Rural deprivation and service need:

a review of the literature and an assessment of indicators for rural service planning
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Summary

The aims of this report are as follows:

- To review the range of ways in which ‘rurality’ is defined and measured, and the implications of this for policy makers (section 2).
- To review existing methods of measuring deprivation and to determine how well they identify rural deprivation (section 3).
- To advise on what measures currently (if any) are best placed to detect rural deprivation (section 4).
- To identify any existing methods of measuring distance and access in the public or commercial sector (section 5).

The report is structured around an understanding that, if rural agencies are to make clear statements of the funding they require to deliver services to their communities, they require 1) indicators that are sensitive to the way in which social disadvantage is expressed in rural areas and 2) methods of accounting for the additional costs of providing services to dispersed and/or peripheral areas.

The main conclusions of the report are as follows:

- The way in which rurality is defined will have important implications for the way in which service needs and problems of access are interpreted.
- Peripherality appears to be associated with high levels of disadvantage (including poor health status). However, when rural areas are defined on the basis of alternative measures, such as settlement size and population density, the problems faced by peripheral communities tend not to be captured.
- Measures of rurality alter with the scale at which analysis takes place. Key aspects of rurality (and indeed rural deprivation) cannot always be gauged from standard indicators where the unit of analysis is too large to capture the greater degree of heterogeneity that characterises rural areas.
- Indicators that capture deprivation in an urban context (e.g. car ownership, unemployment) should not be expected to perform similarly in rural areas.
- When focused studies have been undertaken, significant problems relating to employment, low incomes, housing, transport and education have been revealed in rural areas.
- The assumption that rural environments are inevitably ‘healthier’ is increasingly open to challenge – rural mortality advantages disappear after controlling for socio-economic status and limiting long-term illness appears to be subject to a U-shaped pattern of prevalence, the highest rates being observed in the most urban and the most peripheral areas.
- Service deprivation emerges as a key component of disadvantage in rural areas. For example, a recent survey of British local authorities found that rural authorities traditionally spent less on social care services and direct provision. Accessibility problems, self-reliance, lower expectations of services and a lack of anonymity also combine to ensure that service needs are not explicitly registered.
- Three main options have emerged for the development of more appropriate indicators of measuring rural disadvantage. These are 1) measures that reflect multiple dimensions of deprivation; 2) the use of direct measures of service need rather than proxies; and 3) methods that enable planners to develop people-based rather than area-based policies in heterogeneous rural areas.
- When, as is often the case, deprivation is used as a ‘proxy measure’ for specific service need, direct methods provide more robust and transparent indicators than general (or summary) deprivation indicators. In recent years there has been considerable progress in developing needs estimates that are both directly tailored for specific service sectors (e.g. employment, housing, education, health) and that are created for functionally meaningful units (e.g. schools, general practices, primary care trusts) rather than census administrative areas.
- Of the summary measures of deprivation that are available, the Index of Multiple Deprivation 2000 is found to exhibit the closest overall association with standardised illness and mortality ratios. It also has by far the strongest association in rural areas, suggesting that it is able to best express rural disadvantage as it impacts upon health status.
- The investigation of utilisation is of key interest to service providers who are seeking to monitor equity of access. Nevertheless, it is generally accepted that, because utilisation is influenced by some factors that lie outside the control of service providers, potential accessibility (the physical availability of services) is a more realistic and legitimate target for policy intervention.
- Reviewing recent developments in the measurement and modelling of potential accessibility, we find that, using travel time (which is generally superseding the use of straight line distance), more people in rural areas appear to have reasonable access to basic services than has been thought in the past. In light of this rural
service providers might more usefully focus on the question of how to improve access to more specialist services.

- With regard to capturing the additional costs of providing rural services, modelling (which includes simulation, algorithm and cover range approaches) has proved useful in helping planners to quantify the resources required to achieve basic access standards. The modelling of service accessibility has also made explicit the fact that activities such as ambulance response times do vary between rural and urban contexts.
### Glossary

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>ACRE</td>
<td>Action with Communities in Rural England</td>
</tr>
<tr>
<td>CAB</td>
<td>Citizens Advice Bureau</td>
</tr>
<tr>
<td>CTB</td>
<td>Council Tax Benefit</td>
</tr>
<tr>
<td>DETR</td>
<td>Department of the Environment, Transport and the Regions</td>
</tr>
<tr>
<td>DH</td>
<td>Department of Health</td>
</tr>
<tr>
<td>ED</td>
<td>Enumeration District</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>GIS</td>
<td>Geographical Information System</td>
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<tr>
<td>HAZ</td>
<td>Health Action Zone</td>
</tr>
<tr>
<td>HB</td>
<td>Housing Benefit</td>
</tr>
<tr>
<td>LAs</td>
<td>Local Authorities</td>
</tr>
<tr>
<td>ILC</td>
<td>Index of Local Conditions</td>
</tr>
<tr>
<td>ILD</td>
<td>Index of Local Deprivation</td>
</tr>
<tr>
<td>IMD 2000</td>
<td>Index of Multiple Deprivation 2000</td>
</tr>
<tr>
<td>IS</td>
<td>Income Support</td>
</tr>
<tr>
<td>MAFF</td>
<td>Ministry for Agriculture, Fisheries and Food (now DEFRA, Department for Environment, Food and Rural Affairs)</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service</td>
</tr>
<tr>
<td>ONS</td>
<td>Office for National Statistics</td>
</tr>
<tr>
<td>RDA</td>
<td>Rural Development Area</td>
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<tr>
<td>RDC</td>
<td>Rural Development Commission</td>
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<tr>
<td>SDRG</td>
<td>Social Disadvantage Research Group (University of Oxford)</td>
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<tr>
<td>SSA</td>
<td>Standard Spending Assessment</td>
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</table>
1 Introduction

There is a strong and growing concern amongst those involved with rural policy making that traditional measures of disadvantage fail to disclose levels of need for services in rural areas. This is in part a reflection of the fact that the statistical indicators used fail to reflect the nature of rural deprivation. Disadvantaged and poor households in rural areas are unlikely to be spatially concentrated, they tend to live amongst the more affluent and the actual numbers involved tend to be small. Their presence is thus unlikely to make much of a statistical impact on an area (e.g. a ward or parish) basis. Commonly used indicators (such as unemployment and car ownership) perform in different ways in urban and rural contexts whilst potentially useful indicators (such as ways of capturing social isolation) tend not to be available.

There is thus growing acknowledgement that poverty and deprivation differ between the city and the countryside and that this is not adequately captured in standard deprivation measures. However, the search for high quality indicators to inform rural service planning is complicated by the fact that disadvantage in rural areas is not merely a function of individual level attributes or household composition, but is inextricably linked to characteristics of the wider area. Some rural areas are more sparsely populated than others, some are located near to urban centres or large towns, while others are not in close proximity to supporting urban services. These differing area characteristics are associated with differing economies of scale for service providers that can have important implications for service accessibility and quality. For example, the higher unit costs in very sparse areas (where there are lower catchment populations) or in highly peripheral areas (where economies of scale associated with cross boundary flows in service use cannot be achieved) make attempts to promote equity of access considerably more difficult. The identification and measurement of service need in rural areas thus rests upon:

- the development of indicators of disadvantage that are sensitive to the multiple ways in which deprivation may be experienced by people in rural areas; and
- the development of methods that capture the geographical dimensions of rurality that impact upon service provision and utilisation.

This report begins with a discussion of what is meant by rurality itself (section 2). This is because the way in which rurality is defined will have important implications for the way in which service needs and problems of access are interpreted. There is growing interest, for example, in the way in which peripherality appears to be associated with high levels of deprivation, low health status and poor service access.

Measures of rurality also alter with the scale at which analysis takes place. Key aspects of rurality and rural deprivation cannot always be gauged from standard indicators where the unit of analysis is too large to capture the heterogeneity that characterises rural areas. This issue is taken up in section 3, which reviews different ways of measuring rural deprivation and illustrates the difficulties of representing such need on an areal basis. The section concludes with a description of the various ways in which indicators are currently being improved, which include the development of measures that reflect the multiple dimensions of deprivation and the use of direct measures rather than proxies.

In section 4 we present an empirical analysis of the way in which different indices predict deprivation in rural areas and of their sensitivity to phenomena that are known to be associated with disadvantage. To this end, we examine how different deprivation indices predict variations in standardised illness and mortality ratios. We conclude that the DETR Index of Multiple Deprivation 2000 is best able to express the impact of disadvantage in rural areas. Finally, section 5 relates to the issue of accessibility. Here recent developments in the measurement and modelling of potential accessibility are reviewed.
2 Defining rural areas

2.1 Introduction

Rurality is now increasingly recognised as a phenomenon worthy of its own policies and ‘an essential component of policy making in general’ (Noble and Wright, 2000:294). Performance indicators are informing the strategies being drawn up by Regional Development Agencies in England, whilst government consultation on the Rural White Paper (DETR/MAFF, 2000) actively sought ideas for appropriate indicators for rural areas. Meanwhile, in a European context, the development of broader rural development policies within the Common Agricultural Policy similarly requires information on the incidence of disadvantage within rural areas beyond the agricultural sector (Hodge et al., 2000).

However, the definition of rurality is far from straightforward (see for example Halfacree, 1993) and the delineation of rural areas is highly dependent not only on the definition employed but also on the size of the spatial unit selected. This has important consequences for the ways in which levels of service need, provision and utilisation appear to vary between rural and urban areas. Martin et al. (2000) have examined how the representation of deprivation and low health status changes markedly using alternative measures of rurality. For instance, the profound problems faced by many peripheral communities are not always reflected when rural areas are defined on the basis of population density. Similarly, the aggregation of small areas of rural deprivation into larger areas and the incorporation within them of low-density affluent rural settlements serve to obscure many aspects of rural deprivation.

Unfortunately, there is no definitive way of describing what constitutes a rural area, or one definitive or preferred measurement of rurality. Most commentators choose definitions and measurement systems that are best suited to their own application, taking into account issues of data availability, quality, consistency and ease of collection. This has led some to question whether evidence of rural-urban differentials in health service need and utilisation has been subject to methodological artefact (Higgs, 1999).

Whilst there remains little agreement on what is meant by the term ‘rural’, it is possible to identify six broad approaches to the measurement of rurality (Chapman et al., 1998; Higgs, 1999). These, which are discussed in this section, include:

- measures of settlement size;
- population density/sparsity;
- accessibility to services;
- peripherality;
- land use; and
- multivariate classifications.

The latter tend to comprise a combination of primary characteristics of rurality (e.g. sparsity and peripherality) and secondary characteristics such as a limited range of employment, a lack of services, low levels of provision of public transport and a high proportion of pensioners. The merits and limitations of multivariate classifications are discussed below. At this stage, however, it may be useful to emphasise the fact that secondary characteristics ‘are often (historically, but by no means logically) consequences of being a small scattered population, and not defining features per se’ (Noble and Wright, 2000:297, original emphasis).

2.2 Settlement size

Settlement size has been commonly used to define rural areas. However, Shucksmith (1990) notes the lack of international consensus on settlement size thresholds. In England, the Countryside Commission defines rural parishes as those comprising populations of less than 1,000, while Phillimore and Reading (1992) used wards with a population below 5,000 in their study of rural health inequalities. By contrast in Sweden, settlements are only defined as rural if they comprise less than 500 people. In the United States, towns with populations over 2,500 are classified as urban and all other settlements are defined as rural, while in Greece, rural settlements are those with less than 10,000 residents.

In addition to variation in thresholds between countries, the use of settlement size is complicated by the difficulty of defining settlements in the first place. The parish is one of the most stable spatial units available in England. However, key data are not available for all parishes throughout the country. Area units such as electoral wards are used nationally. However, these vary erratically in size (Coombes and Openshaw, 1991) and their interaction with underlying settlement patterns is inconsistent. For example, an urban ward may be but a small part of a major settlement. In a rural area, a single ward may contain one or more different villages, whilst in a peri-urban location, a ward may contain a mix of different villages and part of a major urban area.

2.3 Population density

Population density is probably the most widely used measure of rurality (Martin et al., 2000) which, in addition to distinguishing urban from rural areas, can be used to discriminate between rural areas. Population density has the advantage of being intuitive and easy to calculate. As a continuous variable, the results can be ranked, making comparison with other areas
straightforward. However, simple population density takes no account of the distribution of population within areas. For example, an urban industrial ward that contains a large open space would, by virtue of its low population density, emerge as ‘rural’ using this measure. Equally, population density does not adequately capture the type of rurality where very sparsely populated areas are interspersed by small towns. Craig (1987) examined how Cornwall and Somerset compare using population density as a measure of rurality. At the Enumeration District (ED) level, the counties have a similar urban/rural distribution of 65% to 35% respectively. However, in Cornwall, urban areas are smaller and more numerous, so Somerset has more purely rural wards.

As with other measures of rurality, decisions also have to be made about appropriate threshold values that define urban and rural population densities. Martin et al. (2000) outline how over time, researchers have used differing levels of population density to define rural areas. In the Standard Spending Assessment (SSA), measures of sparsity and super-sparcity, based on the average number of people per hectare in each ward at the 1991 census, are used with respect to education and other services (e.g. refuse disposal, leisure services, libraries, planning and benefit administration). The process by which these thresholds were established is not clear.

Like standard population density measures, sparsity and super-sparcity also fail to take account of population clustering, a factor that will bear strongly upon the economies of scale that can be achieved in providing services to meet population needs. Indeed, work conducted for the Rural Development Commission in 1996 suggested that the SSA adjustment bears little relation to the higher costs actually faced. ‘The sparsity factor...is worth only £16 per head to the receiving authorities – and little or no recognition is given to measures of rural deprivation such as the effects of social isolation on the need for social services for the elderly.’ (R Hale and Associates and IPF 1996:vii.) Suffolk County Council, for example, calculated that the costs of sparsity were under funded by £10 million for an additional £500,000 in their SSA to reflect the effect of sparsity on domiciliary social services for older people (Suffolk County Council, 2000).

There are various forms of weighting that can be applied to population density to take account of the way in which populations are clustered around specific geographical points. These include measures such as the weighted population density (WPD), geometric mean density (GMD) and population potential. These measures are relatively simple to calculate. However, they are not as easy to interpret as the conventional measure of population density. They are also limited in their ability to differentiate between types of rural area as they do not adjust for factors such as proximity to built up areas.

2.4 Accessibility

An interesting alternative measure of rurality is that of nearest neighbour distance. The mean distance between all residential locations, for example, can be calculated using a geographical information system (GIS). This provides a continuous variable that, unlike standard population density, takes some account of the degree of clustering within the spatial unit of interest. This is important as two administrative areas will have very different values if the population of one is widely dispersed and the other is concentrated in a single settlement. Nearest neighbour distance is also complementary to those measures of accessibility that seek to identify distance to higher-level service centres, as it describes geographical isolation at the local level.

As discussed in section 5 below, measures of accessibility can be used to distinguish between rural and urban areas. Accessibility concerns the physical availability of facilities and services and attempts to capture the ease with which a defined population can access services. Until recently, this tended to be reduced to crow-fly distance. However, travel times can now be readily computed using Geographical Information Systems (GIS) and are increasingly being incorporated into attempts to model access and utilisation of services in rural areas. As access standards are gradually being established in very diverse areas of service delivery, there are growing demands for standards that explicitly acknowledge the difficulties that rural providers can face in delivering services to dispersed populations. As a proxy for rurality, however, accessibility suffers from similar inconsistencies in terms of interaction with settlement type as does population density. There are, for example, small towns that are further away from centralised facilities than farming communities on the edge of cities.

2.5 Peripherality

Peripherality is an important dimension of accessibility and has been used to highlight service access problems associated with rurality in a number of academic studies (e.g. Bentham and Haynes, 1986). Philips and Williams (1984) describe peripherality as areas that experience disadvantage in the core/periphery relationship. While terrain, climate and remoteness are the physical aspects, social aspects such as low incomes and ageing populations predominate. In major reviews of health resource allocation systems in Scotland and Wales

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1 For education ‘sparsity’ is the percentage of an authority’s population which lives in wards where the density of population is between 0.5 and 4 people per hectare and ‘super-sparcity’ is the percentage of an authority’s population which lives in wards where the density of population is 0.5 or fewer people per hectare (DETR 1997a) with super-sparcity given twice the weight of sparsity. The definitions for other services are the same but measured at ED level.
peripherality has been identified by the term 'remote rural' to differentiate it from purely rural. The reviews have focused on the difficulties faced by remote rural areas where distance to the facilities and markets of large urban centres gives a level of disadvantage to the resident population. Other aspects of peripherality include geographical barriers such as an extensive coastline, mountains or poor roads. Thompson (1996), for example, notes that the physical landscape of Cornwall (which has a long indented coastline) results in the need to duplicate fire service facilities in a short linear distance. The location of settlements on the coast effectively reduces the potential service catchment area because much of this is sea. The long, narrow nature of the peninsula exacerbates problems of peripherality as there is reduced scope for achieving economies of scale by sharing service provision with neighbouring providers. England contains a number of peripheral areas which makes this concept of relevance to rural health in the country. In addition to Cornwall, these include East Anglia, Cumbria and North Yorkshire.

