are other potential problems with the non-Census sources and material employed in the Oxford Indexes. One problem is its relative inaccessibility to local users. Although domain scores are available for the IMD and the Welsh IMD, values for the component variables are not released on a small area basis. Some of these variables are difficult for local authorities to estimate as they are based on elaborate modelling-down procedures using data from national surveys, or complex mapping and apportioning techniques. Some of these data may be too expensive for purchase by local authorities and other local agencies. Also issues of commercial secrecy and ethics relating to fully postcoded data may impede or preclude local access to some of the more useful sources.

6.2 Census-based Indexes

The components of eight indexes based on Census data are briefly described in [Table 6.1](#).

The IMD

The IMD 2000 is an attempt to develop an index from Census variables to predict low income prior to the national availability of income support data. Income support data obtained from Oldham and Oxford, were regressed against a set of Census variables. The resulting equation contains seven Census variables ([Table 6.1](#)) to predict areas of low income.

The Jarman Index

This well-known index followed the Acheson committee's call for evidence on the areas in which there was most difficulty providing effective primary care.

Table 6.1. Components of Census-based indexes

<i>Variables</i>	<i>Jarman (UPA8)</i>	<i>Townsend</i>	<i>Scotdep</i>	<i>Socdep</i>	<i>Matdep</i>	<i>DoE91 ED ward and district</i>	<i>Breadline</i>	<i>Oxford (IMD)</i>
Unemployment	X	X	X (male)	X		X	X	X (male)
Youth unemployment				X				
Economically inactive								X
Children in poor households						X		
Children aged under 5	X							
Lone parents	X			X			X	X
Overcrowding	X	X	X		X	X		X
Lacking amenities					X	X		
Lack central heating					X			
Low social class	X		X				X	
Single pensioner	X			X				
No car		X	X		X	X	X	
LA rental								X
All rental (not owner occ)		X					X	
Owner occupiers								X
Children living in flats						X		
Born new commonwealth	X							X
Residential mobility	X							
Self-report long-term limiting illness				X			X	
Single dependent pensioner households				X				

A pilot survey was conducted on 100 London GPs, asking what services and socio-demographic factors put most pressure on their workload. The final questionnaire was distributed to 1 in 10 of all GPs. It asked them to rate the relative importance of 13 social factors (identified in the pilot), including unemployment, poor housing, and single parent households, and eight service factors, such as long out-patient waiting times, high percentage of single-handed GPs and low local authority expenditure on home help.

The index was constructed from the results, with two major omissions. All the service factors were excluded, partly because they were thought to be sensitive to changes in local and national policy and NHS management, and also that there were no relevant data at small area level. Several important social variables were also dropped, including the highest rated factor (the proportion of the population aged over 65) and transport difficulties in visiting patients. These variables were omitted because the existing GP remuneration scheme already took them into account. Crime rate was excluded because there was no suitable Census variable or proxy. Several other variables were excluded because of differences between the 1971 and 1981 Census definitions. The final version of the index is based on eight variables (see [Table 6.1](#)).

All eight are derived from 1991 Census, but are subject to algebraic translations to standardise and otherwise improve their distributional properties. The transformed variables are combined using weights derived from the GP ratings in the 1981 National Survey of GPs.

The index is still widely used and was used in the methods for computing GP remuneration until last year. That it is still described as the UPA8 (the 8-item Underprivileged Area Score) is a reminder of the ambiguity that surrounds its development. The question is whether it is a measure of deprivation or of the factors that GPs perceive as impacting on their workload, excluding those that were already incorporated in the remuneration scheme in 1981. Strictly speaking, it is the latter. Although it was not designed as a measure of deprivation, it is of interest in measuring health inequalities because it has been found to be a good predictor of some types of healthcare utilization.

The Townsend Index

The Townsend Index [\[201\]](#) is an unweighted combination of four variables, representing a best attempt to measure material deprivation with the range of data available from the 1981 and 1991 Censuses. The four variables cover: lack of access to good housing (having to rent and live in overcrowded conditions), lack of material possessions, lack of access to private transport (no car) and unemployment.

