Geographic patterns of deprivation and health inequities in South Africa: Informing public resource allocation strategies

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IMPORTANT NOTE
This report is a summarised version of the original research report. If readers would like more extensive information on the literature review, research methodology and research results, please contact Di McIntyre (dimac@cormack.uct.ac.za <mailto:dimac@cormack.uct.ac.za>) to request a copy of the original research report.

EXECUTIVE SUMMARY

South Africa is a country with vast inequities in the distribution of income, in socio-economic and health status and in access to key social services. Much of this inequity is attributable to the systematic dis-advantaging of certain race groups under apartheid. The post-apartheid government, under the leadership of the African National Congress, has committed itself to redressing these inequities. In a country such as South Africa where inequities are substantial, a vertical equity perspective, which prioritises human development benefits for the most dis-advantaged through the differential allocation of government resources, is arguably the most appropriate approach for effectively and speedily achieving equity gains.

While the primary underlying concern of this research is that of reducing inequitable health status differentials within South Africa, it does not focus simply on the allocation of health care resources. This is partly due to the fact that health is influenced by a range of factors other than health services, and particularly that there is an internationally established relationship between deprivation (or relative social and material dis-advantage) and ill-health. In addition, the allocation of centrally collected government resources in South Africa takes the form of block grants to individual provinces, which themselves determine allocations to the health and other social sectors. It is, thus, necessary to take a broader perspective than purely health resource allocation issues.

In order to prioritise the allocation of limited government resources to those who would benefit most from human development improvements, a mechanism for identifying the most dis-advantaged groups is required. As resource allocation mechanisms in South Africa are largely geographically based (i.e. allocations are made between different geographic areas such as provinces), small area analysis was seen as a possible means of identifying the most dis-advantaged in society. Thus, the aim of this study was to assess the usefulness of an analysis of small areas (using magisterial districts in this study) in developing deprivation indices, as a tool for informing the allocation of government resources from a vertical equity perspective.

Four alternative deprivation indices were constructed and analysed in this study. Firstly, a general index of deprivation (GID) was compiled using principal component analysis (PCA). PCA is a statistical technique which is increasingly being used in the development of deprivation indices. It essentially identifies those socio-economic, demographic and physical household characteristics that are most highly correlated with each other in explaining deprivation. Using data available in the 1996 census, the GID variables resulting from this analysis included the proportion of the population in each magisterial district who: are female; are children under 5; live in a rural area; are older than 25 years and have no schooling; are unemployed; live in a traditional dwelling, shack or tent; have no piped water in their house or on site; have no access to any form of refuse disposal; have no access to a phone; do not have access to electricity for lighting; and live in households headed by a woman. Each variable was weighted according to its relative contribution to overall deprivation.

Secondly, a policy-perspective index of deprivation (PID) was developed using groups identified by policy-makers as being particularly dis-advantaged or as groups which should receive priority in social service delivery. The groups most frequently referred to in this context were: Africans, the elderly, children, women and rural dwellers.

The third index created in this study was a single variable index of deprivation (SID). The purpose of the SID was to explore whether the use of a single variable (far simpler to work with) would be as effective as composite indices in identifying

disadvantaged groups. In our analysis, lack of access to piped water was found to be appropriate for use in the SID.

Finally, a health-related index of deprivation (HID) was constructed. Once again, PCA was used to identify those socio-economic, demographic and physical household characteristics (using data drawn from the census) that were highly correlated with a mortality measure (drawn from the vital statistics database). The variables identified for inclusion in the HID were, the proportion of the district population who: are African; are unemployed; are disabled; live in a traditional dwelling, shack or tent; have no piped water in their house or on site; live in households headed by a female. In addition, the proportion of deaths that were attributable to infectious diseases, as the selected mortality measure, was included in the HID. Each variable was weighted according to its relative contribution to health-related deprivation.

The alternative deprivation indices were then compared with each other. It was found that the GID and SID are most highly correlated, and that both the GID and SID correlate well with the PID. In contrast, there is a lower correlation between the HID and all of the other deprivation indices. A detailed assessment of mortality data indicated that the different pattern produced by the HID is largely attributable to the poor quality of mortality data currently available from the vital statistics database. For this reason, the HID is not regarded as an appropriate deprivation index to use in South Africa until the quality of death registration information has improved dramatically.