2.6 Land use

It can be seen that no one form of measurement of rurality will capture all the aspects needed to differentiate different types of rural areas. One way to avoid the problems of partial definition and threshold setting which are common to the preceding measures of rurality is to use multivariate area classification schemes, and to attempt to identify those area types which together define rural areas.

The Office for National Statistics (ONS) has defined every ED in the country as urban or rural on an urban land use basis (OPCS, 1992). What is not urban is by default rural. As EDs are the building blocks of wards, this allows wards to be classified as urban or rural, on the basis of their constituent EDs. Rurality can also be described simply in terms of economic activity, such as a baseline percentage of those involved in agriculture or the extractive industries, although with the demise of the numbers employed in both these industries it becomes a less reliable marker.

2.7 Multivariate data classifications

A range of multivariate data classification approaches is also available. Many of the standard geodemographic classifiers (Birkin, 1995) include rural area types, although these do not constitute a standard definition. The first major use of principal components to describe rural areas was undertaken by Cloke in 1977 and then revised using 1981 census data (Cloke and Edwards 1986). They analysed a variety of factors related to rurality, including population density and occupation, and constructed an index to group non-urban local authority districts into rurality quartiles from extreme rural to extreme non-rural, excluding districts defined as metropolitan or urban. The variables contained in this analysis included distance from the nearest urban node with a population of over 50,000, population density and persons over 65. ONS have also used principal components and cluster analysis on 1991 census data to produce a national ward classification comprising 14 area groups, two of which are 'rural areas' and 'rural fringe' and a total of 40 clusters (Wallace et al., 1995).

The theoretical advantages of these classifications are that they provide a multi-dimensional view of social circumstances allowing areas with a similar set of socio-economic and environmental characteristics to be grouped. A corresponding disadvantage is that there is no rank order to the classification. Techniques such as principal components analysis may help in understanding covariance structures and in the identification of the major factors characterising rurality. However, they do not result in clearly labelled definitions of rurality.

2.8 Conclusion

The debate about which measures most effectively capture rurality is not merely academic. There has been growing concern amongst health authorities serving rural populations that resource allocation mechanisms fail to incorporate rural dimensions of need which take into account supply side factors and the fact that there are additional costs involved in providing rural health services. The difficulties faced by such authorities will vary, however, according to the type of rural area they serve.

The point can be illustrated by returning to the example of Cornwall and Somerset which, according to some population density measures, have comparable levels of rurality. Somerset has long borders with Devon, Dorset, Wiltshire and Avon. It is therefore able to share services with neighbouring counties in a way that increases accessibility for its resident population and achieves economies of scale for its service providers. Cornwall, by contrast, is surrounded by sea on three sides and bordered by a river with few crossing places on most of its fourth side. As a result, the difficulties that this county faces in providing similar levels of service accessibility are considerably more pronounced.

The way in which we conceptualise rurality will therefore have important implications for the way in which service needs and problems of access are interpreted. There is no smooth continuum from 'urban' to 'rural' as implied by continuous measures such as population density. Such measures can conceal important differences between urban and rural areas, and between and within rural areas. Measures of rurality also alter with the scale at which such analyses take place. Key aspects of rurality and, as discussed in the next section, rural deprivation, cannot always be gauged from standard indicators where the unit of analysis is too large to capture the heterogeneity that characterises rural areas.
3 Measuring deprivation in the rural context

3.1 Introduction

There is a strong and now well-documented concern that indicators of disadvantage fail to depict accurately the existence of need in rural areas. Shucksmith et al.'s review of rural disadvantage for the Rural Development Commission (1996a) demonstrated very clearly how problems of deprivation that are visible in urban areas are hidden in rural areas. This has been borne out graphically by a number of important local studies; Scott et al.'s work in the Peak District National Park (1991) and Welch's study of life in rural Suffolk (1996) are good examples. In the words of Scott et al.: 'There is a danger of lapsing into cliche here, but the shrug of the shoulder to questions about not having things urban people have and expect...was very real' (1991:49). This situation was described as a 'case of having to make do' and 'that's the way things are'. This sense of resignation extended to public transport, access to Job Centres, the DHSS and CABs, services critically connected to employment, income, advice and information.

If we lack accurate measures of need then we also lack the means either to allocate resources equitably or to determine policy appropriately. As Action with Communities in Rural England suggests:

The lack of a set of indicators that adequately reflect the true level of need in rural areas, coupled with the tendency to associate rural areas with the vision of the 'rural idyll' will continue to be the sharpest form of social exclusion faced by people living in rural communities. (ACRE, 1998:16)

Recent years have thus seen increasing attention paid to describing the problems faced by people in rural areas, explaining these in the context of the prevailing socio-economic, cultural and political conditions, comparing reality with the available statistical measures, and attempting to increase the accuracy of these measures.

This section of the report draws on the established literature, together with a survey of rural local authorities and health authorities, to define and describe rural deprivation and to illustrate the difficulties associated with representing such need on an areal basis. Specifically, it describes what is understood by the concept of deprivation, outlines the dimensions of rural deprivation as experienced by people on a day-to-day basis, and illustrates why traditional indicators of disadvantage fail to show this need. The section concludes with a description of the various ways in which indicators are now being improved, including more accurate classifications of rurality, the use of direct measures rather than proxies and a focus on individuals rather than areas.

3.2 Defining rural deprivation

There is a substantial literature on poverty, disadvantage and, more recently, social exclusion (see e.g. Oppenheim, 1993; Alcock, 1993; Room, 1995; Cloke et al., 1995a). All remain, to a degree, contested, but equally all remain linked to the desire to see improvements.

Poverty

The concept of poverty has traditionally been defined in absolute terms. The influential work of Rowntree in Victorian England, for instance, focused on conditions where people were unable to provide the minimum of food, clothing and shelter for the maintenance of merely physical health (Rowntree, 1902). Such a definition, with its focus on sustaining life, is no longer seen as adequate given the wider significance of low income as a barrier to social participation and inclusion. A key point in the shift towards understanding poverty as a relative, rather than an absolute, concept was established by Townsend who defined poverty as existing whenever people 'lack the resources to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary...in the societies to which they belong' (Townsend, 1979:88).

A continued broadening of the debate to include not only deprivation or disadvantage but also social exclusion and the mechanisms necessary to increase inclusion has intensified this shift away from a focus on poverty alone (see Howarth et al., 1998). Again, however, there is no unanimity. Cloke and Little, for instance, suggest that attention should continue to be directed at poverty not deprivation.

Deprivation presents a word-bin into which all manner of incongruities in rural life may be placed, without any particular impetus to ascribe them as problematic, or to do something about the problems concerned. (Cloke and Little, 1997:255.)

Deprivation

Definitions of deprivation and disadvantage remain typically quite general, for example, ‘a state of ...observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belong’ (Townsend, 1987). Or, with an emphasis on the rural context, ‘a set of economic and social conditions which have the potential to cause problems for individuals or particular social groups within rural areas, or a lack of resources (material, cultural, social) which excludes people from the styles of life open to the majority in the countryside’ (Shucksmith et al., 1996a).
The emphasis is thus on the outcomes experienced by individuals rather than on the social systems that have led them to those circumstances (see e.g. Shucksmith and Philip, 2000).

**Social exclusion**

In contrast, social exclusion is defined as the dynamic process whereby the systems of social integration fail. For example, the welfare system (particularly in rural areas) fails to make sure that those on low incomes claim their full entitlements, the social housing system in rural areas fails to provide affordable housing, and the variability of service provision by area acts to the detriment of rural communities. On the other hand, informal family/friend support networks and the voluntary sector together constitute an alternative system that promotes social inclusion. Rural areas have traditionally been regarded as more successful in providing local support networks. Informal processes may now be weakening such local support networks in some areas leading to increasing isolation for particular groups.

Shucksmith and Chapman (1998) suggest the distinction between poverty and social exclusion is thus clear. The former focuses on static outcomes, the latter on a dynamic process. Conversely, Atkinson (1998) suggests the concept of social exclusion has yet to be adequately consensually defined or measured at the small area level.

**The importance of context**

What is clear is that firstly, whilst poverty, deprivation and social exclusion are much debated, ‘rural poverty is a less considered problem’ (Davis and Ridge, 1997:9) and secondly, that definition is contextually dependent. Thus, a Local Government Association survey, following the establishment of the Social Exclusion Unit in the Cabinet Office in December 1997, found that whilst half of all local authorities had staff dedicated entirely to social inclusion and poverty work ‘county and district councils were least likely to have dedicated staff, and metropolitan authorities were most likely’ (Local Government Association, 2001:2).

The nature of deprivation and the composition of deprived groups will vary according to the dimensions considered. In turn, ‘the way that deprivation is defined invariably determines the way that it is measured. This makes definition a key feature in any discussion’ (Pion Economics, 2000:45).

**Introducing the rural**

This immediately raises the question as to what we mean by rural deprivation as opposed to deprivation *per se*. How is it distinct from urban deprivation? It is clearly the case that households, rather than administrative areas, suffer deprivation and many aspects of deprivation experienced by people in rural areas are nominally, at least, similar to those experienced by people anywhere: low incomes, lack of affordable housing, difficulties in childcare arrangements, problems of old age, or unemployment. However, some problems are likely to be experienced to a greater or lesser extent, or assume greater significance, in rural rather than urban areas. ‘While rural deprivation inevitably shares some of the features of traditional urban deprivation, it is not a parallel paradigm and tends to involve dimensions that reflect the difference in geography between urban and rural areas.’ (Pion Economics, 2000:6; see also Scott and Russell, 1999.)

An early and important contribution to the understanding of rural, rather than urban deprivation was provided by Shaw (1979) who identified three main contributory factors potentially leading to a ‘self-sustaining spiral of (rural) disadvantage’. These involve:

- resource deprivation as embodied in problems of low income and housing;
- opportunity deprivation which relates to availability of services (for example, health and recreation); and
- mobility deprivation which concerns transport costs and the inaccessibility of jobs, services and facilities.

Pion Economics (2000) suggest that whilst resource deprivation is likely to differ in nature and severity according to location, it will be present in both urban and rural areas. In contrast, opportunity and mobility deprivation derive specifically from the role of rural geography. Examinations of rural deprivation must, therefore, be sensitive to the particular circumstances facing rural households, both in terms of inequality of outcomes and inequality of opportunities.

**Introducing the individual**

It follows that objective measures of deprivation alone are insufficient. We also need to consider how individuals actually perceive and experience life in a rural area. As Copus et al. (1996) suggest, quantitative research is required to establish how many households could be described as poor, but it requires a qualitative approach to identify what being poor actually means.

There is a considerable literature which does just this (e.g. Bradley et al., 1986; Cloke, 1995a, 1995b, 1996; Shucksmith et al., 1996a; Woodward, 1996; Matthews et al., 2000). There is also a considerable literature that draws on the individual and local to graphic effect often in a specific attempt to influence policy (see for example, Mullins et al., not dated; Derounian, 1993; Newton, 1993; Davis and Ridge, 1997 and Halliday, 1998).

However, the powerful myth of the rural idyll, in which ‘rural’ and ‘exclusion’ are often seen as mutually exclusive terms, combines with a lack of anonymity so that ‘those who experience different kinds of deprivation...conceal their condition’ (Scott, 1993:62). In this way serious social problems can be denied, attributed to a point in the past or constructed as a failure of the individual, and there is a similar reluctance to seek assistance. People’s subjective assessment of their poverty also tends to contradict objective definitions (Shucksmith et al., 1996b).
Defining rurality
As discussed in section 2 of this report, the definition of rurality is, like the definition of deprivation, far from straightforward. Martin et al. (2000) go so far as to argue that the distorted representations of both rural areas and deprivation which are currently available should seriously challenge our existing understanding of some basic research issues concerning rural deprivation and its relationships with other phenomena such as morbidity and mortality. The combination of standard deprivation indicators and standard measures of rurality can thus both contribute to the inadequate measurement and understanding of rural deprivation.

Choice of indicators: the meaning attached to indicators in common use
A first problem concerns the ambiguity associated with a number of potential indicators such as car ownership and levels of social housing. An obvious corollary is behavioural differences, reflecting not just (as in these examples) an increased pressure to purchase but, for example, job-search behaviour and the take-up of benefits.

Car ownership
Car ownership, particularly multiple ownership, for instance, tends to be associated with resource availability; money is required to purchase a vehicle and to insure and run it. In rural areas, however, the dispersed nature of employment and services together with the lack of public transport means that car ownership is often considered a necessity and, for household mobility as opposed to mobility for one individual within a household, multiple car ownership will also often be considered a necessity. Pacione, working in rural Scotland, thus found that low-income rural residents were more likely to own cars than their urban counterparts, suggesting an extent of enforced car ownership (Pacione, 1995). For the residual population without a car, or those lacking access to a car within car-owning households, the problems are intensified by minority status.

Unemployment
Unemployment is similarly problematic. The validity of claimant counts has long been questioned as a measure of unemployment in rural areas. People may, for instance, be more likely not to register as unemployed, or to categorise themselves instead as sick, retired or self-employed. This can be in response both to the local labour market (a paucity of local jobs, a restricted range of employment opportunities for all those who wish to participate in the labour market) and to the stigma still seen to be attached to unemployment.

3.3 Indicators of disadvantage fail to show the existence of need in rural areas
The above discussion has shown that the process of identifying urban deprivation is not directly transferable to the identification of rural deprivation. It follows that indicators devised in an urban context should not be expected to perform a similar function in rural areas (see Dunn et al., 1996a; Midwinter and Monaghan, 1990 and Bruce et al., 1995). The reasons for this have been rehearsed many times. Essentially, commonly used indicators (such as unemployment and car ownership) perform in different ways in the urban and rural context, as outlined later in this section, whilst useful indicators (such as ways of capturing social isolation or the cost of delivering services) tend not to be available. People may also respond by moving away in search of jobs or homes, thus removing evidence of the problem. For instance Centrepoint, working in rural Devon, suggest that the reason there are so few young people claiming housing benefit within the South Hams area could be ‘the acute shortage of affordable, accessible private sector accommodation in the area’ (Centrepoint Devon, 1997:111).

Additionally, disadvantaged and poor households in rural areas are unlikely to be spatially concentrated, they tend to live amongst the more affluent and the actual numbers involved tend to be small. Their presence is thus unlikely to make much of a statistical impact on an area (e.g. a ward or parish) basis. A household rather than area-based approach has therefore been suggested as more appropriate to rural deprivation (see e.g. Hodge et al., 1996).

At the same time the quality of life experienced within rural areas can depend upon conditions at a very local level. For those without access to private transport, gaining access to facilities even a few miles away can represent a significant obstacle. Again, therefore, the definition adopted, the choice of indicators and the way in which location is handled are critical.

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The work of Dunn et al. (see below) attempts to compensate for such problems by following Beatty and Fothergill’s approach (1997) taking a broad definition of unemployment. It thus includes not only unemployed claimants, but census self-reported unemployed, those on government schemes, the permanently sick and the early retired. Any excess within the local labour market is calculated relative to a baseline established in the South East, with higher rates taken to represent the effects of fewer employment opportunities and lower levels of labour market participation. However, as the authors admit, this still assumes that behaviour in rural areas does not differ from elsewhere. If, for example, people who retire early or who are permanently sick choose to move to rural areas they would be inappropriately recorded as the ‘hidden unemployed’ by this method.

2 Where the economy is considered buoyant enough to offer opportunities for all those who wish to participate in the labour market.
Self-employment
In the absence of a census-based question on income, self-employment has been argued by many to be an important indicator of need in rural areas (see for example Peak District Deprivation Forum reported in Hodge et al., 2000). Again, this is a different interpretation to the one that would prevail in urban areas. Pacione (1995) for instance, found a significant correlation between self-employment and households with two or more cars for urban areas. In rural areas, however, there was a strong correlation between self-employment and households with no car. Thus whilst the presence of self-employment in urban areas might be interpreted as indicative of higher income earners the reverse may hold in rural areas.

Indeed, it has also been suggested that high rates of self-employment may depress benefit take-up, because occasional, short-term, seasonal or contract work and irregular agency work mean that people working in this way do not fit easily into the administrative categories used by the tax and benefit authorities (Jordan et al., 1992). Meanwhile, 'a higher proportion of the labour force in self-employment implies that more people approaching retirement age will not face retirement at a fixed age' (Phillipson, 1998:81).