Until the recent availability of means-tested benefits' data, the Townsend Index was a popular choice for studies wanting to compare levels of morbidity and mortality in different economic groups. Townsend himself

uses the index for this purpose in an analysis of health inequalities in the north of England [202].

Scotdep

Scotdep is quite closely related to the Townsend Index in its intentions; it was developed by Carstairs and Morris for the analysis of Scottish health data and health inequalities [203,204]. In a subsequent comparison with four other indexes, its authors conclude that their formula, together with the Townsend Index, are the best of this group at predicting variations in health. As with Townsend, Scotdep is entirely Census-based. The two indexes have three variables in common: unemployment, no car and overcrowding. For the fourth variable, Scotdep replaces rented housing with low social class because the proportion of social rented housing in Scotland was sufficiently high to blunt its sensitivity. Statistically, Scotdep is also similar to Townsend: an unweighted combination of four standardised variables. Its calculation is even simpler as it lacks the log transformation that Townsend uses to reduce the skewness of unemployment and overcrowding.

Matdep and Socdep

Gordon and Forrest's [190] approach to index construction received considerable attention amongst local authorities following the 1993 release of the small area results from the 1991 Census. The two indexes described here reflect the Townsend distinction between material and social deprivation. The components of Matdep will be familiar to those who use either the Townsend Index or Scotdep: overcrowding, lack of amenities (no bath or shower and/or no inside WC and/ no central heating), and no car. The method of calculation is also similar: an unweighted combination of Z scores. The main differences are that a higher proportion of Matdep's components refer to housing conditions and that lack of car ownership is the main proxy for income. As Carstairs and Morris note: "one single indicator (no car) emerges as a variable which performs well in explaining variations in health measures" [205].

The relation between lack of car ownership and poor health is unsurprising given the positive correlation with poverty and age. However, these effects are strongest in urban areas and indexes that exclusively use car ownership as the economic proxy may not always be valid for use in rural areas or for rural urban comparisons.

Socdep is an interesting collection of Census variables that is particularly relevant to predicting the need for local authority services, especially social services. It has six unweighted components, the proportion of: unemployed persons, unemployed youth, lone parents, single pensioners, households with at least one person with LLTI, and households with no member without LLTI.

The Breadline (Britain) Index

This index is made up of Census variables, but was developed by Gordon [199] from an individual and household level analysis of the data from the Breadline Britain survey. The method of derivation makes this index particularly easy to interpret. The aim of the index is to predict which households are 'poor' by using variables from the survey that are also present in the 1991 Census. The analysis of the Breadline Britain survey developed a definition of a poor household – one that is unable to afford three or more of 32 items that are regarded as necessities by 50% or more of respondents.

Variables from the survey are used as the independents in a logistic regression to predict whether or not a household is defined as poor by the above criterion. Because these variables are also present in the 1991 Census, the results of the regression can be used to predict levels of poverty anywhere in Britain. Moreover, the score can be interpreted as a prediction of the proportion of poor households.

The work has received considerable attention and there have been some local replications. Saunders [206] repeated Gordon's approach on a smaller scale with data from the Breadline Greenwich (a south London Borough) survey. Results were similar to Gordon's national analyses except for some differences in the weightings of the variables. Saunders concludes that replicating the Breadline survey locally can be a good basis for developing accurate and meaningful indicators of local deprivation.

6.3 Indexes with a Majority of Non-Census Components

Five indexes are described: Scottish Area Deprivation Index, The Index of Multiple Deprivation-2004, The Welsh IMD, HPI and the Arbutnot Index.

The Scottish Area Deprivation Index

Developed by Kearns et al. [200] in the mid-1990s, this was a significant attempt to produce an index from non-Census data. Six domains were chosen on theoretical grounds as representing the main dimensions of deprivation (in urban areas). The choice of variables was largely governed by data availability at the post code level. Generally only two or three variables could be found for each domain and these were reduced to a single variable by a combination of correlational criteria and factor analysis. The final variables are shown in Table 6.2. The index is the unweighted sum of signed logged chi-squared transformed variables. Despite being based on non-Census variables, the Scottish Area Deprivation Index closely correlated with Census-based indexes (Table 6.3).