The high correlation between the GID and SID suggests that a single-variable index may be as effective in identifying the most dis-advantaged households and communities as a composite deprivation index. Given that PCA is a complex statistical procedure and is relatively time consuming, a single-variable index will be more user friendly for health and other social service planners. It is also easier to routinely monitor changes in a single variable than a composite index. It is also of interest that the PID correlates well with the GID and SID. Firstly, this suggests that policy-makers have reasonably accurately identified groups who are relatively dis-advantaged, even though they have used broad demographic and areal categorisations. Secondly, it highlights again that simple indices containing a few variables with no weightings may be effective in identifying small areas with high deprivation levels.

The GID, PID and SID all identified the Northern Province and Eastern Cape as having the highest proportion of their populations residing in the two most deprived quintiles of magisterial districts, followed by KwaZulu-Natal, North West and Mpumalanga. It is these provinces, and the most deprived districts within them, which should receive priority in the allocation of public resources.

The inclusion of a measure of deprivation in the formula used for the allocation of central government budgetary resources between provinces would substantially alter current resource allocation patterns. Although the current Department of Finance (DoF) formula includes what is termed a ‘backlogs’ component, this merely focuses on infrastructural backlogs and is given only a 3% weighting which results in a marginal redistributive impact on the formula. If the backlogs component were based on a broader indicator of human development backlogs, such as one of the deprivation indices developed in this study, and given greater weighting, the preferential allocation of limited government resources to the most deprived areas would be strengthened significantly.

The analysis of deprivation in relation to small areas is particularly useful in informing detailed service planning and resource allocation within provinces. If budgets are

allocated preferentially towards the most deprived areas, and if these financial resources are translated into service delivery improvements on the ground (through the redistribution of other service resources such as personnel and through management capacity improvements), significant progress towards health equity in South Africa could be achieved.

One area of concern arising from the analysis is that the variables in the respective deprivation indices do not adequately reflect the views of those who experience deprivation. While there is some degree of commonality between the quantitative variables used in the indices and perceptions of deprivation, the dominant theme of social isolation found in perceptional data (e.g. the South African Participative Poverty Assessment) is poorly reflected in these variables. The perceptional data emphasise that any index will inevitably be a simplification of anyone's understanding of poverty or deprivation. Instead, the use of deprivation indices should be supplemented by qualitative enquiries into people's own perceptions of their circumstances and needs. In particular, it would be important to critically review resource allocation processes and to consider ways in which communities, particularly in the most deprived areas, could contribute actively to these decision-making processes.

The key remaining concern in the current analysis is that deprived communities within large metropolitan areas, who should also benefit from preferential resource allocation strategies, are not being identified with the use of magisterial districts as the unit of small area analysis. There are indications that there is insufficient homogeneity within magisterial districts in the metropolitan areas, and therefore pockets of deprivation in these areas are not being identified as the average deprivation index scores in metropolitan magisterial districts reflect low levels of deprivation in all cases. For this reason, it would be advisable to conduct an analysis using enumerator area (which cover much smaller areas than magisterial districts) data in metropolitan areas and magisterial district data in non-metropolitan areas. This will enhance the degree of homogeneity within the small area analysis. Unfortunately, time constraints precluded such an analysis in the current project, but it is regarded as a priority area for future research.

This study has relevance to other countries in that it demonstrates that small area analyses of deprivation can be undertaken in data poor contexts, even though data constraints will limit the extent of the analysis that can be undertaken. Of particular importance in other low- and middle-income countries is the conclusion that, in the absence of good quality health status data, the use of general socio-economic and demographic indicators of deprivation is valuable in promoting the equitable allocation of limited government resources. These findings are especially relevant for guiding decision-making in decentralised systems, where equity in resource allocation has been shown to be a particular challenge.

This study has gone some way towards reviewing the usefulness of small area studies of deprivation in promoting equitable resource allocation, with the ultimate goal of significantly reducing gaps in health status within South Africa as rapidly as possible. A range of additional research will strengthen the arguments presented here. However, a key remaining challenge is to assess the extent to which policy-makers and service managers find the small area deprivation analysis approach useful to guide decision-making in pursuit of vertical equity goals.