Evidence of this kind shows how the same indicator can have very different implications for the measurement of deprivation across the urban/rural spectrum.3

The requirement for additional indicators
There is also a wide variety of factors potentially associated with rural disadvantage in addition to those typically included in national indices, for example, access to transport, services, and the housing market, together with issues related to gender, culture, isolation and powerlessness. Even within Dunn et al.’s comprehensive approach to describing rural disadvantage notions of economic vulnerability and social isolation appear not to be readily amenable to measurement (see Hodge et al., 2000; also Somerset Health and Social Needs Analysis Group, 1999).

Reliance on census-based data
The reliance of traditional deprivation measures upon census-based data is also partly responsible for their urban bias. Most studies (see below) perceive levels of service provision and accessibility to be important facets of rural deprivation but these are not measured by census-based indicators. Indeed, the fact that the census occurs only every ten years and cannot take account of intervening changes may also be more limiting in the smaller, and hence statistically more volatile, rural areas than in their urban counterparts.

There are of course also a number of more general concerns regarding the several composite indicators based primarily on the census. These include the choice of indicators, the inter-relationships between indicators leading to the possibility of ‘double-counting’, the statistical methodology by which a composite indicator is calculated, the weighting attached to individual indicators and their spatial bias (Lee et al., 1995; Gordon, 1995; Simpson, 1996; Higgs and White, 2000).

Relationship with policy
Indicators are chosen because they have the potential to track the process of change or the performance of public or private initiatives and the achievement of political goals. There are inevitably problems in ensuring that the chosen indicators effectively capture policy objectives, particularly when policies have multiple goals, some of which are inherently qualitative. The question then becomes whether it is possible to ‘identify quantifiable variables that are in some way causally linked to those qualitative objectives’ (Hodge et al., 2000:1871) or indeed, whether they are effectively linked to policy objectives at all. It is not only that existing indicators ‘may not serve to reveal adequately the nature of rural disadvantage’ (Dunn et al., 1998:22) but that their links to policy aims are unclear.

The Jarman Index or UPAB, for example, consists of eight census variables identified by GPs as contributing most to increased workload/pressure of work, and weighted accordingly. Eight years after its development, however, it was adopted as a means of allocating deprivation payments to GPs (see for example Leavey and Wood, 1985) and has since been used more widely to designate areas as underprivileged or deprived. The move towards evidence-based medicine (both rhetorical and real), it has been suggested, ‘is likely to increase pressure to develop similar indices to implement health policy’ (Taylor, 1998:713). However, necessary precursors include indices that actually follow from policy goals (Carr-Hill and Sheldon, 1991) and the willingness to overcome inertia. Too often 'the default option is for an index or allocation procedure to be used in perpetuity, even if there are questions about the index or goals of the policy’ (Taylor, 1998:721; see also Farmer et al., 2001).

3.4 Evidence that rural deprivation exists
A range of studies has investigated the extent of rural deprivation within the UK. During the 1980s, McLaughlin (1986) surveyed five rural areas in England. Building on the work of Townsend (1979), he generated an index of

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3 Using principal components analysis on 15 indicator variables, Pacione (1995) argues that the four indicators of most significance to rural deprivation are self-employment, agricultural employment, car-less households and households lacking basic amenities.
poverty and established a deprivation threshold that suggested that, in the five studied areas, the proportion of households in poverty ranged from 21% to 30%.\(^4\)

In the 1990s, the Rural Lifestyles research programme provided a snapshot of the incidence and perception of deprivation in rural areas ten years further on (see, for example, Cloke, 1995a, 1997; Woodward, 1996). This sought not only to identify deprivation in an objective sense but also to discover individual perceptions and experiences of rural living. In nine out of the twelve study areas, more than 20% of households were living in, or on, the margins of poverty in the early 1990s (Cloke 1997).

A similar study of disadvantage in rural Scotland examined four case study areas (Harris, Wester Ross, Angus and North Ayrshire) and combined quantitative data on poverty and other aspects of disadvantage with qualitative survey data in order to explore ‘the perceptions and needs of disadvantaged people living in rural Scotland’ (Shucksmith et al, 1994, p.1).\(^5\)

All three studies identified similar groups as the most likely to be affected by processes of social exclusion, that is the elderly, the young, women and low income households in general. Low incomes whilst in employment translate into a limited propensity to save and limited or non-existent occupational pensions; they thus affect security across the lifecycle.

The elderly in rural areas are, for instance, vulnerable to low income in combination with problems of isolation and poor access to services. At the time of the 1991 census, for example, there were over 11,000 pensioners living alone in rural Northamptonshire, three quarters of these households had no car and a quarter had no central heating (Northamptonshire County Council, 1997).

Meanwhile, young people experience a combination of problems relating to housing, transport and employment opportunities, and are more likely to move out of remote rural areas than other age groups. A further key group is single person households (for example see Shucksmith and Chapman, 1998). Certain defining characteristics of deprivation also emerge to a greater or lesser degree from such research into rural areas. Pion Economics (2000) summarises these under six headings: employment, income, housing, transport, education and training, health and social services provision. The latter, given the focus of this report, is explored in the most depth.

**Employment**

Rural deprivation and poverty tend to be the consequence of low pay, self-employed, part-time and seasonal work rather than long-term unemployment.

Those working in the countryside thus ‘survive economically in more diverse ways than city-based wage earners could ever understand’ (Stern and Turbin, 1986).

There are fewer career opportunities in rural areas, firms are smaller and opportunities for graduates are more limited, as are opportunities for training and opportunities for progress within individual firms (see Cartmel and Furlong, 2000). There is also often a limited choice by sector, with primary industries continuing to be the subject of structural decline and alternatives frequently offered only by low wage service occupations such as the tourist sector which is also often only on a seasonal basis.

Chapman et al. (1998) found that whilst the persistence of low pay is greater for rural than non-rural areas there were few significant differences between the characteristics associated with low pay in the different areas. They suggest that the relatively low escape rate from low pay for individuals employed in small rural workplaces and their dominance in rural employment may be an important explanatory factor. Simply having a job does not in itself prevent social exclusion. Young people in low paid, unskilled and often seasonal employment, for example, have been shown to feel undervalued and marginalised within their community (Pavis et al., 2000). In addition to defining the nature of the problem some studies suggest potential solutions (see Monk et al., 1999, 2000).

**Low income**

Households with a low income have been shown to be widespread in rural areas and to be no less prevalent than in urban areas. As noted above, low incomes are more typically a consequence of low rates of pay, seasonal employment or low returns from self-employment than a reflection of high rates of unemployment. Phimister et al. (2000), for example, draw on the British Household Panel Study to show that one-third of rural households in the persistent low earner category had at least one earner in the rural against only 18% of households in the non-rural case. However, Chapman et al., (1998) similarly analysing rural households in the British Household Panel Study, stress that of those of working age on low incomes in rural Britain, 41% were actually detached from the labour market (e.g. long term sick or family carers).

The limited evidence available suggests this situation is compounded by lower levels of benefit take-up in rural areas as compared with urban areas (see e.g. Bramley et al. 2000). Noble and Wright using grid reference mapping in Shropshire, for instance, found families that claim IS HB/CTB were scattered throughout the district, and that the presence of poverty was not restricted to towns and large villages; there were substantial numbers suffering the same low income as their urban counterparts ‘with the added disadvantage that their sparse distribution, at the very least means that costs of living and access to services may be very much greater.’ (Noble and Wright, 2000:302).

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\(^4\) Defined as income lower than 140% of supplementary benefit entitlement.

\(^5\) The findings of this study are documented in a recent Scottish Executive report (Shucksmith et al, 2000), which also provides a review of other research on rural deprivation and exclusion in England.
Again the situation reflects a number of variables. Bramley et al. (2000) working in Scotland, for instance, found that urban-rural differences were not as important as the 'marked differences in the extent to which benefits are claimed and the coverage of poverty provided by benefit eligibility between elderly and other households and between areas which are more and less affluent' (2000:507). The general tendency is thus for eligibility to exceed actual take-up, particularly for elderly households, and for this tendency to be much greater in more affluent areas.

Low incomes and lower levels of benefit uptake are accentuated by generally higher cost of living in rural areas. Transport costs, for instance, are a complex reflection of, inter alia, distances to be travelled, fuel costs at small rural petrol stations, infrequent public transport with few concessions, substitution by more costly private transport or taxi services and the costs of keeping older than average cars on the road.

A report by Cornwall Community Health Council (2000) on transport and access to health services in Cornwall, found that the cost of transport was a real concern, with patients resident throughout Cornwall having to pay their full transport costs, unless they are on benefits or have transport arranged by the ambulance service. For voluntary (independent) car services this averaged 25p–30p per mile and with nearly two-thirds of those sampled at Treliske Hospital having to travel more than ten miles to reach the hospital this is a considerable cost.

In addition a study by Cornwall and Isles of Scilly HAZ found that access to affordable transport limits the ability of young people to participate in a wide range of activities. In Devon, MORI (1998) found that more and cheaper bus and train services emerged as local residents’ most common priority in terms of improving their quality of life.

The same concerns are reflected in the cost of a typical food basket. Local shops are more expensive: ‘We’ve got a little store across the road, which is quite expensive, and the fresh produce is awful, but yes it is there. There’s a little Co-op downtown, which you would probably say much the same about. Most of the shops are for tourists’ (Rita, 38, lone parent family, three children, Cornwall, cited in Mullins et al. not dated). Yet the alternatives incur travel costs and opportunity costs. The fact that women are prepared to struggle on public transport with young children and pushchairs rather than shop locally is evidence of the costs associated with shopping locally (see for example Halliday, 1999).

Similar concerns surround the housing market where data from the ONS and Provisor show, for example, a ratio of housing costs to earnings nearly twice as high in the former county of Devon as in the two Devon urban areas of Plymouth and Torbay. Fuel poverty is a further problem which is heightened by the absence of gas in many rural areas. ‘People heating their homes with electric night storage heaters’ it has been suggested ‘are often paying up to £10 a week more than those few families with gas central heating’ (Mullins et al. not dated:37).

The Scottish Poverty Information Unit (1999) reported food prices to be 8% higher in rural areas compared to Aberdeen, and transport costs to be 13% higher. Averaged over all goods and services, the price differential was estimated at 3%. Given that the cost of basic items such as food, fuel and essential transport consume a disproportionate share of household income such price differentials also have a greater significance than a simple average price index implies (Pion, 2000).

### Housing

The shortage of low cost housing has been described as the 'principal engine of social change in rural Britain' (Shucksmith, 2000), with house prices inflated by immigrants and second home owners. Owner occupation rates tend to be higher with opportunities for renting often limited in both the public and private sectors. Insecurity of tenure follows from both tied properties and the holiday market. Given that landlords commonly find tenants by word of mouth, support structures and contacts are vital (Bevan and Sanderling, 1996).

The condition of properties in the private rented sector is also on average relatively poor and if measurable would be a better indicator of rural disadvantage than overcrowding. The limited availability of low cost housing (see Bramley, 1995) in combination with the need to run a car prevents young people from leaving the parental home or leads to migration out of the area. As the RDC (1998) recently emphasised the lack of affordable housing thus ‘not only affects individuals and families, but also undermines the achievement of balanced, sustainable, rural communities.’ Approximately two-thirds of young people surveyed by the University of York, for example, expected to leave the rural area in which they lived, with the availability of suitable housing a key influence (Ford et al., 1997).

Another ramification is the potentially higher than average number of concealed households in rural areas (Lambert et al., 1992). Normalised conceptualisations about rurality and homelessness serve to separate the two concepts and contribute to the assumption that ‘homelessness is an urban phenomenon which is rendered invisible in rural space’ (Cloke, Milbourne and Widdowfield, 2000:715).

### Transport deprivation

Lack of public or accessible transport is a key concern and the cause of social exclusion for many rural residents. Hooper (1996) working with rural lone-parents, for example, found social networks to be fairly limited and somewhat fragile. Financial constraints were not only restricting social activity but social contact too because this was mediated by access to either a telephone or a car and two-thirds had no access to the latter.

Particular groups are disproportionately affected, primarily the elderly, many women and young people. Storey and Brannen (2000) for instance, found that, out of a sample of young people (15–24 years) in South
West England, over 40% reported that transport issues had influenced their post-16 education decisions. Employment opportunities and social activities are often severely restricted by the availability of transport and there is often little or no provision in the evenings and at weekends. The Countryside Agency (2000) notes that local authority spending on public transport in the rural areas of the South West averaged only £1.40 per head in 1997/8 contrasting with £4.70 per head in the urban areas of the region and an English average of £7.60 per head (although this pre-dated the large increases made possible by the Rural Bus Grant ). The Government has, however, recently emphasised that transport should be considered as a component part of all services. ‘Welfare State provisions were instituted at a time when average weekly mileage per person was about 25 miles. Now it is nearer 130. If a provision has a high transport costs it ceases to be a welfare benefit’ (DETR, 2000a:Executive Summary:1).

Education and training
Due to a recent policy push, there have been some improvements in early years education and childcare facilities. In general, however, the inhabitants of rural areas still suffer from a marked paucity of affordable nursery education and childcare facilities, just as they are typically expected to travel further to access education and further education. Indeed, rural students do not have the same opportunities to live at home while studying, as others are increasingly doing. The problem is compounded by the lack of local opportunities and size and sectoral characteristics of many rural firms means a lack of demand for graduates.

Health status
There are widely, and officially acknowledged, variations in mortality and morbidity within the population (as documented, for example by the Doh 1998 and Acheson, 1998). However, it is argued that there has been a paucity of research into rural health issues (Watt et al., 1994; Higgs, 1999; Pion Economics 2000), perhaps due to the perception that rural areas are healthier places to live than towns and cities. However, most studies which have explored the geographical aspects of this variation draw attention to the contrasts between urban and rural areas and the assumption that a rural lifestyle is inevitably healthier is now regarded as an over-simplification and increasingly open to challenge.

Research tends to reveal a complex picture which in some cases points to a ‘healthier’ rural environment and in other cases does not. Male suicide rates, for example, have been consistently higher in the Highlands over the last twenty years compared to Scotland as a whole, even excluding non-residents, with farmers the single largest occupational group at risk (Stark et al., 2000). There are also studies which identify other specific problems exhibiting a rural dimension, for example, higher risk of accidents to agricultural workers and higher road traffic accident deaths. Poor diets have also been identified as a particular problem for remote communities such as those in the Western Isles (see McKie, 1996; Clarke et al., 1996). The opportunity to improve diets is hampered by high food prices, low income and (ironically) the limited availability of fresh fruit and vegetables.

In general, however, research tends to suggest that whilst urban areas are characterised by pockets of poor health, rural areas are characterised by low average rates of mortality (see McLoone and Boddy, 1994 and Congdon 1995). This pattern of variation is replicated for all major disease classes, the exceptions being traffic accidents and suicides (Senior et al. 2000).

However, as researchers have become more sophisticated in their appreciation of both indicators of disadvantage and the urban-rural categories used it has become apparent that the observable differences in health outcomes are often explained by social and demographic characteristics rather than locality as such (see for example Verheij, 1996). Again the case is not straightforward. Phillimore and Reading (1992) looking at the SMR for 0–64 year olds in the Northern region of England, for instance, initially found a distinct trend from conurbations (with the highest SMRs) to rural areas. When rural and non-rural areas were then matched by deprivation scores this rural mortality advantage disappeared and little difference remained between the areas. However, when rural areas were further subdivided to include a remote rural component a perceptible difference again became apparent with the remote rural areas having a lower SMR than their more urban counterparts.

It has been recently argued that such findings are a product of the measures of deprivation used. For example, Senior et al. have recently investigated the relationship between premature mortality and material deprivation in urban and rural areas in Wales (Senior et al., 2000). They again initially found inequalities in all-cause premature mortality to be widest in the cities and narrowest in the deeper rural areas but after controlling for socio-economic characteristics (using a range of deprivation measures) the tendency for lower mortality in deeper rural areas was substantially reduced. The residual difference between urban and rural areas was shown to be dependent on the way deprivation is measured and the disease group under study. So for cancers, for example, there were no significant residual mortality differences, whilst for respiratory diseases these were accounted for by employment variables, particularly employment in the coal industry. Diamond et al. (1999) similarly emphasise the importance of customised deprivation indices that are specific to the health outcome in urban and rural areas.