Table 6.2. Components of Scottish Area Deprivation Index

<i>Domain</i>	<i>Indicator</i>	<i>Source</i>
Housing	Overcrowding	Census
Health/morbidity	SMR 0–64 year olds	ONS
Education	Non-participation in higher education	Scottish DoE
Crime	House contents insurance rating	Four insurance companies
Unemployment	Unemployment claimant count	
Poverty	Income support recipients	

Table 6.3. Correlation of Scottish Area Deprivation Index with several Census-based indexes

	<i>Jarman</i>	<i>Matdep</i>	<i>IMD</i>	<i>Carstairs</i>	<i>Townsend</i>
Matdep	0.66				
Oxford	0.81	0.69			
Carstairs	0.78	0.64	0.84		
Townsend	0.82	0.69	0.90	0.86	
New Scottish	0.77	0.63	0.82	0.78	0.84

Source: from Kearns et al. [200] p. 1549.

The IMD-2000/2004 (ODPM) and Welsh IMD

These indexes represent the most ambitious attempts to date to produce multi-dimensional indexes of deprivation for use at small area level in the U.K. Although they use different sets of variables (and therefore their results are not comparable) there are sufficient similarities in their methods of development and construction to discuss these together.

The indexes were developed for various reasons, including the need to rank areas in order to target regeneration funds, and modelling levels of deprivation to support both national and local policy. These indexes are intended equally for LAs to use in order to understand and address local patterns of deprivation, as well as for national government to assign resources to LAs (or to other areas with special needs).

The development of both indexes included a series of consultations on the constituent domains and variables.

Ward level values for both the IMD 2000 and 2004 (ODPM) and Welsh indicators and their domains (but not all their constituent variables) are available on the ONS Neighbourhood Statistics website. The method of construction is principally normative. The intention was that the period of consultation should provide more or less consensual judgements on the choice of constituent domains and variables.

The several reports on the indexes provide useful commentary on the technical feasibility of getting suitable ward-level data. A second round of consultation invited comments on the more promising variables and the reasons for excluding several interesting candidates (the full list of indicators in these indexes is shown in [Table 6.4](#)). At this stage in the consultation, proposals were floated for weighting the variables. Two levels of weighting are required. First, to combine the constituent variables into domain scores and second to combine the domain scores into an overall index score. The second is the simpler to describe as it involves normatively derived weights and does not attempt to use statistical techniques such as factor analysis or validation against external variables. Two reasons are given for not using equal weights for all domains: first, the consensus of both the literature and of the project commissioners, that income and employment should carry more weight than the others; second, the domains with the more robust scores should be weighted more than the rest.

The Indexes of Deprivation 2004 (ID 2004) are measures of deprivation for every Super Output Area and local authority area in England. They combine a number of indicators across seven domains (Income, Employment, Health deprivation and Disability, Education, Skills and Training deprivation, Barriers to Housing and Services, Living Environment deprivation and Crime) into a single deprivation score and rank for each area. There are also six summary measures for County Councils, an Income Deprivation Affecting Children Index, and an Income Deprivation Affecting Older People Index.

The development of both indexes is impressive in the range of techniques employed to estimate, improve and combine the values of the component variables. Most of the methods are described in [Section 7](#). The methods included the following:

- ◆ *Shrinkage techniques* for improving reliability of area values with small nominators and denominators applied to most of the variables in the index, instead of the more commonly used signed chi-squared approach.
- ◆ *Modelling down and apportioning strategies* to estimate small area values for variables that could only be obtained for larger areas.
- ◆ *Factor analysis* for combining variables that are not in the form of simple counts. The analysis provides a set of weights to generate factor scores and may suggest that some variables should be dropped.

The Health Poverty Index

The NHS Plan specifically mentions the development of a HPI as one of the tools for addressing inequalities in health and service provision. Eleven

consultative workshops were held in 2001 to investigate the types of health poverty measurement that were already taking place, and collect suggestions for the structure and components of a new index.