1. INTRODUCTION

This research project explores the potential use of small geographic areas as a unit

of analysis for identifying communities with high levels of deprivation or relative disadvantage. It also considers the usefulness of such small area analyses in informing resource allocation decisions, with the ultimate goal of redressing health inequities in South Africa.

1.1 South African context

South Africa has one of the highest levels of measured income inequalities in the world. It also has vast inequities in other aspects of socio-economic status, health status as well as in access to social services. Apartheid policies, whereby certain race groups were systematically discriminated against, played a critical role in creating these inequities.

The African National Congress (ANC) government, which has been in power since the first democratic elections in 1994, has committed itself to redressing these inequities. However, it has to achieve this in the face of severe macro-economic constraints. At the time of the 1994 elections, there was substantial government debt and a growing budget deficit. While Gross Domestic Product (GDP) has grown in real terms since this time, averaging 2.3% per annum between 1995 and 1999 (Department of Finance 2000), this rate of growth was lower than anticipated.

Under pressure from the international community, the government adopted a new macro-economic policy termed GEAR (Growth, Employment and Redistribution) in early 1996 (Department of Finance 1996). GEAR's fiscal policy reiterated the previously stated government commitment to rapidly reducing the budget deficit, while simultaneously not increasing the overall tax burden, thus requiring real decreases in government expenditure. GEAR contained explicit and quite ambitious budget deficit reduction targets, particularly in the light of lower than projected economic growth rates, which has translated into real budget constraints for all government departments. This is of considerable concern, given that GEAR envisages government spending on social services as the primary mechanism for redistribution within South Africa (*ibid*).

Given the central role of social spending in redistribution efforts, it is important to assess the extent to which government expenditure is addressing historical inequities. In particular, it is necessary to consider whether government social spending is being allocated preferentially to those who are currently most disadvantaged. Such preferential allocation is essential in order to reduce the massive socio-economic disparities in South Africa within a resource constrained context (McIntyre and Gilson 2000).

While this paper has an expressed concern for health (and health system) inequities, it also considers broader socio-economic issues and overall government resource allocation patterns (rather than simply health sector resource allocation) for two reasons. Firstly, the international literature has clearly established that a range of factors other than health care influence health status (e.g. Berman *et al.* 1994; Whitehead 1995). Household health and welfare are inextricably intertwined. The poorest households suffer from low incomes as well as 'capability deprivation'; that is, they have little access to the range of economic, social and political resources that enable them to lead healthy and productive lives (Dreze and Sen 1995; Sen 1992). Consequently, the distribution of these resources between households, and the way in which government policy and spending patterns affect this distribution, will influence patterns of health inequity.

The second reason for not focusing solely on government *health care* resource patterns is the fiscal federal government structure in South Africa. The 1996

Constitution introduced a quasi-federal political structure whereby considerable autonomy in decision-making has been granted to provincial legislatures. As from the 1996/97 financial year, provinces have been allocated block grants (or global budgets) from the central treasury and can themselves determine the distribution of these resources between different sectors. The inter-provincial distribution of these block grants, determined through a resource allocation formula developed by the national Department of Finance, strongly influences provincial health allocations (McIntyre *et al.* 1998; Collins *et al.* 2000). Thus, it is important within the South African context to consider the extent to which these block grant allocations, and the formula on which they are based, take into account relative household level dis-advantage or deprivation and thereby contribute to redressing existing socio-economic disparities. There is currently considerable debate about these issues, and there have been calls for the Department of Finance's inter-provincial resource allocation formula to pay more attention to the extent of 'backlogs' in some provinces. These backlogs primarily occur in the former 'homelands', where the majority of the African population was forced to live, and which were systematically disadvantaged under apartheid. Most of these former 'homeland' areas are located in the Eastern Cape, Northern Province, KwaZulu-Natal, Mpumalanga and North West. Thus, backlogs resulting from apartheid policies, in human development, infrastructural development and in access to social services should be actively redressed. Such considerations also need to be reflected in the intra-provincial allocation of social sector resources (e.g. in terms of the allocation of the provincial health budget between geographic areas, such as health districts, in each province).