6 The rural bus funding, provided by the DETR includes three types of financial support, the rural bus service grant, a challenge fund (covering, for example information and new facilities) and a rural transport partnership to provide community transport.
Question marks therefore remain about the validity of previous evidence on rural/urban variations in health status. Gregoire and Thornicroft (1998), for instance, suggest that an urban bias both to mental health services and to research has led to an inability to make any definitive statements about rural patterns of disease and mental health and their relationship to rural deprivation.

The previous sections have shown how it has proved difficult to both measure deprivation and to adequately conceptualise and thus measure rurality. In contrast, people within rural areas have been demonstrated to experience poverty combined with a number of dimensions of disadvantage. The next section shows how organisations of all sizes and forms are finding that unless they can make a clear statement of such local need they cannot attract the funding they require to deliver services or to respond to community needs (see Dumfries and Galloway Council, 1995; Powys County Council, 1997; Suffolk County Council, 2000). Critically again, the statistics they have to hand often fail to make this statement.

3.5 Requirement for identifying rural poverty for resource allocation procedures

**Why it is important to identify rural poverty?**

The UK Government allocates money to Local Authorities (LAs) in a variety of ways. The most significant is through the Revenue Support Grant which accounts for around 70% of a LA’s income and is calculated using a Standard Spending Assessment (SSA). This has a complex formula with several components, some of which, such as the personal social services sub-block for children’s social services, take some account of deprivation/poverty. Section 2.3 above illustrated how this fails to capture the true costs of sparsity.

Since the 1960s there have also been a number of programmes which specifically target resources at regeneration for deprived areas. The Single Regeneration Budget (successor to the Urban Programme) has, for instance, distributed significant money to LAs through an annual competition since 1994, with the Labour government placing an increased emphasis on targeting resources at areas of greatest need. Need for this purpose is often identified using an index of deprivation, currently the Index of Local Deprivation 1998 (ILD) the successor to the Index of Local Conditions (ILC). Both are sub-district level indices derived from the 1991 Census of Population and both have been subject to various criticisms (see Connolly and Chisholm, 1999). The main methodological defects that have been identified are the influence of the scale of the spatial units on the resulting score, the correlations between the variables in the index and the effect of the weights given to the variables.

The Labour government which came to power in 1997 initially accepted the ILC as a persuasive way of identifying such need and the commissioned update was thus ‘limited in scope’ because the Government was satisfied that ‘in broad terms the index is a robust measure of general deprivation’ (DETR 1997). However, they have now accepted that the ILC has limited application to rural areas where deprivation is ‘much more dispersed than it is in urban areas, and tends not to be identified even at ED (enumeration district) level’ (DETR, 1997).

A more fundamental revision has, therefore, recently taken place for both England and Wales, resulting in the Index of Multiple Deprivation (IMD) 2000 (DETR, 2000b). This ward-level index, developed by the Social Disadvantage Research Group (SDRG) at the Department of Social Policy and Social Work at Oxford (see e.g. Noble et al. 1999) is constructed from six sub-indices reflecting different dimensions or domains of deprivation. These are income; employment; health deprivation and disability; education, skills and training; housing; and geographical access to services.

These indices make extensive use of administrative data, especially of claimant counts. They also draw on new estimates for ward-level populations. The result is thus a more up-to-date index. However, it does raise questions about ‘the comparative take-up rates for benefits in rural areas and the interpretation of the take-up of benefits for public policy.’ (Hodge et al., 2000: 1870). Under a separate contract with the Countryside Agency, the SDRG have also constructed a regional level rural analysis of the indices (Chandola et al., 2000). Our own analysis of the way in which the DETR index depicts deprivation in rural and urban areas is presented in section 4.

**Accounting for the cost of rurality**

Decisions concerning resource allocation need to take into account not only the presence of poverty but also an accurate assessment of the cost of rurality. In the absence of better indicators allocation models have tended to use existing expenditure as a guide.

However, expenditure on services is the outcome of two quite separate forces. The first relates to demand or need and is driven by factors such as the size of the population and its demographic and socio-economic

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7 In 1991 the Department of the Environment published an Index of Local Conditions (ILC) for all local authorities, wards and enumeration districts, based primarily on variables from the population census – with chi2 values summed to produce a single index (DoE, 1994 and Bradford et al. 1995). At ED level there are three variables measuring income deprivation (resources domain) unemployed persons, children in low earning households, households with no car; and three measuring housing stress (environment domain) overcrowded households, residents in households without basic amenities and children living in unsuitable accommodation (Robson et al. 1997). Some modest revisions were made to produce the ILD in 1998 (DETR 1998 Index of Local Deprivation: a summary of results) with variables for children in unsuitable accommodation and households lacking a car dropped and a variable for non-income recipients in receipt of council tax benefit added.
characteristics, including variations in levels of deprivation. The second relates to the cost of producing and delivering goods and services. This tends to be higher in rural areas because of the absence of economies of scale and the cost of overcoming distance between producers of goods, service providers and consumers.

Pion Economics, describing the operation of the Grant Aided Expenditure (GAE) in Scotland, point out that ‘crucial to the whole structure is the implication that authorities effectively provide the same level of service’ (2000). (GAE are payments above the standard resource allocation for specific services.) As long as this is the case then expenditure will tend to provide a reasonable profile of cost pressures assuming there are no significant variations between authorities in terms of efficiency. However, one response to the existence of higher costs is obviously low and/or declining levels of provision in rural areas. Rural deprivation, as measured by equality of access to services, arises precisely because all households ‘do not have equal access to the same range of services within a stated maximum travelling time/distance’ (Pion, 2000:29).

Indeed, Craig and Manthorpe's (2000) survey of British local authorities found that rural authorities traditionally spent less on social care services and direct provision. They argue that it is no longer sufficient to identify transport difficulties as the main problem for rural areas and suggest that allowance for sparsity in the costs of rural social services is insufficient to cater for the different social care requirements of different types of rural areas. The additional costs of providing accessibility to available services are also more often than not borne by rural residents, rather than suppliers, as evidenced by their greater reliance on private transport even at relatively low income levels.

It may also be argued that rural areas are characterised by suppressed demand for services. Some needs are not registered because of accessibility problems, self-reliance, lower expectations of services or lack of anonymity and are thus not met. The Rural White Paper suggests that ‘information on levels of access will help identify these reasons and (where necessary) develop responses’ (DETR/ MAFF, 2000:18).

The Disadvantage in Scotland Report (Shucksmith, 2000), for example, reported low usage of the welfare and benefits advisory service and suggested that rural people, particularly the elderly, were not well-informed and were reluctant to take up welfare benefits because of what has been termed a dominant rural ideology of self-reliance. In some cases, even calling the doctor is viewed as a last resort. The evidence shows that the elderly, including those in rural areas, are particularly vulnerable in this respect (see Devon Welfare Rights Unit Campaigns, 1998).

There is thus a self-reinforcing cycle of low expectations of provision, low actual levels of provision, and a culture of 'coping', all of which combine to ensure that some needs are not explicitly registered. Indeed, even where area-based initiatives target resources at rural areas there is a suggestion that external agenda, formal requirements for partnership working, competitive bidding regimes, short-term funding and existing power structures limit the effectiveness of rural regeneration initiatives and require new approaches to capacity building in the rural context (Shucksmith, 2000; Edwards et al., 2000). Integrated Area Plans, developed as part of Cornwall's Objective 1 Programme, for instance, propose a delegated fund for capacity building in order to facilitate the necessary community development.

### 3.6 Devising better indicators

A body of research is emerging which addresses the issue of more appropriate indicators of rural disadvantage. This tends to concentrate on factors such as access to employment, services and affordable housing, the quality of employment and low incomes, together with the effects of peripherality and isolation. A first refinement is thus research which introduces such elements explicitly into the equation. These often occur in tandem because, for instance, if one seeks to capture remoteness and the accompanying social or economic fragility it is necessary not only to consider income, employment and industrial structure but also population sparsity, population growth or decline, and accessibility/peripherality (Copus and Crabtree, 1993, 1996).

**Introducing service provision and accessibility**

Some recent studies perceive levels of service provision and accessibility as the important facets of rural deprivation that are not measured by census-based indicators. A comparison of these indicators with those more traditionally relied upon to detect deprivation shows, in many cases, little correspondence.

Higgs and White draw attention to the need for a research agenda which uses spatial analytical techniques to measure access to key rural services at the community level (1997). Using GIS-based techniques, in conjunction with a database of public services in Wales, they have developed and tested four alternative types of indicators of social disadvantage, each concerned with the provision and/or demand for such key services. The four categories are: levels of service provision; isolation; potential physical accessibility; and public transport dependency (Higgs and White, 2000).

A comparison of these indicators with those more traditionally relied upon to detect deprivation – in this case the Welsh Office Index of Local Conditions, the Index of Local Conditions, Townsend Deprivation score and Breadline Britain Index – showed, in many cases, little correspondence (an outline of the main deprivation indices is given in Appendix 1). The isolation indices, for example, are negatively correlated with the standard deprivation measures (reaching -0.6 in some cases) and the public transport dependency indicator tends to pick out more urban communities. Isolated communities
Interestingly, the notions of economic vulnerability or social isolation were not pursued.

...
Senior et al. (2000) working in Wales, for instance, distinguished six urban/rural categories based on a combination of land-use characteristics and settlement size. Variations between categories 'confirmed the highly differentiated nature of rural areas' which were found to 'harbour pockets of severe mortality and deprivation' (Senior et al., 2000; 303).

The bulk of recently published studies focus on the construction of isolation, peripherality and accessibility measures as appropriate indicators of rurality. At the forefront of this work lie indicators based on 'nearest neighbour' concepts and distance to points of service provision such as post offices and GP surgeries.

Martin et al.'s study (2000) of health inequalities in the South West of England investigates three different measures of rurality designed to reveal more about where people live in relation to each other: population density, sparsity and 'nearest neighbour' distances. A comparison of these three measures of rurality showed that only 16% of wards were classed as rural by all three criteria. Two of the measures, population density and nearest neighbour distance, reveal evidence of a U-shaped relationship with deprivation, with deprivation scores at their lowest in the suburbs and rural/urban fringe areas but rising in both the more urban areas and (although less steeply) the more peripheral areas. This pattern is most evident when nearest neighbour distances are used to define rural areas.

When limiting long-term illness (LLTI) is used rather than more general measures of deprivation, this urban/rural U-shaped relationship is even more marked, with wards in the most peripheral county of Cornwall exhibiting the highest rates. The significance of physical isolation suggest that accessibility to public and health services may be an important issue and requires further research (Barnett et al., 2001).

As part of the research for the five Scottish authorities (see above) Pion Economics (2000) developed a nearest neighbour measure for Scotland. The construction of this indicator is very similar to that of the dispersion indicator that currently plays a role in resource allocation. This again demonstrates the much higher isolation that exists in some rural areas and, even within such areas, the extensive isolation that can exist outside settlements.

An alternative approach to peripherality employs principles of the gravity model in which the degree of interaction between two points is a positive function of their economic mass and an inverse function of the distance between them. Economic mass may be measured by variables such as employment or population and distance in either space or cost terms. Communities that are far from major centres are therefore predicted to have a low degree of interaction with such centres and hence a higher peripherality score. Threshold peripherality scores are then selected in order to classify communities as lying in remote, intermediate rural, or urban areas (Copus and Crabtree, 1996).

Using direct measures rather than proxies

Another significant development has been the increasing use of direct measures of need rather than proxies. Work conducted at the University of Oxford (see Noble and Smith, 1998) has been key in not only demonstrating the utility of benefits data in describing the distribution of need but also increasing the availability of such administrative data. The methodology has several major advantages, including the fact that the information is up-to-date and can be repeatedly extracted. It is also postcoded, allowing geo-referencing at enumeration district level. It allows the identification, and separate analysis, of various claiming groups such as pensioners and lone parents – a key advantage if we are to understand better the impact of poverty on different sections of the population and tailor services to promote social inclusion.

This work has now been extended to rural areas with Noble and Wright (2000) looking at housing benefit and council tax benefit recipients in the districts of three predominantly rural counties: Dorset, Shropshire and Wiltshire. This, despite acknowledged (but unquantified) problems of under-claiming) reveals 'there are significant numbers of people living in rural areas who are experiencing poverty'. Over one-quarter of Shropshire's HB/CTB claimants, for instance, live in the least densely populated quintile of English wards.

It also demonstrates how benefit dependent households can be identified at small area levels in rural areas - a potentially useful component of national indices of deprivation for the allocation of central government resources to LAs. Indeed, given the evidence from these three shire counties that existing indices of deprivation do not correlate well with this direct measure of low income in areas of low population density it stresses that the direct measures are 'inherently more satisfactory measures than the proxies' (Noble & Wright, 2000; 299).

In a similar study Pion Economics (2000) looked at the claimant rates for housing and council tax benefit in both LA and other sector properties. Like Noble and Wright, they found that the most urban authorities did generally experience the highest claimant rates but that again the rates declined across rural areas in only a moderate manner from that in more urban authorities. The notion of a 'rural idyll devoid of the problems of under-claiming) reveals 'there are significant numbers of people living in rural areas who are experiencing poverty'. Over one-quarter of Shropshire's HB/CTB claimants, for instance, live in the least densely populated quintile of English wards.

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10 Initial they also considered the distance from urban settlements as well.
11 Health deprivation and more general deprivation measures were tested.
12 People under the retirement age of 65.
13 We are aware of no similar indicator of relevance to Scotland. Some consideration might be given to exploring similar structures in due course.
In recent years there has been considerable progress in developing needs estimates that are both directly tailored for specific service sectors and that are created for functionally meaningful units rather than census administrative areas. Linking individual pupil postcodes with census administrative data at the enumeration district level, Gibson and Asthana (1998) have produced an Index of Educational Disadvantage that can be calculated for individual schools. Used in OLS ‘best-fit’ prediction models, this index was found to have significantly higher ‘explanatory power’ in predicting examination performance than the more commonly used proxy of free school meal entitlement (Gibson and Asthana, 2000a; 2000b).

Within the health sector, Gibson et al. (2002) have also developed a method of deriving morbidity-based needs estimates. These have been calculated by linking age/sex/class prevalence tables derived from the Health Survey for England (HSE) with the age/sex/class profiles of general practice and Primary Care Trust populations. When these estimates are compared with those based on standard proxies, a very different picture of variations in health needs between rural and urban areas emerges, depending on the disease/condition examined. Thus, whilst the prevalence of mental disorder is particularly high in urban areas of high social deprivation, rural areas serving demographically older populations have the higher prevalence rates of conditions such as coronary heart disease.

The growing availability of direct needs estimates raises fundamental questions about the purpose of using traditional measures of deprivation. When, as is often the case, deprivation is used as a ‘proxy measure’ for specific service need, direct methods arguably provide more robust and transparent indicators than general deprivation indicators. The use of the latter should therefore be increasingly confined to work that aims to provide a general (or summary) account of deprivation per se.

Targeting rural disadvantage: places versus people

The work commissioned by the Rural Development Commission has moved some way towards being able to focus on people rather than places. The methodology provides an indication of the numbers of those disadvantaged in each bundle in each ward. It is thus possible, in principle, to identify an ‘efficient’ pattern of targeting, defined as the designation of the smallest number of wards which will include a given number of people living in disadvantaged circumstances.

Focusing just at the most rural end of the spectrum they firstly calculated the numbers of people within the Rural Development Area and then, for each bundle, defined a list of the most deprived wards (target wards) until the cumulative numbers in disadvantage matched those included within the designated RDA wards. In every bundle the target wards had a higher average percentage of disadvantage ‘suggesting the extent to which it might be possible to direct policy in a more focused way’ (Hodge et al., 2000:1880). For housing accessibility, for example, the methodology identified 49 target wards where some two-fifths of households were disadvantaged as opposed to some 96 RDA wards where approximately one-fifth were disadvantaged.

The Peak District Deprivation Forum also independently tested the bundles and continue to stress that because income disparities occurred on a house-to-house basis there will always be limits to the use of area-based methods in identifying rural deprivation.

Haynes and Gale (2000) make a similar point when they suggest that the differences between urban and rural correlations with poor health are a reflection not of the choice of deprivation indicators or census areas but a product of the greater internal variability, smaller average deprivation range and smaller population size of rural areas. In consequence ‘deprived people with poor health in rural areas are hidden by favourable averages of health and deprivation measures and do not benefit from resource allocations based on area values’ (2000:275).

The Local Government Association also add weight to this argument when they query, from a rural perspective ‘whether the balance is right between...area based policies and people based policies’ (LGA Rural Executive, 2000:2). Similarly, the results of Phimister et al. (2000) looking at the dynamics of low income in rural areas ‘emphasise the need for “client” based measures...addressing the needs of specific groups such as the elderly’ (2000:415).