Following the publication of the Health Poverty Index Scoping Project (July 2001), the Department of Health commissioned the South East Public Health Observatory in collaboration with the Social Disadvantage Research Centre of the Department of Social Policy and Social Work (Oxford University) to develop the HPI. A website for consultation was launched around March 2003 and modified in response to comments received from registered users and an expert user advisory group. It is available as an online tool to make comparisons between areas (by local authority and primary care trusts) or groups (<http://www.hpi.org.uk>).

The Arbutnot Index

The Arbutnot Index may have a major impact on the distribution of healthcare resources in Scotland. It originates in the 'Fair Shares for All' programme or 'The National Review of Resource Allocation' that was established in 1997 to advise on methods of allocating NHS resources between the Scottish Health Boards. The review proposed many separate formulae for predicting the consequences of population characteristics on the need for different types of NHS activities. At the consultation stage, these formulae were thought to be too complicated, so there was pressure to find a single index that might be a simpler predictor of need.

Appendix F to the 'Fair Shares For All' report states that: "four indicators were found to be significantly more successful than other indicators in explaining the differences observed in the use of services between postcode areas". The indicators are:

- ◆ The SMR among people aged 0–64 averaged over a 5-year period.
- ◆ The proportion of households having two or more deprivation indicators.
- ◆ The proportion of the population aged 65 and over claiming income support.

The indicators based on mortality rates, unemployment and income support are available annually, while the indicator of deprived households is taken from the Census. The index is the unweighted sum of the Z scores of the four variables. It appears that the intention is to regress the values of this index against healthcare utilisation data for different types of health services and thereby produce a small set of equations (with the same independent variables) that can be used to compute the extent to which resource allocation has to be weighted for population life circumstances and morbidity ([Table 6.4](#)).

Table 6.4. Components of the IMD 2000/2004 and Welsh IMD

<i>Components</i>	<i>IMD</i>	<i>Welsh IMD</i>	<i>Level</i>	<i>Source</i>
<i>Employment</i>				
Unemployed claimant count (averaged to overcome seasonal years)	X	X	W	JUVOS, ONS
People out of work, but in TEC delivered government supported training	X		W	DfEE
People aged 18–24 on new deal options	X	X	W	DfEE/ES
Incapacity benefit recipients aged 16–59	X	X	W	DSS
Severe disability allowance recipients aged 16–59	X	X	W	DSS
<i>Health and disability</i>				
Comparative MRs under 65	X	X	H	ONS
Attendance allowance (above 65s) DLA (below 65s)	X	X	W	DSS
People aged 16–59 receiving incapacity benefit or severe disablement allowance	X	X	W	DSS
Limiting long-term illness (self-report) – age–sex standardised	X	X	W	Census
Low birth weight	X	X	W	ONS
<i>Education, skills and training</i>				
Working age adults with no qualifications (only at UA level)	X	X	M	LFS
Persons aged 16–18 not in fulltime education (computed from child benefit data)	X	X	W	DSS
Proportion of people aged 17 and above who have applied (unsuccessfully) for higher education	X	X	W	UCAS
Key stage 2 primary school education data (only available for school catchment areas – reassigned to Eddivs using GIS techniques)	X	X	M	DfEE
Primary school children with English as a second language	X		M	DfEE
Absenteeism at primary level (all absences)	X		M	DfEE

(Continued)

Table 6.4. (Continued)

<i>Components</i>	<i>IMD</i>	<i>Welsh IMD</i>	<i>Level</i>	<i>Source</i>
<i>Housing</i>				
Homeless households in temporary accommodation	X		M	LA HIP returns
Overcrowded households	X		W	Census
Poor private sector housing – modelled from 1996 English house condition survey with RESIDATA	X		M	EHCS/ RESIDATA
Proportion of housing in disrepair (1998 Welsh House Condition Survey)		X	M	WHCS
Proportion of houses w/o central heating (1998 Welsh House Condition Survey)		X	M	WHCS
Proportion of housing w/o roof/loft insulation (1998 Welsh House Condition Survey)		X	M	WHCS
<i>Geographical access to services by those on low income</i>				
Access to a post office	X	X	W	GPO(PO Counters)
Access to large food shops	X	X	W	Data consultancy
Access to a GP	X	X	W	NHS, BMA
Access to a primary school	X		W	DfEE
Access to accident and emergency hospital facilities (Welsh ambulance services NHS Trust)		X	W	WAST
<i>Income</i>				
Adults in income support households	X	X	W	DSS
Children in income support households	X	X	W	DSS
Adults in income based job seekers allowance households	X	X	W	DSS
Children in income-based job seekers allowance households	X	X	W	DSS
Adults in family credit households	X	X	W	DSS
Children in family credit households	X	X	W	DSS
Adults in disability working allowance households	X	X	W	DSS
Children in disability working allowance households	X	X	W	DSS