There are growing concerns that the introduction of fiscal federalism has adversely impacted on equity goals and that relative dis-advantage is not being accounted for adequately in inter-provincial resource allocation decisions (McIntyre *et al.* 1998; Gilson *et al.* 1999; McIntyre and Gilson 2000; Collins *et al.* 2000). Fiscal federalism has made it particularly difficult to ensure equity within the health sector as sectoral resource allocation decisions now rest largely at the provincial level. Shortly after the 1994 elections, the national health department embarked on an ambitious programme of health budget redistribution between provinces. However, recent research has shown that since the advent of fiscal federalism, which removed responsibility for overall health budget decision-making from the national Department of Health, the initial trend towards equitable inter-provincial health budgets has been stalled, and in some provinces reversed (McIntyre *et al.* 1998; Gilson *et al.* 1999).

This research seeks to contribute to the current debates about appropriate mechanisms for equitably allocating limited government resources in South Africa. In particular, it considers alternative ways of identifying those who are most dis-advantaged in order they may preferentially benefit from social spending. Small geographic areas form the basis of this analysis for two reasons. Firstly, government resource allocation decisions are largely geographically based. Secondly, given the difficulty of targeting resources to specific individuals, an areal targeting approach is worthwhile investigating.

1.2 Relevance to other countries

The context in which this study was implemented has broader relevance. The fiscal federal nature of governmental resource flows within the context of the South African national/provincial governance structure has relevance to other decentralised health systems. Decentralisation is one of the central components of health reform programmes that have been promoted internationally, and a critical element in any decentralised structure is the mechanism through which resources are channelled from central/national levels to peripheral/sub-national units (Cassels 1995; Gilson and Mills 1995; Gilson and Travis 1997; Mills 1998). The allocation of resources

within decentralised systems is recognised to be one of the most important influences over the impact of decentralisation on equity (Collins and Green 1994; Kohlemainen-Aitken and Newbrander 1997; Russell and Gilson 1995). This study adds to debate about how to evaluate resource allocation flows, and may be particularly useful for other low- or middle-income countries with fiscal federal structures. At the same time, it provides a basis for further consideration of how to develop resource allocation approaches that can be used both within the health sector and across sectors to promote equity in health (recognising that health results from resource allocations to a wide range of sectors) as well as equity in health care.

2. REVIEW OF THE LITERATURE AND CONCEPTUAL FRAMEWORK

2.1 Deprivation, equity and related conceptual issues

2.1.1 Deprivation

The concept of deprivation, or relative dis-advantage, is used extensively in this report. It is important to distinguish between poverty and deprivation. Traditionally, poverty has been defined primarily as insufficiency of income and has been measured in relation to a poverty line, with those individuals or households with incomes below this level being regarded as poor (World Bank 1990). More recently, some authors have used a broader definition of poverty, which encompasses aspects other than income. For example Singh and Titi (1994) define poverty as a "condition of lack of access to options and entitlements which are social, political, economic, cultural and environmental". The broader definition of poverty is similar to the concept of deprivation used in this paper. In order to avoid the potential problem of poverty being interpreted as only referring to insufficiency of income, we prefer to use the term deprivation.

Townsend (1987: 125) defines deprivation as "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 belongs." Deprivation, thus, refers to the material and social *conditions* that are experienced by individuals and households, where these conditions are inadequate *relative to* what is usually available or experienced in society. While there are different aspects to deprivation, two of the key components are:

- Material deprivation which includes: lack of or inadequate food, clothing, housing, sanitation, water, household assets; poor physical and/or mental health; living in a deprived environment where there may be air and noise pollution, no recreational facilities and no shops etc.; and poor working environment.
- Social deprivation which includes: no or low level of education; few employment opportunities and lack of rights in employment; separated families; lack of recreation; lack of integration into the community, possibly as a result of racial and gender discrimination; and lack of participation in social institutions (Townsend 1989).

Deprivation can then be seen as the inability to achieve an adequate level of capabilities relative to that which exists in society as a whole.

The concern with deprivation is importantly related to the concern to redress inequities. In order to reduce the massive disparities that exist in South Africa, priority must be awarded to policy interventions that promote capabilities' development among the most deprived or dis-advantaged in our society.