3.7 Conclusion

As the above discussion makes clear, the critique of the use of traditional measures of disadvantage in rural areas is wide-ranging. Concerns have been expressed that indicators which capture deprivation in an urban context (e.g. car ownership, unemployment) should not be expected to perform similarly in rural areas. When more focused studies have been undertaken, significant problems relating to employment, low incomes, housing, transport and education have been revealed, casting doubt on the validity of previous evidence on rural/ urban variations in disadvantage.

The assumption that rural environments are inevitably ‘healthier’ is also open to challenge. Rates of suicide and road traffic accidents have been found to be higher in rural areas. Rural mortality advantages disappear after controlling for socio-economic status and limiting long-term illness appears to be subject to a U-shaped pattern of prevalence, highest rates being observed in the most urban and the most peripheral areas.

Unless rural agencies can make a clear statement of levels of need and of the funding they require to deliver services to their communities, there is a danger that rural areas will suffer from lower levels of service provision relative to their needs than their urban counterparts. As part of this, methods of accurately
accounting for the additional costs of providing services in rural areas should be developed. Recent studies that attempt to measure levels of service accessibility go some way towards this. Efforts are also being made to devise more appropriate indicators of disadvantage itself. These include measures that reflect multiple dimensions of deprivation (e.g. the DETR 2000 Index of Multiple Deprivation and the RDC commissioned work on 'bundles' of indicators). Another significant development has been the use of direct measures of service need rather than proxies.

We have argued that, when a measure of a specific service need is required, the potential of using direct estimates rather than deprivation as a proxy should be explored. There remains a need, however, for summary accounts of deprivation in different areas and it is important that these are as effective at capturing disadvantage in rural as in urban areas. In the following section, we explore in more detail the range of different summary measures that are available. To this end, we carry out an empirical analysis, comparing the way in which the DETR’s IMD 2000 and more traditional indicators depict deprivation and reflect health status in rural and urban areas.
4 Empirical investigation of summary measures of deprivation in different contexts

4.1 Introduction

In the previous sections it has become clear that measures of deprivation have tended to be used for two overlapping but importantly different reasons.

• First, to act as a summary measure of deprivation per se. Such a measure is typically contrasted with variations in some key dependent variable – enabling, for instance, policy makers to explore the extent to which the health status of communities is dependent on levels of deprivation. The concerns here are: i) what precisely is meant by the term deprivation, ii) whether it is possible to summarise such a phenomenon in a single quantitative measure using available data, and iii) whether such a measure means the same thing in different contexts and can thus fairly and effectively encapsulate variations in deprivation from one community to the next.

• Second, to act as a proxy measure for some sort of service need (e.g. the need for health care). This is an issue for a variety of resource management functions, including resource allocation, performance monitoring and the monitoring of equity. In light of the growing availability of direct needs estimates, we have proposed that, when indicators are required for a specific policy purpose, questions should be asked about why summary measures are used at all.

In this section we therefore consider the use of indices of deprivation as summary measures.

4.2 Indices of deprivation and rurality

Although a wide variety of measures of deprivation have been used, there are a few which appear again and again in the health and health service literature (an outline of the main deprivation indices is given in Appendix 1). Conceived and constructed for a particular purpose, many of these are used well beyond what could be construed as their legitimate domain. The emergence of Jarman’s UPA score as a generic measure of deprivation is a clear case in point as it was explicitly conceived as a method of comparing the workload of GPs. The near ubiquitous use of Townsend’s Index of Material Deprivation raises similar concerns. With a series of pre-calculated indices of deprivation readily available at ward level, it is sometimes questionable whether the choice between them is driven less by any a priori evaluation of their suitability for the task in hand than by the extent to which they support a particular case.

As illustrated by Figure 1, different indices of deprivation undoubtedly ‘reveal’ very different levels of deprivation in rural areas. This shows how five key indices of deprivation profile the 1,690 English wards which the ONS classify as either wholly or predominately rural. As might be expected, whatever measure of deprivation is used there is a general tendency for rural wards to fall predominately in the less deprived deciles. Yet significant variation is evident. Jarman’s UPA Index, for instance, places very nearly 25% of rural wards into the least deprived decile and only 0.06% into the most deprived decile. (In England as a whole, 10% of wards will fall into each of the ten deprivation deciles.) Indeed, according to Jarman’s UPA Index no less than 89.2% of rural wards fall in the five least deprived deciles. The DETR’s Index of Multiple Deprivation 2000, on the other hand, places just 7.8% of rural wards into the least deprived decile and only 70.3% of wards in the five least deprived deciles. In brief, rural areas appear far less socially advantaged if the DETR Index of Multiple Deprivation 2000 is used instead of Jarman’s UPA or, for that matter, any of the other traditional measures of deprivation. This is not unexpected as the Index of Multiple Deprivation 2000 incorporates a ‘Geographical Access to Services’ domain in an explicit attempt to capture social isolation as part of its much broader definition of deprivation.

In view of such differences, it is unsurprising that levels and patterns of deprivation ‘revealed’ in a rural region such as the South West of England are highly dependent on how deprivation is measured. In the following two maps, wards are once again placed into national deprivation deciles according to the Breadline...
Britain Poverty Index (Figure 2), and the DETR's Index of Multiple Deprivation 2000 (Figure 3). Cornwall and Devon are, in particular, treated profoundly differently by the different measures. Given the lack of a generally accepted definition of deprivation, the adoption of one measure in preference to the others is largely discretionary. In light of this, agencies in the South West could make a stronger political case if they moved away from the more established measures of deprivation towards the DETR's Index of Multiple Deprivation 2000.
Figure 2: Deprivation in South West England: Breadline Britain Index of Poverty

National Deprivation Deciles
- Most deprived (24)
- 2nd (55)
- 3rd (109)
- 4th (145)
- 5th (168)
- 6th (161)
- 7th (151)
- 8th (148)
- 9th (144)
- Least deprived (131)

District/Unitary Authority
- Isles of Scilly
- Plymouth and environs
- Bristol and environs

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Source: Breadline Britain Index of Poverty
Figure 3: Deprivation in South West England: the DETR’s Index of Multiple Deprivation

National Deprivation Deciles
- Most deprived: 31
- 2nd: 71
- 3rd: 148
- 4th: 149
- 5th: 165
- 6th: 175
- 7th: 152
- 8th: 141
- 9th: 111
- Least deprived: 93

The map illustrates districts and unitary authorities, with deprivation levels indicated by color. The map includes areas such as Isles of Scilly, Plymouth, and Bristol.

Source: DETR Indices of Deprivation 2000

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4.3 Deprivation, health status and geographical context

Despite the difficulties of establishing a generally accepted definition of deprivation, it is possible to explore empirically whether different indices are more sensitive to how phenomena that are known to be associated with disadvantage are expressed in different types of area. Evidence from a large number of studies has demonstrated the profound social gradients that exist in certain measures of health status such as limiting long-term illness and mortality. Given the availability (e.g. via the Attribution Dataset provided by the NHS Executive to all Health Authorities) of ward-level standardised illness and mortality ratios, it is relatively easy to examine whether different measures of deprivation provide a consistent representation of health status across the urban-rural continuum.

Recent and as yet unpublished work (Barnett et al., forthcoming) has sought to examine how well three commonly used indices of deprivation predict ward-level variations in morbidity and mortality in three ONS-defined geographic contexts, namely: rural areas, the rural fringe and urban areas. The results show that all three indices are better able to predict variations in both morbidity and mortality in urban areas than they are in rural areas. The authors conclude that, in contrast to their established effectiveness in urban areas, standard ‘generic’ deprivation indices are poor explanatory variables in rural locations. A number of explanations for this are offered, including the possibility that standard deprivation indices are simply not adequately detecting rural deprivation.

Our own elaboration of this analysis, in which we examine the relationship at ward-level between six deprivation indices and the standardised illness ratio for household residents under 75 (SIR<75) in each of the fourteen ONS geodemographic categories, supports this conclusion. As shown in Table 1 below, for all indices of deprivation except the DETR’s Index of Multiple Deprivation 2000, relatively strong relationships in a variety of urban contexts contrast markedly with extremely poor (and sometimes even inverse) relationships in rural areas and the rural fringe. A broadly similar pattern, albeit with generally lower correlation coefficients, emerges with respect to standardised mortality ratios (Table 2).

It is possible, as argued by Haynes and Gale (2000), that this urban-rural gradient is in part a statistical artefact produced by an inconsistent scale of analysis. Notwithstanding any such effect, the DETR’s Index of Multiple Deprivation 2000 is able to offer both a better overall prediction of standardised rates of morbidity and mortality at ward level (Figures 4 and 5), and is significantly better at discriminating between wards within rural areas and the rural fringe.

It is only in the context of ‘deprived city areas’ that any of the other measures of deprivation are able to match the ability of the DETR Index to predict variations in morbidity, and only in the context of ‘inner city estates’ and ‘deprived city areas’ that other measures match its ability to predict variations in mortality.

The DETR’s IMD 2000 also offers a more consistent relationship between deprivation and both morbidity and mortality. Thus, as illustrated in Tables 3 and 4 with respect to the Breadline Britain Poverty Index and Townsend’s Index of Material Deprivation, the use of all indices except the DETR’s results in a range of very different regression coefficients for the various ONS-defined areas. For instance, using the Breadline Britain Index suggests, improbably, that in ‘Rural Areas’ both the standardised illness and mortality ratios fall slightly as the level of poverty increases $(b = -0.14 [-0.46 to 0.19]$ and $-0.07 [-0.43 to 0.28]$ respectively), which contrasts markedly with a regression coefficient of 4.44 [3.47 to 5.41] for the standardised illness ratio in ‘Industrial Areas’ and 4.38 [3.49 to 5.27] for the standardised mortality ratio in ‘Inner City Estates’. This implies that the impact of deprivation on health is profoundly different in different geographic contexts. Using Townsend’s Index to measure deprivation results in even greater variability in the relationship with both morbidity and mortality. Not so the DETR’s Index of Multiple Deprivation, which results in a range of coefficients from 0.97 [0.86 to 1.08] for ‘Rural Areas’ to 1.96 [1.78 to 2.13] for ‘Prosperous Areas’.

These are unstandardised beta coefficients and thus are not strictly comparable between indices. However, the central point here is that the DETR IMD 2000, whilst confirming previous observations that regression coefficients tend to be lower in rural wards than elsewhere (Haynes and Gale, 1999; Haynes and Gale, 2000), offers a much more consistent and intuitively satisfactory insight into the impact of social deprivation.

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16 Morbidity data are derived from the Limiting Long Term Illness (LLTI) question in the 1991 Census. Health status is thus defined in terms of the proportion of people resident in households, under the age of 65, who report an LLTI in the census. The data are age standardised.

17 Mortality data were obtained from the ONS for the number of deaths from all causes to those in the 0–74 age group in the period 1991–1996. These data are age-standardised.

18 The Office for National Statistics (ONS) has generated a geodemographic Ward Classification that classifies all of the wards in England and Wales into one of fourteen categories. The categories ‘Rural Fringe’ and ‘Rural Areas’ are used, with the remaining twelve categories aggregated to form the urban group.

19 For instance, a strong relationship between LLTI and the Townsend deprivation index in urban areas $(p=0.72)$ becomes a lot weaker in the rural fringe $(p=0.27)$ and weaker still in rural areas $(p=0.18)$. A similar pattern also emerges from the relationship between mortality and the Townsend index, with the strong relationship in urban areas $(p=0.61)$ again becoming weaker in the fringe $(p=0.14)$ and rural areas $(p=0.22)$.

20 The Standardised Illness Ratio (SIR) is derived from the Limiting Long Term Illness question on the 1991 census.
### Table 1: Correlations (Pearson) of standard deprivation indices and standardised illness ratios at ward level in different geographic contexts (ONS groups)

<table>
<thead>
<tr>
<th>Description</th>
<th>N</th>
<th>Mean</th>
<th>Range</th>
<th>Breadline Poverty Index</th>
<th>Carstairs’ Index of Deprivation</th>
<th>DOE Index of Local Conditions, 1991</th>
<th>Jarman’s UPA Index</th>
<th>Townsend’s Index of Multiple Deprivation</th>
<th>DETR Index of Multiple Deprivation</th>
<th>DETR IMD 2000 (without health component)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suburbia</td>
<td>944</td>
<td>84.0</td>
<td>83.7</td>
<td>0.327**</td>
<td>0.386**</td>
<td>0.177**</td>
<td>0.100**</td>
<td>0.263**</td>
<td>0.663**</td>
<td>0.583**</td>
</tr>
<tr>
<td>Rural areas</td>
<td>736</td>
<td>81.3</td>
<td>113.5</td>
<td>-0.029</td>
<td>0.108**</td>
<td>0.073**</td>
<td>-0.084**</td>
<td>0.127**</td>
<td>0.548**</td>
<td>0.499**</td>
</tr>
<tr>
<td>Rural fringe</td>
<td>979</td>
<td>87.5</td>
<td>149.3</td>
<td>-0.001</td>
<td>0.142**</td>
<td>-0.017</td>
<td>-0.136**</td>
<td>0.077**</td>
<td>0.566**</td>
<td>0.477**</td>
</tr>
<tr>
<td>Industrial areas</td>
<td>630</td>
<td>126.3</td>
<td>174.5</td>
<td>0.288**</td>
<td>0.260**</td>
<td>-0.097**</td>
<td>-0.184**</td>
<td>0.199**</td>
<td>0.666**</td>
<td>0.521**</td>
</tr>
<tr>
<td>Middling Britain</td>
<td>978</td>
<td>102.7</td>
<td>156.2</td>
<td>0.181**</td>
<td>0.259**</td>
<td>-0.001</td>
<td>-0.136**</td>
<td>0.208**</td>
<td>0.664**</td>
<td>0.561**</td>
</tr>
<tr>
<td>Prosperous areas</td>
<td>962</td>
<td>70.8</td>
<td>121.9</td>
<td>0.106**</td>
<td>0.105**</td>
<td>-0.091**</td>
<td>-0.147**</td>
<td>0.013**</td>
<td>0.470**</td>
<td>0.417**</td>
</tr>
<tr>
<td>Inner city estates</td>
<td>122</td>
<td>143.5</td>
<td>149.3</td>
<td>0.634**</td>
<td>0.343**</td>
<td>0.074</td>
<td>0.219**</td>
<td>0.423**</td>
<td>0.688**</td>
<td>0.608**</td>
</tr>
<tr>
<td>Established owner-occupied</td>
<td>1164</td>
<td>74.0</td>
<td>147.3</td>
<td>0.103**</td>
<td>0.151**</td>
<td>-0.034</td>
<td>-0.147**</td>
<td>-0.003</td>
<td>0.616**</td>
<td>0.551**</td>
</tr>
<tr>
<td>Transient populations</td>
<td>98</td>
<td>86.2</td>
<td>99.2</td>
<td>0.329**</td>
<td>0.273**</td>
<td>0.211**</td>
<td>0.231**</td>
<td>0.222**</td>
<td>0.488**</td>
<td>0.454**</td>
</tr>
<tr>
<td>Metropolitan professionals</td>
<td>231</td>
<td>88.3</td>
<td>134.5</td>
<td>0.484**</td>
<td>0.650**</td>
<td>0.630**</td>
<td>0.583**</td>
<td>0.469**</td>
<td>0.746**</td>
<td>0.737**</td>
</tr>
<tr>
<td>Deprived city areas</td>
<td>230</td>
<td>119.2</td>
<td>84.3</td>
<td>0.776**</td>
<td>0.721**</td>
<td>0.678**</td>
<td>0.671**</td>
<td>0.742**</td>
<td>0.743**</td>
<td>0.714**</td>
</tr>
<tr>
<td>Lower status owner-occupied</td>
<td>481</td>
<td>117.1</td>
<td>128.1</td>
<td>0.486**</td>
<td>0.473**</td>
<td>0.286**</td>
<td>0.225**</td>
<td>0.447**</td>
<td>0.702**</td>
<td>0.621**</td>
</tr>
<tr>
<td>Mature populations</td>
<td>682</td>
<td>88.0</td>
<td>129.6</td>
<td>0.357**</td>
<td>0.527**</td>
<td>0.273**</td>
<td>0.180**</td>
<td>0.426**</td>
<td>0.689**</td>
<td>0.638**</td>
</tr>
<tr>
<td>All</td>
<td>8519</td>
<td>93.2</td>
<td>212.3</td>
<td>0.766**</td>
<td>0.793**</td>
<td>0.647**</td>
<td>0.647**</td>
<td>0.744**</td>
<td>0.878**</td>
<td>0.851**</td>
</tr>
</tbody>
</table>

** = significant at 0.01; * = significant at 0.05

### Table 2: Correlations (Pearson) of standard deprivation indices and standardised mortality ratios at ward level in different geographic contexts (ONS groups)