(Continued)

Table 6.4. (Continued)

<i>Components</i>	<i>IMD</i>	<i>Welsh IMD</i>	<i>Level</i>	<i>Source</i>
Non-earning, non-IS pensioner and disabled council tax benefit recipients (DSS) apportioned to wards	X		M	DSS
People in HB/CTB households who are not in receipt of income support, JSA(IB) or family credit/working families tax credit (HBMS)		X	WM	

Note: W, ward level data (electoral division in Wales); M, higher level data that has been modelled down or apportioned to ward level; H, higher level data applied unmodified to wards; WM, ward level data with modelling used to fill some gaps in supply.

6.4 Geo-classification and Other Area Classification Systems

Though not primarily designed to measure deprivation or poverty, there are several widely used classifications that distinguish areas by their types of housing and/or populations. At least one of the classifications, Super-Profiles, provides a ranking of types roughly corresponding to levels of disposable income.

The Office for National Statistics Area Classification

This classification “provides a simple indicator of the characteristics of areas and the similarity between areas, for comparative or targeting purposes, and a variable for analysis with other data”. It is based on 37 socio-economic and demographic variables from the 1991 Census. A stepwise clustering procedure groups similar authorities and results in a three-level classification (for the 406 local authorities) of: 7 families, 15 groups and 27 clusters. Examples of the titles used for the groups include: rural areas, remoter rural, urban fringe, coalfields, ports and industry, and prosperous England.

An attractive feature of this method is that it provides a measure of the distance/difference between authorities and groups of authorities, and that these can be pictorially represented to give an indication of the relationship between the various types.

The classification has recently been re-computed to take account of the changes in local and health authority boundaries. The results are freely available from the ONS website. There is a ward level classification that can be purchased from the same source.

ACORN and SuperProfiles

Two major marketing companies have produced methods for classifying the population of areas to assist in advertising, marketing and product targeting. Both sell products that convert postcodes to their population categories; they also have large databases of the purchasing and life-style patterns of these population groups.

The ACORN system, (www.caci.co.uk) is entirely based on Census data and uses variables such as age, education, SEG, housing tenure and car ownership. The 17 ACORN primary groups are described both in terms of area type (predominately referring to housing stock) and types of resident. For example, Group 4 is “affluent executives, family areas”, and Group 13 is “older people, less prosperous areas”.

The 17 groups are sub-divided into 54 types. For example, Type 5, a subset of Group 1 “wealthy achievers, sub-urban areas”, is described as “mature, well-off suburbs”.

The SuperProfiles system (from CLARITAS) bases its classification on a slightly wider range of sources and uses credit information and market research data in addition to Census variables. It is a three-level system. The most detailed level divides areas into 160 SuperProfile Clusters, which are based on 40 market profile groups, which, themselves are sub-categories of 10 SuperProfile Lifestyles. Examples of these lifestyles are: affluent achievers, thriving greys, hard-pressed families and have-nots.

Both the ACORN and SuperProfile systems have been used to present information on health inequalities. It looks as though the Department of Health has licensed at least one version of the SuperProfile system for internal use. There has been little evaluation of the effectiveness of these profiles as proxies for deprivation. Aveyard et al. [207] considered the relationships between mean birth weight and both Townsend deprivation scores and ranked versions of the SuperProfile Lifestyle and Target Market groups, and found that the SuperProfiles approach may not be suitable for very small-scale work as the analysis was based on sub-ward or enumeration district. Further evaluations would be helpful, as there is considerable interest in using SuperProfiles as a tool for mapping health inequalities.