2.1.2 Equity

As this paper is concerned with strategies for addressing health inequities in South Africa, it is important to clarify the equity concepts underlying the analysis. The equity goals of any health system are rarely established clearly or specified fully. The range of possible goals may include the outcome of equal health status, as well as equity in the distribution of benefits (such as equal access or utilisation for equal need) and in the distribution of burdens (e.g. payment on the basis of ability to pay).

A key element of equity debates has been how to define and judge the benefits of health care. Should they be seen as health status improvements, even though health care is only one input to health status? Should they be seen as reflected in levels and patterns of utilisation, even though utilisation cannot be coerced through policy action? Should they be seen as reflected in levels of access, and if so, what type of access (for example, geographical vs. financial vs. cultural)?

Another topic of debate is whether horizontal or vertical equity goals should guide health sector decision-making and the analysis of health care financing and provision patterns. Horizontal equity refers to the equal treatment of equals while vertical equity refers to the unequal (but equitable) treatment of unequals. In the health economics literature, horizontal equity has often been taken to be primarily a matter of service provision (e.g. reflected in the goal of equal service inputs, access or utilisation for equal need). In contrast, vertical equity has generally been taken to reflect the equity principle of differential payment according to ability (Wagstaff and Van Doorslaer 1993). Until recently, the main focus in health and health system equity debates has been on mechanisms for achieving horizontal equity (with the exception of the literature focusing on health care financing equity issues). Mooney (1996) has recently motivated that vertical equity should receive more attention, suggesting that an emphasis on vertical equity is particularly important in countries where there are substantial differences in health status between different groups in society. He argues that “if, as is normally the case, ill health is not randomly distributed across different groups in society, might that society not want to give preference, *on vertical equity grounds*, for health gains to those groups in that society who are on average in poor health?” (Mooney 1996: 102). This implies that there should be preferential allocation of health care resources in favour of those with, on average, poor health status. In some contexts, such groups may be primarily characterised by low socio-economic status, although other characteristics are also likely to be important, such as race within the South African context.

A vertical equity approach underlies much of the analysis presented in this paper. The preference for this approach is due to the systematic dis-advantaging of certain groups under apartheid, which suggests that treating all South Africans equally is unlikely to achieve health or health system equity. As noted by McIntyre and Gilson (2000), “a vertical equity approach, which recognises that different groups have different starting points and therefore require differential treatment, seems more likely to redress current inequities.”

Another critical element of health equity debates relates to how to judge health need. One approach receiving increasing support in the literature is to define need as ‘capacity to benefit’ (Creese 1990; Normand 1991; Culyer and Wagstaff 1993). Capacity to benefit implies that need should not be equated to ill-health. Thus, an individual may have the capacity to benefit from health care but not be ill, as is the case for preventive interventions. Alternatively, a person may be ill but not need health care, as is the case when there is no effective treatment (Culyer and Wagstaff 1993). While the notion of ‘capacity to benefit’ is conceptually appealing, it is difficult to operationalise in some instances, particularly where health data are poor. In practice, many studies use mortality as a proxy for health need. However, if one

defines health need as the 'capacity to benefit', mortality is an inadequate measure of health need. Given the well-documented relationship between relative dis-advantage and ill-health, measures of deprivation are sometimes incorporated in health care resource allocation formula (DHSS 1986). Given that those who are most deprived are also likely to be those who do not have the ability to pay for health service use, deprivation indices are an important indicator of the need for health services that are funded from government sources. For this reason, this study considers both measures of mortality and deprivation in assessing the need for health services.

As indicated previously, vertical equity is the preferred approach in this study. While alternative specific definitions will be raised in the analysis where relevant, the main equity goal guiding the analysis in this paper is: The preferential allocation of resources towards those geographic areas identified as having the greatest levels of need where:

- Resources are considered in relation to:
  - financial resources (available for service provision at the small area and provincial level)
- need is considered in relation to:
  - mortality (although it should be recognised at the outset that mortality data are poor in South Africa)
  - health-related socio-economic deprivation
  - socio-economic deprivation

This goal could be stated slightly differently as follows: striving for unequal (more) resources for unequal need (higher levels of deprivation). An alternative vertical equity goal would be that of striving for unequal (more) inputs (measured for example by number of health personnel) for unequal need (higher levels of deprivation). Due to the lack of disaggregated input data in South Africa, it is not feasible to measure or monitor progress towards the latter goal at present.