<table>
<thead>
<tr>
<th>Description</th>
<th>N</th>
<th>Mean</th>
<th>Range</th>
<th>Breadline Poverty Index</th>
<th>Carstairs’ Index of Deprivation</th>
<th>DOE Index of Local Conditions, 1991</th>
<th>Jarman’s UPA Index</th>
<th>Townsend’s Index of Multiple Deprivation</th>
<th>DETR Index of Multiple Deprivation</th>
<th>DETR IMD 2000 (without health component)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suburbia</td>
<td>944</td>
<td>91.1</td>
<td>107.6</td>
<td>0.235**</td>
<td>0.226**</td>
<td>0.120**</td>
<td>0.103**</td>
<td>0.198**</td>
<td>0.344**</td>
<td>0.306**</td>
</tr>
<tr>
<td>Rural areas</td>
<td>736</td>
<td>85.7</td>
<td>102.2</td>
<td>-0.016</td>
<td>-0.061</td>
<td>-0.199**</td>
<td>-0.183**</td>
<td>-0.040</td>
<td>0.155**</td>
<td>0.124**</td>
</tr>
<tr>
<td>Rural fringe</td>
<td>979</td>
<td>89.8</td>
<td>119.6</td>
<td>0.018</td>
<td>0.045</td>
<td>-0.027</td>
<td>-0.089**</td>
<td>0.052</td>
<td>0.257**</td>
<td>0.203**</td>
</tr>
<tr>
<td>Industrial areas</td>
<td>630</td>
<td>114.6</td>
<td>119.2</td>
<td>0.275**</td>
<td>0.276**</td>
<td>0.067</td>
<td>-0.001</td>
<td>0.252**</td>
<td>0.462**</td>
<td>0.388**</td>
</tr>
<tr>
<td>Middling Britain</td>
<td>978</td>
<td>102.3</td>
<td>116.8</td>
<td>0.177**</td>
<td>0.267**</td>
<td>0.059</td>
<td>-0.001</td>
<td>0.213**</td>
<td>0.460**</td>
<td>0.401**</td>
</tr>
<tr>
<td>Prosperous areas</td>
<td>962</td>
<td>80.0</td>
<td>122.1</td>
<td>0.106**</td>
<td>0.103**</td>
<td>-0.036</td>
<td>-0.080**</td>
<td>0.069**</td>
<td>0.354**</td>
<td>0.304**</td>
</tr>
<tr>
<td>Inner city estates</td>
<td>122</td>
<td>138.0</td>
<td>109.6</td>
<td>0.661**</td>
<td>0.270**</td>
<td>0.025</td>
<td>0.188**</td>
<td>0.441**</td>
<td>0.466**</td>
<td>0.377**</td>
</tr>
<tr>
<td>Established owner-occupied</td>
<td>1164</td>
<td>81.8</td>
<td>128.6</td>
<td>0.121**</td>
<td>0.116**</td>
<td>-0.004</td>
<td>-0.030</td>
<td>0.092**</td>
<td>0.335**</td>
<td>0.309**</td>
</tr>
<tr>
<td>Transient populations</td>
<td>98</td>
<td>83.2</td>
<td>71.3</td>
<td>0.291**</td>
<td>0.213**</td>
<td>0.143</td>
<td>0.175</td>
<td>0.244**</td>
<td>0.268**</td>
<td>0.251**</td>
</tr>
<tr>
<td>Metropolitan professionals</td>
<td>231</td>
<td>98.5</td>
<td>92.3</td>
<td>0.405**</td>
<td>0.488**</td>
<td>0.444**</td>
<td>0.408**</td>
<td>0.390**</td>
<td>0.561**</td>
<td>0.547**</td>
</tr>
<tr>
<td>Deprived city areas</td>
<td>230</td>
<td>118.0</td>
<td>114.5</td>
<td>0.562**</td>
<td>0.411**</td>
<td>0.357**</td>
<td>0.427**</td>
<td>0.516**</td>
<td>0.337**</td>
<td>0.308**</td>
</tr>
<tr>
<td>Lower status owner-occupied</td>
<td>481</td>
<td>116.6</td>
<td>124.0</td>
<td>0.400**</td>
<td>0.330**</td>
<td>0.291**</td>
<td>0.254**</td>
<td>0.388**</td>
<td>0.472**</td>
<td>0.427**</td>
</tr>
<tr>
<td>Mature populations</td>
<td>682</td>
<td>87.9</td>
<td>106.7</td>
<td>0.393**</td>
<td>0.391**</td>
<td>0.275**</td>
<td>0.236**</td>
<td>0.396**</td>
<td>0.438**</td>
<td>0.397**</td>
</tr>
<tr>
<td>All</td>
<td>8519</td>
<td>95.3</td>
<td>215.2</td>
<td>0.694**</td>
<td>0.707**</td>
<td>0.596**</td>
<td>0.611**</td>
<td>0.685**</td>
<td>0.736**</td>
<td>0.722**</td>
</tr>
</tbody>
</table>

** = significant at 0.01; * = significant at 0.05
Figure 4: Ward level variations of Townsend’s Index of Deprivation against the Standardised Illness Ratio (N = 8,481)
Figure 5: Ward level variations of the DETR’s Index of Multiple Deprivation 2000 against the Standardised Illness Ratio (N = 8,481)
Table 3: Regression co-efficients (with 95% confidence intervals) for ward level relationships between various Indices of Deprivation and the Standardised Illness Ratio

<table>
<thead>
<tr>
<th></th>
<th>Breadline Britain</th>
<th>Townsend’s Index</th>
<th>DETR’s Index 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural areas</td>
<td>-0.14 (-0.46 - 0.19)</td>
<td>1.06 (0.46 - 1.67)</td>
<td>0.97 (0.86 - 1.08)</td>
</tr>
<tr>
<td>Deprived city areas</td>
<td>1.13 (0.48 - 1.78)</td>
<td>1.85 (0.22 - 3.47)</td>
<td>1.04 (0.67 - 1.41)</td>
</tr>
<tr>
<td>Rural fringe</td>
<td>1.52 (1.22 - 1.82)</td>
<td>3.36 (2.83 - 3.90)</td>
<td>1.09 (1.00 - 1.18)</td>
</tr>
<tr>
<td>Transient populations</td>
<td>2.72 (2.44 - 3.01)</td>
<td>6.49 (5.73 - 7.25)</td>
<td>1.11 (0.98 - 1.24)</td>
</tr>
<tr>
<td>Mature populations</td>
<td>2.85 (2.39 - 3.31)</td>
<td>5.24 (4.30 - 6.19)</td>
<td>1.29 (1.17 - 1.41)</td>
</tr>
<tr>
<td>Lower status owner-occupied</td>
<td>1.90 (1.45 - 2.34)</td>
<td>3.97 (3.00 - 4.94)</td>
<td>1.31 (1.15 - 1.46)</td>
</tr>
<tr>
<td>Suburbia</td>
<td>0.00 (-0.40 - 0.40)</td>
<td>0.87 (0.16 - 1.58)</td>
<td>1.43 (1.30 - 1.57)</td>
</tr>
<tr>
<td>Industrial areas</td>
<td>4.44 (3.47 - 5.41)</td>
<td>7.43 (4.58 - 10.28)</td>
<td>1.47 (1.19 - 1.75)</td>
</tr>
<tr>
<td>Middling Britain</td>
<td>1.49 (1.21 - 1.76)</td>
<td>2.31 (1.77 - 2.85)</td>
<td>1.48 (1.38 - 1.59)</td>
</tr>
<tr>
<td>Deprived industrial areas</td>
<td>1.83 (1.14 - 2.51)</td>
<td>5.28 (3.39 - 7.16)</td>
<td>1.51 (1.27 - 1.75)</td>
</tr>
<tr>
<td>Inner city estates</td>
<td>0.54 (0.21 - 0.87)</td>
<td>0.11 (-0.43 - 0.65)</td>
<td>1.52 (1.33 - 1.70)</td>
</tr>
<tr>
<td>Metropolitan professionals</td>
<td>1.36 (0.90 - 1.83)</td>
<td>3.34 (2.35 - 4.33)</td>
<td>1.71 (1.59 - 1.83)</td>
</tr>
<tr>
<td>Established owner-occupied</td>
<td>0.53 (0.23 - 0.82)</td>
<td>-0.03 (-0.54 - 0.48)</td>
<td>1.76 (1.63 - 1.89)</td>
</tr>
<tr>
<td>Prosperous areas</td>
<td>2.74 (2.03 - 3.45)</td>
<td>4.75 (2.92 - 6.59)</td>
<td>1.96 (1.78 - 2.13)</td>
</tr>
<tr>
<td>All ONS areas</td>
<td>2.95 (2.89 - 3.00)</td>
<td>5.92 (5.80 - 6.03)</td>
<td>1.62 (1.60 - 1.64)</td>
</tr>
</tbody>
</table>

Table 4: Regression co-efficients (with 95% confidence intervals) for ward level relationships between various Indices of Deprivation and the Standardised Mortality Ratio

<table>
<thead>
<tr>
<th></th>
<th>Breadline Britain</th>
<th>Townsend’s Index</th>
<th>DETR’s Index 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural areas</td>
<td>-0.07 (-0.43 - 0.28)</td>
<td>-0.36 (-1.02 - 0.30)</td>
<td>0.30 (0.16 - 0.44)</td>
</tr>
<tr>
<td>Deprived city areas</td>
<td>2.16 (1.75 - 2.57)</td>
<td>4.93 (3.87 - 6.00)</td>
<td>0.55 (0.35 - 0.75)</td>
</tr>
<tr>
<td>Rural fringe</td>
<td>0.10 (-0.26 - 0.45)</td>
<td>0.53 (-0.11 - 1.17)</td>
<td>0.59 (0.45 - 0.73)</td>
</tr>
<tr>
<td>Transient populations</td>
<td>1.24 (0.42 - 2.05)</td>
<td>2.51 (0.51 - 4.51)</td>
<td>0.71 (0.20 - 1.21)</td>
</tr>
<tr>
<td>Mature populations</td>
<td>1.71 (1.41 - 2.01)</td>
<td>3.19 (2.63 - 3.75)</td>
<td>0.71 (0.60 - 0.82)</td>
</tr>
<tr>
<td>Lower status owner-occupied</td>
<td>2.04 (1.62 - 2.46)</td>
<td>3.97 (3.12 - 4.81)</td>
<td>0.76 (0.63 - 0.88)</td>
</tr>
<tr>
<td>Suburbia</td>
<td>1.08 (0.79 - 1.36)</td>
<td>1.76 (1.20 - 2.31)</td>
<td>0.78 (0.64 - 0.91)</td>
</tr>
<tr>
<td>Industrial areas</td>
<td>1.72 (1.25 - 2.19)</td>
<td>3.97 (2.78 - 5.16)</td>
<td>0.89 (0.76 - 1.03)</td>
</tr>
<tr>
<td>Middling Britain</td>
<td>1.02 (0.67 - 1.38)</td>
<td>2.61 (1.86 - 3.37)</td>
<td>0.91 (0.80 - 1.02)</td>
</tr>
<tr>
<td>Deprived industrial areas</td>
<td>1.80 (1.24 - 2.35)</td>
<td>5.49 (3.98 - 7.01)</td>
<td>0.92 (0.70 - 1.14)</td>
</tr>
<tr>
<td>Inner city estates</td>
<td>4.38 (3.49 - 5.27)</td>
<td>7.33 (4.66 - 10.00)</td>
<td>0.94 (0.62 - 1.27)</td>
</tr>
<tr>
<td>Metropolitan professionals</td>
<td>1.59 (1.12 - 2.05)</td>
<td>3.29 (2.29 - 4.30)</td>
<td>0.98 (0.79 - 1.17)</td>
</tr>
<tr>
<td>Established owner-occupied</td>
<td>0.69 (0.37 - 1.01)</td>
<td>0.89 (0.34 - 1.45)</td>
<td>1.05 (0.88 - 1.22)</td>
</tr>
<tr>
<td>Prosperous areas</td>
<td>0.54 (0.19 - 0.88)</td>
<td>0.61 (0.05 - 1.17)</td>
<td>1.19 (0.98 - 1.39)</td>
</tr>
<tr>
<td>All ONS areas</td>
<td>2.03 (1.99 - 2.08)</td>
<td>4.15 (4.05 - 4.24)</td>
<td>1.04 (1.02 - 1.06)</td>
</tr>
</tbody>
</table>
on both morbidity and mortality than do other indices. This lends support to the idea that these other indices incorporate some form of 'urban bias', offering an inadequate insight into the variation of social disadvantage within rural areas, and are thus poor predictors of the relationship between social disadvantage and health status.

The DETR’s Index of Multiple Deprivation 2000 is notable because it utilises non-census data and is thus, and can in the future be kept, broadly up-to-date. The other deprivation indices considered are based on 1991 census data, but this difference is unlikely to account for its success (relative to those other indices of deprivation) at predicting variations in mortality and morbidity because standardised mortality ratios, which we have drawn from the December 1999 Attribution Dataset, have been constructed using data for 1989-1993, whilst standardised illness ratios are based on the 1991 census’ limiting long term illness question.

What is undoubtedly significant is the fact that the Index of Multiple Deprivation 2000 takes a much broader definition of deprivation than the other indices considered. Townsend’s Index, for instance, is based on four variables derived from the 1991 census which address unemployment, household overcrowding, access to a car, and household tenure. The Index of Multiple Deprivation 2000, on the other hand, is based on the premise that deprivation comprises a number of separate dimensions. Within the constraints of the data that were available at ward level, the Index thus attempts to capture these multiple dimensions through the weighted incorporation of six separate ‘domain’ indices. These relate to Income (25%), Employment (25%), Health Deprivation and Disability (15%), Education, Skills and training (15%), Geographical Access to Services (10%) and Housing (10%). Each domain index is itself constructed using a wide variety of indicator variables. For instance, the Geographical Access to Services domain index is constructed using data relative to access to i) a post office, ii) food shops, iii) to a GP, and iv) to a primary school. The Housing domain index is constructed using data relative to i) homeless households in temporary accommodation, ii) household overcrowding, and iii) poor private sector housing provision.

It might be argued, of course, that part of the success of the DETR’s Index in explaining variations in morbidity and mortality lies with the fact that one of its component domains concerns ‘Health Deprivation and Disability’, and that one of the five variables used to construct this domain index is an age and sex standardised ratio of limiting long term illness (based on 1991 census data). However, using the same methodology (with appropriately changed domain weights) to calculate a modified DETR Index of Multiple Deprivation which excludes the Health Deprivation and Disability component still results in an index which better discriminates between wards than do the traditional indices of deprivation – both overall and, in particular, in rural areas (as shown on Tables 1 and 2).

This modified Index of Multiple Deprivation exhibits a weaker relationship with standardised illness and mortality ratios than does the actual Index, but the effect is slight. This reflects the fact that the DETR’s Index uses no less than 32 variables to construct the six domain indices upon which it is based. The exclusion of the Health Deprivation and Disability domain thus has only a marginal effect. Notwithstanding this effect we consider its inclusion entirely legitimate on the grounds that the DETR’s Index was originally constructed as a multi-dimensional indicator of the broad condition that is social deprivation.

This broad definition of deprivation adopted by the DETR’s Index of Multiple Deprivation probably relates to why it explains 77% of the ward-level variation in standardised illness ratios and 54% of the variation in standardised mortality ratios. These are impressive figures, particularly given that the Index of Multiple Deprivation 2000 was designed as a generic summary measure of deprivation. It was not, in other words, constructed with the explicit purpose of explaining variations in (using variables selected, transformed and weighted to best fit a least squares model of) morbidity and mortality. Its explanatory power (both overall and in specific geodemographic contexts) is evidence of the appropriateness of the definition of deprivation adopted by the DETR and offers clear confirmation of the long recognised link between deprivation and health status.

**Conclusion**

We conclude that of the measures of social disadvantage explored the Index of Multiple Deprivation 2000 should be utilised. It exhibits the closest overall association with patterns of morbidity and mortality, and has by far the strongest association with those outcomes in rural areas, suggesting that it is able to best express rural disadvantage as it impacts upon health status.
5 Measuring service accessibility in rural areas

5.1 Introduction

It has long been recognized that geography affects the cost and organization of service delivery. In general, the cost of supplying services is higher per capita in rural than urban areas (Ellis Williams, 1987). This reflects a number of factors including the difficulties of achieving economies of scale in sparse and/or peripheral areas, the duplication of facilities, additional travel costs, the high level of unproductive time spent travelling and the need for additional time for management and networking (Woollett, 1990). With few exceptions (e.g. the sparsity adjustment to the SSA), however, resource allocation systems for public services in England do not incorporate rural dimensions to need or take into account the impact of rurality on the costs of supplying health services.