Another underlying vertical equity goal is that of preferentially promoting health status improvements for those who are currently most deprived, in order to reduce the gap in health status between different groups in South Africa. Thus, the preferential consideration of dis-advantaged groups in allocating government resources (as described above) is ultimately intended to promote well-being, including health improvements, among those who are currently most deprived.

2.2 Deprivation indices and related indicators

As indicated previously, it is important to recognise the different aspects to deprivation, particularly the distinction between material and social deprivation. The literature, particularly that relating to the measurement of deprivation, has focused heavily on material deprivation.

2.2.1 Overview of deprivation indices used in high-income countries - their construction and uses

Much of the work on the development of deprivation indices has been conducted in the United Kingdom. Despite the vast body of literature, there exists no definitive method of measuring deprivation. However, common to all these measures is the combination of variables into a composite index. The key factors differentiating the indices from each other are the selection of their component variables, and whether the variables are weighted equally or differentially to form the composite deprivation

index (Saunders 1998). There have been two primary uses of these indices, namely:

- To investigate the relationship between deprivation and ill-health; and
- For resource allocation purposes (e.g. to include in resource allocation formulae).

The most widely known and commonly used deprivation indices are the Jarman UPA (underprivileged area) Index (Jarman 1983 and 1984), and the indices focusing on material deprivation, namely the Townsend Index of Material Deprivation (Townsend *et al.* 1988) and the Scottish Deprivation index (Carstairs and Morris 1989a and 1989b; Morris and Carstairs 1991). The component variables in these indices are summarised in Table 2.1.

Table 2.1: Variables included in frequently used deprivation indices

VARIABLES	**Jarman UPA 8 & Swedish UPA**		**Scottish**
Deprivation score	**Townsend material deprivation index**		
Unskilled/Low social class		X	
Unemployment	X	X	X
Overcrowding	X	X	X
Socio-economic group	X		
Under age of 5	X		
Lone pensioners	X		
Ethnic minority origin	X		
Changed house/ address in past year (Mobility)		X	
No car ownership		X	X
Single parent	X		
Living in rented accommodation			X

Other deprivation indices developed in the United Kingdom include that by Gordon (1995) which contained 32 census based variables, a similar index developed by Saunders (1998) for a study in Greenwich and the British Department of the Environment's deprivation index which includes 13 variables (Drever and Whitehead 1995). Literature on deprivation indices in other high-income countries is extremely limited. The only example within European countries (other than Britain) that could be located in routinely available literature was the Swedish UPA score referred to above (Bajekal *et al.* 1996). Within the United States, two types of indices of relative dis-advantage in access to health services have been developed, namely the Health Professional Shortage Area (HPSA) index and the Index of Medical Underservice (IMU) (Taylor 1998).

The Australian Bureau of Statistics routinely compiles a range of socio-economic indices based on census data (McLennan 1998). The Index of Relative Socio-economic Disadvantage is of most relevance to the current study and has been used to explore the relationship between deprivation and ill-health and is used to ensure that social services are targeted to areas that need them most (*ibid*). The key variables included in this index are: lack of educational qualifications; low family income level; unemployment, unskilled and semi-skilled workers; early school leavers; single parents; living in rented accommodation; no car in household; overcrowding (two or more families in dwelling); and minority groups (Aboriginals, Torres Strait Islanders and those lacking fluency in English).

2.2.2 Key issues in relation to constructing deprivation indices: lessons from high-income countries

The deprivation indices summarised above include a wide range of component variables and there is no agreement on which variables are the 'best'. However, two

variables common to most indices (with the exception of the USA indices) are unemployment and overcrowding. It is of interest that Campbell *et al.* (1991) and Haynes *et al.* (1996) found that a single variable index consisting only of unemployment was as effective in predicting geographic variations in mortality and long-term illness as the composite Jarman, Townsend and Scottish deprivation indices. Morris and Carstairs (1991) also found that a single variable, in this case 'no car' which was used as an indicator of asset ownership, was strongly correlated with health variables. The advantages of a single variable index are that it is simpler to calculate and easier to update on a routine basis (e.g. from routine household survey databases rather than relying on less frequently compiled census data) (Haynes *et al.* 1996). The disadvantage is that a single variable is more susceptible to rapid changes or fluctuations than a composite index (Morris and Carstairs 1991).

In reviewing the international literature, it should be recognised that is unlikely that indicators of deprivation relevant in high-income countries will be entirely appropriate in low- and middle-income countries. However, the literature provides useful guidance on how to embark on constructing a country-specific (and study-specific) deprivation index. In particular, Taylor (1998) suggests four principles to guide the development of a deprivation index (which have been taken into account in this study):

1. Indices should follow from the policy goals - it is important to clearly state the policy goals of the study, and to ensure that index development is based on these goals;
2. It is important to identify the level of geography at which one wishes or expects to identify the particular phenomenon under study (i.e. the nature of the small area to be studied);
3. The index must be specific to the program/issue being focused on and indices that were developed for other purposes should not be used inappropriately (e.g. "the UPA8 has come to be used generally as a measure of deprivation and is not usually referred to as a proxy measure for increased GP workload which is what the index was originally designed to measure" (Taylor 1998: 719));
4. The index should be reviewed regularly (particularly if being used for resource allocation purposes) to take account of new data and technical innovations.

Another relevant methodological guideline is that provided by Gordon (1995), who argues that when constructing a deprivation index, it should meet 2 criteria to ensure accuracy, namely that component variables should be additive and that differential weighting should be assigned to variables. Saunders (1998) explains 'additive' to mean that if an individual ranks poorly with regard to two or more variables of an index, that individual is more likely to be deprived than an individual belonging to only one of the categories. There is growing consensus in the literature that component variables should be weighted instead of constructing a simple additive index. The lack of weighting for individual variables reflects an implicit, and often false, assumption that individuals displaying any one characteristic reflected in the index are just as likely to experience deprivation as individuals or households displaying any other characteristic (Gordon 1995; Folwell 1995). Weighted indices make explicit the relative importance of different variables in driving deprivation. One statistical technique that ensures additivity and differential weighting of component variables is that of principal component analysis (PCA), which is the approach used in the current study (see methodology section).

2.2.3 Deprivation indices in middle-income countries

Very few examples of the construction and use of deprivation indices in middle-income countries could be found, most of which were not specifically designed for use in health-related studies. A recent study in Mexico used the Marginality Index,

which was developed by the Mexican government for general analysis of marginality or deprivation, to evaluate health inequalities between small areas/counties (Lozano *et al.* 2000). This index comprises:

- The percentage of the population within each county who:
  a. are illiterate;
  b. have not completed primary/elementary schooling;
  c. earn less than twice the minimum wage; and
  d. live in a small town (with less than 2,500 inhabitants); as well as
- The percentage of households in each county which:
  a. have no running water, electricity, sewage facilities and a proper floor in their dwelling; and
  b. are overcrowded.

The only other examples of deprivation indices in middle-income countries that could be located during the literature review all relate to South Africa.

May *et al.* (1995) compiled a Basic Needs Indicator (BNI) to measure poverty levels in South Africa. It should be noted that these researchers assumed a broader definition of poverty than merely insufficient income, and argued that lack of access to basic needs should also be considered. They selected four indicators of material deprivation or lack of access to basic needs, namely households' relative access to sanitation, potable water, energy sources, and housing (both the structure and the extent of overcrowding).

A similar approach was adopted by Gilson and McIntyre (2000) for developing a simple Environmental Health Index (EHI). The EHI consisted of three variables namely access to water, sanitation and energy source for cooking.

Klasen (1998) compiled a composite deprivation index consisting of 14 indicators. The indicators were: education; income; wealth (household durable goods); housing characteristics; type of water access; type of sanitation facilities; source of energy for cooking; employment status; transport (type used to get to work); extent of debt; nutritional status of children; use of health care during last illness; perception of safety; and perceived general well-being. The main purpose of Klasen's analysis was to compare deprivation with standard measures of poverty. He found that approximately 30% of the most deprived people, as identified by the deprivation index, were not identified by the income poverty measure.