With the exception of the adjustment made for emergency ambulance services, the English resource allocation system has not adjusted for the additional costs of providing health services in rural areas (Asthana et al, 2002). Concerns have consequently been expressed about the implications of urban-rural differences in supply for accessibility to and utilization of primary and secondary health care. For example, Smith and Ramana's (1998) study of deprivation in south Cambridgeshire showed that although some rural areas experienced equivalent levels of deprivation to urban areas (even using urban biased indicators) they nevertheless encountered problems with regard to the provision of levels of mental health services and accessibility to these. Health care services where Shucksmith et al. (1996b) found access to be particularly problematic were chemists, opticians, family planning and hospitals.

Difficulties of access, isolation and lower levels of service provision in rural areas can actively contribute to health and social care problems for the elderly. However, the provision of social care services also tends to be based on policy guidelines developed for more urban areas (Craig and Manthorpe, 2000). According to a recent study of home care services for the elderly, 1 in 16 people over the age of 65 received home care services in their urban areas. In sparse areas this reduced to 1 in 23 and in super-sparse areas to 1 in 30, almost half the rate in urban areas (Cumbria County Council, 1997).

There are alternative solutions to the problems of service provision in remote areas. These include the provision of multiple services from one fixed site, the deployment of mobile services, multi-skilling of health and social care professionals and the use of ICT to provide remote access to shopping and banking services. However, the coverage of such schemes is, as yet, patchy (Hogg, 2000).

Turning to rural/urban differences in service utilization, several studies have noted a distance decay effect in rates of GP consultations (Haynes and Bentham, 1982; Bentham and Hayes, 1985; Jones et al, 1998). However, the age, gender and socio-economic circumstances of individuals may again have a more profound influence on the uptake of services than distance; ‘elderly poor women living at a distance from services are the most disadvantaged’ (Wiltshire Health Authority, 1997).

Access to acute hospital services (in terms of the numbers of hospital beds per head of population and the distances which potential patients have to travel to hospital) is lower in the most rural Health Authorities (Hale et al, 1996). Hospital referral and admission rates have also been shown to be significantly lower with increasing distance from hospitals (Haynes and Bentham, 1979).

Such studies suggest the need for rural service delivery to be given greater attention on the policy agenda. However, one of the obstacles to developing policies to improve service access in rural areas has been the difficulty of quantifying the problem. The investigation of patterns of utilization is complex, due to the difficulties of disentangling the impact of need, demand and supply factors on use. For example, Doogan et al. (1997) note the difficulty of interpreting the meaning of low GP consultation rates in rural Wales. On the one hand, low attendance could reflect relatively high levels of health. On the other, it could suggest problems of accessibility.

The development of direct morbidity estimates does provide a methodological advance in this respect, as it provides a measure of need that can be distinguished from demand and supply factors that are associated with variations in use. For example, focusing on the use of cardiology services, Gibson et al. (2002) find that the practice populations of rural surgeries make significantly lower use of inpatient services according to need than urban practice populations. In their analysis, fairly simple measures of service accessibility, namely distance from acute hospitals to GP surgeries and population sparsity, are used. There are, however, alternative measures that can be used to this end. In this section, we review existing methods of measuring distance and access, focusing on work conducted in both the academic and commercial sectors to measure and to
model service accessibility.

The ultimate aim of work that has been conducted to isolate accessibility effects on patterns of utilization is, of course, to support rural agencies in their attempts to achieve equitable service provision to rural communities. We therefore begin this section by considering how problems of accessibility have been approached within the policy arena.

5.2 Policy and rural accessibility

When the market is left to work in rural areas, there is a dearth of provision. Retail outlets are sparsely distributed and there are declining numbers of village shops. Rural transport, never abundant, has retreated even further since the deregulation of the industry and there is a far more restricted choice of jobs than in an urban setting.

The distribution of privately provided services reflects the difficulties of fulfilling basic threshold requirements in rural areas. However, although public service providers face the same difficulties, provision of public goods such as health care has not been primarily influenced by market considerations in Britain. Even if rural areas have lower levels of demand than urban settings, public services still have to be provided, without the economies of scale that can be achieved for urban provision. Thus, for public authorities charged with making services available to all, higher unit costs for lower catchment populations will be unavoidable.

The additional costs associated with rural service provision have been gradually gaining more attention on the policy agenda. For example, groups such as the fire service started their own sparsity group to lobby about the increased costs of maintaining cover in difficult rural areas. There has been formal Home Office acknowledgement of work conducted to demonstrate the sparsity effect on costs of providing rural police services. The current Welsh formula includes a weighting for the additional costs of providing services in sparsely populated areas in relation to community and ambulance services and cash limited General Medical Services. The major review of the distribution of funds for health care in Scotland conducted by the Arbuthnot Working Party also makes explicit the need to adjust for the excess cost of delivering services in remote and rural areas (SHED, 1999a; 1999b).

In England, the problems faced by rural health service providers have not been strongly acknowledged (White, 2001; Asthana et al., 2002). The English Formula for Hospital and Community Services does apply a weighting for sparsity to expenditure on the emergency ambulance service, but this only represents less than 2% of the HCHS budget. Rurality does not emerge as a focus for inquiry in the Acheson Report on Inequalities in Health. Similarly, when the authors of a recent NHS scoping exercise on access to health care were asked about their views on problems of access to health care in rural areas, they admitted that they not identified this as a potential theme for research and development funding.

Rural access is identified as an issue in the Rural White Paper that was published in November 2000. This highlights the publication of a ‘Rural Service Standard’ setting out what ‘rural users’ can expect. Although it acknowledges that ‘we don’t have firm access standards’, it promises an annual independent audit so that problems can be identified and targets set. National standards for library services and less frequent attendance at job centres for unemployed people in rural areas are envisaged. With regards to response time targets, the only new target is the requirement for ambulances to respond to 75% of life threatening calls within 8 minutes by March 2001 and other 999 calls within 19 minutes in 95% of cases. Reviewing the White Paper, Hale (2001) concludes that the proposals are unlikely to do much to narrow the gap between levels of service provision in urban and rural areas.

As we have argued above, this partly reflects the difficulties that have been encountered in empirically demonstrating the impact of accessibility on service use. The use of direct needs estimates overcomes one methodological problem, namely the difficulty of disentangling the effects of need from socio-economic status, accessibility, etc., on patterns of utilization. However, a series of other methodological problems affect the investigation of rural access. For example, variable quality of provision in rural areas has received scant attention (Watt et al., 1994). The impact of a relative mix of primary, secondary and community care is another area where further research could be usefully undertaken. It is possible that lower than expected rates of hospital care are countered by higher levels of primary and community management in rural areas. Finally, there is the issue of how to measure accessibility itself.

5.3 Measuring potential accessibility

In the literature on health service access and utilisation, the distinction is sometimes drawn between potential and effective accessibility. The former refers to the physical availability of services. What makes people actually use services is the combined impact of a number of factors - physical service availability is just one of these. Effective accessibility therefore refers to the actual utilisation of services.

The investigation of utilisation is of key interest to service providers who are seeking to monitor equity of access. Nevertheless, it is generally accepted that,

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22 Undertaken by the NHS National Co-ordinating Centre for Service Delivery and Organization, Research and Development.

because utilisation is influenced by factors that lie outside the control of service providers, potential accessibility is a more realistic and legitimate target for policy intervention. We therefore examine literature that has focused on the development and application of methods to measure and model potential accessibility.

One of the simplest ways of capturing potential accessibility is to examine the location of rural services in relation to settlement type. For example, the Rural Development Commission (now called the Countryside Agency) has undertaken a survey of English parishes every four years. Until recently, the approach taken was to report on the percentage of parishes comprising particular services. In 1994, for example, only 1% of rural parishes housed hospitals with Accident and Emergency and outpatient facilities, 7% a public nursery, 8% homes for the mentally or physically disabled, 17% a GP practice based in the parish, 21% a pharmacy of any kind, 24% residential and nursing homes for the elderly, 25% a daily bus service, 30% a general store, 50% a school and 57% a post office (RDC, 1995).

The RDC surveys clearly demonstrate the lack of public and private services in rural parishes. However, the problem with this approach is that it takes no account of services that may be accessible to parishioners but that are located beyond the physical boundaries of a parish. The Countryside Agency is therefore now exploring the use of postcoded sources of information in order to examine aggregate accessibility to services by households in rural parishes. To this end, it is using data from the Royal Mail’s Address Manager database and postcoded addresses in the Yellow Pages.

Rather than counting services within the arbitrary areal unit of a parish, a grid approach is being used to analyse service distribution. Residents and services are allocated to hectare grid cells and a surrounding buffer zone ensures that there are no distorting edge effects. The key to the allocation process is the unit postcode of each service outlet and the number of delivery points within each postcode contained within the Postcode Address File.

Once dwellings and services are allocated to a fine grid, distances are calculated between dwellings and services, and the number of service outlets available to each dwelling in each cell within a selected distance is calculated. The results can be converted into more conventionally used reporting units by measuring the numbers of residents in each area, such as a parish, or the proportions of residents in that area who have specified levels of potential access to a given number of service outlets.

This approach has been used extensively in the 2001 Parish Survey and provides a very different picture to the previous Rural Survey method of potential service accessibility. For example, only 46% of parishes in Lincolnshire have a post office whereas 89% of households within the county are within 2 km of a post office. Although the use of distance offers clear advantages over the ‘container’ view of space, straight line distance does not equate to travel time distance to rural services. This will vary according to the class of road. Straight line distance will also misrepresent access in areas where geographical features such as rivers and estuaries act as barriers to direct access.

### Travel time

Travel time has been incorporated as a measure of access in a number of studies, notably in part of the NHS Resource Allocation Review commissioned by the Welsh Assembly. This used ED level census data to estimate the numbers of people resident in areas more than thirty minutes travel time from a hospital and fifteen minutes travel time from the general practice. In Wales, 57,944 people (2.05% of the total population) live outside these access times, whilst comparable analysis in Scotland found 1,205,518 people (2.45% of the total population) living in ‘under-served areas’.

An interesting focus of a study based in Norfolk (Jones et al., 1998) study has been to examine patterns of service access by both public and private transport. Estimated car travel time to primary care services was calculated using a digitised road network (based on the 1:25,000 Bartholomew map). Road speed estimates were adjusted for six different road types (from a dual carriageway A road to a minor road) and for urban/rural journeys. Thus, average road speeds on an A road dual carriageway in a rural area are given as 54 mph compared to 28 mph in an urban area. Using these measures, travel times from patients’ addresses to each facility (in the case of general practices, both the nearest surgery and the practice at which a patient was registered) were calculated. The results suggest that a similar proportion of the population are ‘under-served’ in terms of access to GP surgeries as in Scotland and Wales. Only 2.5% of the population were outside fifteen minutes car travel time; 8% lived more than ten minutes drive from a surgery; 67% were within five minutes drive of a main or branch surgery and a further 23% between five and ten minutes drive away. Good car access to one facility was associated with good access to other services. For example, of the people who lived more than ten minutes car journey from the nearest GP surgery, 87% were more than ten minutes distant from both a pharmacist and NHS dentist.

The Norfolk project also examined access using public transport. Details of bus services in East Anglia were obtained by examining public timetables and route maps and a buffer of 800m was placed around patients’ addresses and facilities to represent an acceptable walking distance for most of the population. Bus services were classified into good, moderate and not useable according to the numbers of return daytime journeys available in weekdays. Community transport schemes were also recorded (e.g. community care schemes, dial-a-ride services) and a GIS package, Arc Info, used to calculate travel times using public transport to the nearest GP practice, pharmacy or NHS dentist.

For the majority of Norfolk’s residents (82%), there
was a reasonably frequent daytime bus service to a GP surgery (four or more daytime return journeys every weekday). Five percent of the population could reach a GP surgery using a less frequent bus service (1–3 return journeys per weekday), whilst 13% lived in areas with no return daytime services to a surgery. The latter group was also unable to access dental and pharmacy services. Some of these, of course, will live within a reasonable car travel time (though not all will have access to a car). However, the study estimates that 5% of the population live more than ten minutes car journey and have no useable bus service to a surgery.

The Norfolk study provides just one example of a growing number of attempts to use travel time rather than conventional straight line distance to measure potential service accessibility. Most rely on existing quantitative databases, although questionnaire surveys have also been used to assess patient travel times to GP services (e.g. Saunders, 1998). Operational Research in Health (ORH) based in Reading has produced software that calculates node to node times (snapping postcodes to the nearest node) and can be used to create travel time networks for particular areas. A travel time matrix has also been developed by researchers at the Northern Transport Laboratory at Lancaster University as part of a review of local authority resource allocation. This links varying levels of service delivery to population centres of varying size. For example, a town comprising 20,000 residents would be expected to have a community hospital and a library, whilst a town with a population of 100,000 would have a District General Hospital and a local government function. One of the difficulties encountered in this research has been the fact that thresholds such as these do not apply to all parts of the country. In peripheral areas, for example, more facilities tend to be concentrated in smaller settlements.

5.4 Modelling potential accessibility

The modelling of potential accessibility involves the quantification of the relationship between demand, provision and ‘standards’ achieved. A good access model for a rural area should also work in an urban area, not least so that comparisons can be made between areas that are more or less sparse.

Access models also need to be appropriate for different types of services. Broad distinctions can be drawn between services that are delivered to the client and services that the client travels to. Services also differ according to the extent to which daily activity is predictable or unpredictable. For example, the emergency services provide an example of services that are delivered to clients which have unpredictable daily activity. The numbers of patients accessing open GP surgeries are also unpredictable but in this case the client travels to the service. Examples of predictable daily activity would be home care services and refuse collection (where the service is delivered to the client) and day care (where the client travels to a facility).

In the following sub-sections, three approaches to the modelling of service accessibility (predictable and unpredictable, service to client and client to service) are described. These include simulation models, algorithm approaches and cover range models.

Simulation models

Unpredictable service delivery to clients is the most challenging service type to model. For this type, simulation models have been a preferred option. A simulation approach could, of course, be used to model access for all of the service types described above. However, it requires significant developmental effort. The data requirements can be onerous and the model outputs need careful analysis and interpretation. Once the basic simulation model has been developed for a service, it can be used to examine a range of issues and has great flexibility. Service use can be simulated on a travel time network in response to incidents, generated to match a projected or actual demand profile, or according to defined parameters about access standards.

Operational Research in Health, based in Reading, has been undertaking simulation modelling for the emergency services for a number of years. One example of their work was a research study undertaken for the Home Office which examined the effect of population sparsity on the costs of providing police services (ORH, 1998). This centred on the development and use of a simulation model that allowed the sparsity effect to be isolated and quantified in a way that could inform the Police Funding Formula.

The key resources modeled in the ORH study were single- and double-manned police vehicles, although a facility was also designed for assigning ‘delayed response’ calls to foot patrol officers. The response of manned vehicles to demand levels was analysed, both overall and by distinguishing between immediate and delayed calls. Various measures of demand were used, including formula-projected levels for 1998/99, demand levels recorded in HMIC returns for 1997/98, by shift according to the average pattern found in fourteen sample police forces, and by area in proportion to the resident population by ward. As a first stage, a ward model for each force was used, distributing incidents in relation to ward population size and constructing travel times on the basis of neighbouring ward centroid distances. Analysing variations in resource/demand ratios, sparsity was found to have a significant effect on resource use.

Having isolated the sparsity effect, a simulation model was run to examine the resources required by different areas to achieve a common set of response targets (90% of immediate response calls within ten minutes across urban wards and twenty minutes across rural wards, and 90% of delayed response calls within forty minutes of the scheduled time). Due to the size of the geographical area, the more dispersed clustering pattern of calls, the lower potential for inter-station back-up, the longer ‘turnaround’ times per call, and the
greater variability in call rates around the mean (because of the typically low number of calls), rural areas would have to maintain relatively high availability in order to respond to a high proportion of calls within the target time. There was also less flexibility in the more rural forces in determining the optimum balance between single-manned and double-manned deployed vehicles. Therefore the sparsity effect manifested itself principally as additional availability per call. This effect was far more significant than simply increased travel times per call in sparse forces.

Although the research demonstrated a clear sparsity effect, translating these results into a formula change process had to take account of the assumptions behind the simulation approach and the structure of the formula itself. The sparsity effect is caused by two factors (longer travel time and higher level of availability required), the second of which was by far the most dominant. However, given the formula structure and the specified requirement to focus the study on the call response function, the only component amenable to reallocation was the 'travel to scene' part of call management. A range of options for applying the simulation results to this component were tested with the dual aim of a) using a sparsity indicator that explained a high level of cost variation from the model outputs (R-squared values in excess of 80 per cent) and b) retaining a close link between model outputs and ‘travel to scene’. The best sparsity indicator, based on the sparsity research and the simulation modelling results, was found to be the same ‘ED sparsity’ measure as used at present.

Algorithm approaches
As indicated above, simulation modelling involves considerable resources to set up and run. Thus, whilst it is a useful approach for modelling access to services that are characterised by unpredictable daily activity, other methods may be more efficient for the modelling of predictable daily activity. Tony Hindle and his team at Lancaster University have developed an algorithm approach to this end, termed Simplified Modelling of Spatial Systems or SMOSS. Adapted from earlier work by Christofides and Eilon (1969) and Fernandez et al. (1974), the essence of SMOSS is to devise simple mathematical functions that can yield satisfactory approximations of the travel distances (and times) in a routing situation that would be obtained from the repeated application of more exacting routing algorithms. The aim has been to make feasible (in time and effort) the evaluation of large-scale strategic distributional options, such as facility location, resource requirements and resource allocation.

SMOSS has been applied to a number of service accessibility studies, including the cost of home care and day care service provision (especially for the 'elderly') in England across the urban/rural continuum; health and social service provision in urban/rural areas of Northern Ireland (particularly the cost of providing health visitors, district nurses, social workers, day centres and passenger service vehicles); emergency ambulance provision in Northern Ireland; and facility location in Northern Ireland (particularly of Accident and Emergency services). Thus, the approach can be applied to services that are delivered to clients and to services to which clients travel.

The SMOSS package can cope with geographical data, census data and need indicators from any selected administrative units and models can be built into a simple spreadsheet system. Typically, service co-ordinates and clients are linked to the nearest road nodes associated with enumeration district centroids. Thus, clients are assumed to be randomly located within the area of the relevant ED. Travel times within the SMOSS system are initially calculated using default values for expected speeds on different categories of road. However, a range of options are also available within the package for modifying these assumed speeds on the basis of local knowledge or observed data. A key feature of this package is its flexibility. For example, estimates of service capacity have been adapted to take account of such factors as length of consultation, repeat visiting, service area overlap, hours available for carrying out particular tours of duty and so on.

Using simulation studies (that have typically involved the comparison of SMOSS approximations of travel distances with those obtained from more exact routing applications) as well as empirical work (where travel distances and times have been collected in the field), the results obtained using simplified modelling have been validated. The approach provides results of comparable validity and accuracy to those obtained from more expensive data-intensive techniques such as detailed simulation and scheduling/routing models. SMOSS is also designed to be user-friendly, and public service managers have found the spreadsheet tools to be both useful and easy to interpret.

An example of the application of this approach can be found in a project funded by the County Councils Network of England which investigated the impact of population sparsity on the provision of domiciliary care for the elderly (ORH, 2000). This proposed a simplified model of distance per visit as a function of demand and sparsity (measured as the average area in hectares per population aged 65+). Weightings were obtained by running SMOSS for sample districts that spanned the urban/rural continuum. The validity of the model was tested by comparing the results to those obtained from survey data during the project. Using only the two variables of demand rates and sparsity, the model generated expected distances per visit that compared well with the survey outcomes.

Cover range models
This is one of the simplest approaches to modelling accessibility and, as such, is perhaps most attractive to users untrained in modelling techniques. In essence, incidents are distributed on a travel time network and the range of cover provided by a particular service location is expressed as the percentage of incidents that
An adaptation of the cover range approach has been used by ORH to model Accident and Emergency cover. In this, a travel time model was developed to predict isochrones and catchment areas for hospitals and ambulance stations. This incorporated blue light and standard travel times between any two points on a travel time network (based on distance and road type). Link times were verified with actual times achieved under blue light and emergency response conditions.

Cover range models are easily used in-house on spreadsheets, and can be adapted for initial analysis of a number of access problems. With a little knowledge they can be used as a first step to defining a problem for the model types already discussed, or to calculate approximate results for situations where time and resources are limited.

### Conclusion

This review of the measurement and modelling of accessibility has uncovered the dominance of a few universities and commercial consultants in work on rural access to health services. The use of GIS within Health Authorities appears to be largely restricted to presentational maps where factors such as deprivation are spatially depicted. There is also a division between the academic and commercial sectors in the focus of work conducted. Academic studies tend to have concentrated on examining who does or does not get a certain level of service, whilst work on service provision, particularly its complex modelling, has been the preserve of a few specialist consultancy companies.

With the introduction of less complex systems such as SMOSS, there is certainly scope for service modelling to be carried out in-house. Routing problems such as the routing of refuse collection are already undertaken by county councils where the application of GIS in diverse areas such as housing, planning and transport has allowed sufficient expertise to develop. A range of commercial packages is available and, as efforts are being made to ensure that such software can be easily integrated with other packages, organisations within the health sector could quite feasibly do more work on issues of access themselves.

Regarding access measures, the use of travel time is generally supersedings the use of straight line distance. In order to make studies comparable, however, travel speeds for different road types could be usefully standardised. For example, conventions could be agreed for rush hour and non-rush hour speeds in urban and rural areas. Some agreement on what constitutes a reasonable travel time to a GP surgery or hospital would also be useful. A number of studies have used fifteen minutes travel time to a general practice as a proxy for reasonable acceptability. There are grounds for adapting measures of accessibility with regard to the use of public transport, however. For example, a fifteen minute drive time from home to a surgery car park would produce a very different catchment population to a fifteen minute travel time using public transport where the walk to the bus stop, the wait at the bus stop and the walk from the bus stop to the surgery are included.

The results of recent studies also suggest that common understandings about poor access in rural areas may need to be revisited. The most recent analysis of rural parishes suggests that more people in rural areas are within crow-fly distances of basic services than has been thought in the past. Similarly, access to primary care is not a problem for the vast majority of rural inhabitants. This is not to say that there no problem of access exist. Rurality does appear to be associated with lower levels of hospital use and there will be certain groups of people living within rural areas (often referred to as the transport-poor) for whom access is a real problem. One of the key issues for policy makers is how such populations can be more precisely and effectively targeted.
References


Cartmel F and Furlong A. (2000) Youth unemployment in rural areas, YPS.


Cornwall Community Health Council (2000) Transport and access to health services in Cornwall. CCHC: Truro.


Halliday J. (1999) Telling a different tale: social needs in Devon. Devon Community Foundation.


Stark C et al. (2000) Suicide in the Highlands of Scotland. Highland Health Board.
Wiltshire Health Authority. (1997) Health and deprivation in rural areas: annual report of the Director of Public Health. WHA.
The information in this appendix was taken from the Compendium of Clinical and Health Indicators 2001 published by the Department of Health and produced by the Health Outcomes and Developments Agency and the London School of Hygiene and Tropical Medicine.

In general, deprivation indices measure the proportion of households in a defined small geographical unit with a combination of circumstances indicating low living standards or a high need for services, or both. An important note to be made about all ecological measures of deprivation – that is measures based on geographic areas, rather than individual circumstances – is that not all deprived people live in deprived wards, just as not everybody in a ward ranked as deprived are themselves deprived.

In interpreting deprivation scores it is important to remember that many deprivation scores are relative measures, that is the score for any one area is standardised by reference to the mean for the total of all areas included in the calculation.

Appendix 1: Details of the main Deprivation Indices used in this report

The new IMD 2000 is an innovative and detailed ward level Index with local authority level presentations. It is based on six separate ‘domains’ of deprivation:
- Income
- Employment
- Health Deprivation and Disability
- Education, Skills and Training
- Housing
- Geographical Access to Services.

These each contain information essential to local authorities and others about their areas and the nationwide picture. The IMD 2000 uses up-to-date information from 33 indicators to describe deprivation at ward level. This includes information from previously untapped data sources, such as Department of Social Security (DSS) benefits data and University and Colleges Admissions Service (UCAS) data. Most of the indicators can be updated regularly, and so form the basis for a dynamic Index. In addition to the Domain Indices, the overall ward level Index of Multiple Deprivation brings this substantial amount of knowledge and information together for the first time.

Drawing together these indicators for the first time gives the IMD 2000 a major advantage over previous indices; the range of indicators at ward level enables a focus on deprivation at a small geographical level that was not possible before. This is an improvement on the 1998 ILD which was able to present very little information at ward level, and the information that was included was based on the 1991 census and therefore was increasingly out of date. In addition, the ward-level information allows the new Index to be presented in six ways to represent overall deprivation and pockets of deprivation at local authority level.

The information from the Indices of Deprivation 2000 has been aggregated to enable local authority districts to be ranked according to how deprived they are relative to other districts using six measures. All of the six measures are equally valid and they should not be used in isolation from each other. There is not one overall set of rankings. Patterns of deprivation are complex – in some places the entire district may be generally deprived – but with no very severe areas. Elsewhere deprivation may be concentrated in very severe pockets that co-exist alongside generally affluent areas. The indices have to attempt to reflect these different patterns through six different measures that reflect the differing mosaic of area deprivation in different areas.

Detailed descriptions of measures of deprivation used in this report

Department of the Environment, Transport and the Regions’ Indices of Deprivation 2000

In December 1998, the Department of the Environment, Transport and the Regions (DETR) (now the Department for Transport, Local Government and the Regions) commissioned the University of Oxford to review and update the 1998 Index of Local Deprivation. There were criticisms of the 1998 Index of Local Deprivation (ILD) and the 1991 Index of Local Conditions (ILC) that it updated – the sub-district level indicators were out of date and the chi-squared method needed to be reviewed (the 1998 ILD and 1991 ILC are described briefly below). Also, better small area data at the sub district level was about to come on stream for the first time.

In August 2000, following extensive consultation, DETR published the Indices of Deprivation 2000 (ID 2000). The ID 2000 is made up of:

- Six Domain Indices at ward level (Income, Employment, Health Deprivation and Disability, Education Skills and Training, Housing and Geographical Access to Services)
- An overall ward level Index of Multiple Deprivation 2000 (IMD 2000)
- A supplementary Child Poverty ward level Index
- Six summaries at the local authority district level of the overall IMD 2000.
The six measures are:

- **The local concentration** measure tells us how severe deprivation is in each authority’s ‘hot spots’ of deprivation;
- **The extent** measure is the percentage of each district’s population living in one of the 10 per cent of the most deprived wards in England;
- **The average-scores** measure is the average level of deprivation across the entire district;
- **The average-ranks** also measures the average level of deprivation across the entire district;
- **The income scale** measures how many people suffer from income deprivation;
- **The employment scale** measure how many people suffer from employment deprivation.

As all the rankings are based on the same data, there is not one measure that can be used as an overall ranking. Some Authorities may be ranked poorly on some measures, but less so on others.

**Department of the Environment’s Index of Local Conditions (1991) – superseded by later DETR Indices of Deprivation**

The Index of Local Conditions (ILC) comprised thirteen variables, seven census variables and six non-census variables (all 1991 except where stated):

**Census variables**
1. Unemployment
2. Children in low-earner households
3. Overcrowding
4. Housing lacking basic amenities
5. No car
6. Children in unsuitable accommodation
7. Educational participation

**Non-census variables (sources and dates)**
1. Long-term unemployment
2. Income support
3. Low educational attainment
4. Standardised mortality ratios
5. Derelict land
6. Home insurance weightings

The index of local conditions is an unweighted summation of the selected indicators using their log-transformed signed chi-square values. The actual number of persons which have each selected variable are compared to the numbers that would be expected if average English rates applied. The difference between the actual and expected numbers is squared and then divided by the expected number after which the value of 1 is added. A log transformation is then applied and those scores where the actual rate was below the expected rate are given negative signs. Summed scores greater than zero indicate greater levels of material deprivation.

This index differs from those previously described in using actual numbers rather than percentage rates as the input into the calculations. This has the effect of giving lower weights to those areas where the actual counts are small – and hence statistically less reliable (i.e. an area where 3 out of 10 persons are unemployed will have a lower score than one where unemployment is 30 out of 100).

**Jarman Underprivileged Area Score**

The Jarman Underprivileged Area Score was not originally constructed to measure deprivation but as a measure of General Practice workload. The Jarman Score was derived to take account of geographic variations in the demand for primary care based on a survey of GPs subjective expressions of the social factors among their patients that most affected their workload. The variant of the score in most common use – the UPA8 score – comprises eight variables which were individually weighted by a sample of London GPs.

- **Unemployment**
  (3.34) % of residents unemployed as a percentage of economically active

- **Overcrowding**
  (2.88) % of residents in overcrowded households
  (more than one person per room).

- **Lone parents**
  (3.01) % of residents in 'lone parent' households.

- **Under 5s**
  (4.64) % of residents aged under 5 years.

- **Elderly living alone**
  (6.62) % of elderly persons living alone.

- **Ethnicity**
  (2.50) % of households headed by a person born outside the United Kingdom.

- **Low social class**
  (3.74 ) % of residents where household head is unskilled (social class V).

- **Residential mobility**
  (2.68) % of residents who changed address in the previous year.

Each variable is based on the percentage of all residents in households, with the exceptions of unemployment, which is based on the percentage of the economically active population which is unemployed, and residential mobility where the denominator is the

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24 The standardisation and transformation ‘has the merits of: taking account of the small size of the denominators of many of the observations; using an interpretable value of zero; and using values which approximate the normal curve’ (DoE 1994, p.86).
total resident population. Each variable is firstly expressed as a proportion (between 0 and 1). The proportions are then transformed by first calculating the square root and then finding the equivalent arc sine (asin). The variables are expressed as z scores and multiplied by their respective weighting factors. The final score is obtained by summing the variables (after statistically reworking). Higher scores indicate greater levels of GP workload.

**Townsend Material Deprivation Score**
The Townsend Score is based on four variables, originally taken from the 1981 census, that were selected to represent material deprivation: unemployment (lack of material resources and insecurity), overcrowding (material living conditions), lack of owner occupied accommodation (a proxy indicator of wealth) and lack of car ownership (a proxy indicator of income). The Townsend Score is a summation of the standardised scores (z scores) for each variable (scores greater than zero indicate greater levels of material deprivation). Two of the variables – those relating to unemployment and overcrowding – are firstly transformed using the log transformation \( y = \ln(x + 1) \) to produce more normal distributions. The Townsend score was considered the best indicator of material deprivation available (until the release of the Indices of Deprivation 2000 (ID 2000) in August 2000, although the ID 2000 only covers England, not Wales – unlike Townsend scores). The four variables that make up the Townsend Score are combined together in an overall deprivation index, with each variable being given an equal weight. The units of measurement of the four indicators are:

- **Unemployment** – % of economically active residents aged 16-59/64 who are unemployed.
- **Car ownership** – % of private households who do not possess a car.
- **Home ownership** – % of private households not owner occupied.
- **Overcrowding** – % of private households with more than one person per room.

The variables selected are direct indicators of deprivation, that is, they represent the condition or state of deprivation.

**Carstairs and Morris Scottish Deprivation Score**
The index was constructed by Carstairs and Morris for the analysis of Scottish health data. Like Townsend, the index is based on four variables originally taken from the 1981 census which were judged to represent, or be determinants of, material disadvantage. Three of the indicators are the same as those used in Townsend, the fourth, social class, is used in place of housing tenure. The units of measurement of the four indicators are:

- **Overcrowding** – persons in private households living at a density of more than one person per room as a proportion of all persons in private households.
- **Male unemployment** – proportion of economically active males who are seeking work.
- **Social class IV or V** – proportion of all persons in private households with head of household in social class IV or V.
- **No car** – proportion of all persons in private households with no car.

The deprivation measure is an unweighted combination of the four standardised variables.

**Breadline Britain Score**
The Breadline Britain Score is the result of two surveys carried out by MORI for London Weekend Television and the Joseph Rowntree Foundation in 1983 and 1990. In the 1990 Survey respondents were presented with a set of 44 cards onto each of which was written the name of a different item covering a range of possessions and activities that relate to standards of living. For example, a television, a night out once a fortnight and a warm waterproof coat. Respondents were asked to place the 44 cards into one of two boxes. Box A was for items which they considered necessary; those items which all adults should be able to afford and which they should not have to do without. Box B was for items which they considered to be desirable but not necessary. They were also asked if they felt differently about any of the items in the case of families with children. An item was deemed to be a socially perceived necessity if more than 50 per cent of respondents put it into Box A. Later in the interview the respondents were asked to assign one of the following five options to each of the 44 items:

1. Have and couldn’t do without
2. Have and could do without
3. Don’t have and don’t want
4. Don’t have and can’t afford
5. Not applicable/don’t know

Respondents (and their households) were assigned a deprivation index score each time they answered ‘don’t have and can’t afford’ to an item that was considered to be a necessity by more than 50 per cent of respondents.