The rationale for the development of a multivariate index of poverty in South Africa by Vella and Vichi (1997) was once again that income insufficiency does not reflect all the dimensions of poverty adequately. They favoured a composite index "of poverty based on socioeconomic indicators which are proxies of wealth, health and living conditions" (Vella and Vichi 1997: 6). Using PCA, they compiled an index for rural areas consisting of 13 variables: type of toilet; source of water; ownership of a motor vehicle, television, telephone and fridge; presence of debts in the household; dependency ratio; and gender, age, education, travel for work (migrancy) and illness of the head of household. The index for urban areas was identical to that for rural areas except that it excluded source of water.

While the different indices described above have been used for different purposes, the composition of deprivation indices in middle-income countries is strikingly different to that in high-income countries. It is important to note that all of the deprivation indices (both in high- and middle-income countries) rely entirely on quantitative data derived from a census or household survey. However, as noted previously, poverty and deprivation are multi-faceted and it is therefore important to also draw on qualitative information in determining appropriate indicators of

deprivation.

2.2.4 Perceptions of poverty and deprivation in South Africa

This section provides a brief overview of available South African data drawn from qualitative investigations into poorer groups' perceptions and understandings of poverty. Such data are important as a complement to, and check on, the central element of our analysis, that is the creation of quantitative deprivation indices. These perceptional data allow us, in particular, to critique the indices created through the application of statistical techniques, expert opinion and policy-maker views, and ensure that the perspectives of those who themselves experience poverty are 'heard' in this analysis.

The first key point to note is that people's perceptions of poverty are multi-faceted and different dimensions are intricately linked in a complex web. Ill-health is, for example, included as an inherent aspect of poverty, along with socio-economic and other dimensions. It is, therefore, difficult to extract either a short and simple list of 'variables' or weightings for those different variables that might be brought together in a quantitative index. In addition, whilst common themes can be derived from the available data, perceptions of poverty are linked to the specific circumstances of the individuals expressing their views. Differences between individuals or communities represent different experiences and understandings, and so it is inevitably difficult to capture a common understanding in words, let alone through quantitative analysis.

It is also important to note that the perceptions captured in different studies also partly reflect differences in methodological enquiry and analysis. The data presented by May *et al*. (1996) were collected through participatory appraisal techniques which, in principle, allowed a wide range of participants to present their own views and opinions about their own experiences. In contrast, the views presented in SANGOCO (1996) were drawn from public hearings into different pre-determined dimensions of poverty.

Despite various concerns about how to distil a list of poverty dimensions from the perceptional data, the following key themes, presented in no particular order, can be highlighted:

- isolation from the community and being unable to mix easily with other people;
- demographic/compositional features of the household such as: split families (fathers not present and/or children living elsewhere), female-headed, having many children;
- environmental features of household experience such as poor housing (crowded, in poor condition, of a poor type e.g. shacks); energy use problems (i.e. most basic form used and family often energy insecure); water availability problems (difficult to access and less clean forms of water most accessible);
- nutritional problems such as children malnourished, household food of poor quality, little or no food available in household, household not part of community gardens;
- ill-health, particularly catastrophic illness (such as HIV/AIDS) and death;
- educational features such as not being able to afford school fees, having children who do not attend school; and
- employment and income issues such as nobody in the household is employed, being a farm worker, dependency on pension income within the household.

May *et al*. (1996) emphasise first that income is rarely if ever directly mentioned by study participants as a dimension of poverty and second, that social isolation is a major theme in these perceptions. Although not clearly presented in this way within

perceptions, some of the other features listed above might themselves, thus, be a reflection of social isolation. For example, gender (with women being more isolated), age (with the young and the elderly being more isolated), casual employment, migrancy, children not attending schools, and households not being part of community gardens. In addition, the SANGOCO hearings identified other dimensions of poverty that might be linked to the social isolation of individuals or households, such as distance as a barrier to school or health facility use, and lack of information and knowledge (e.g. about legal and socio-economic rights). The hearings also pointed to features of communities that might contribute to social isolation e.g. lack of facilities within communities and poor leadership.

Some of these perceptions of poverty can be translated into indicators where census or household survey data exist, and can, thus, be included in deprivation indices. Others are not as easy to measure using routinely available data. The key purpose of presenting this information is to provide a basis for critiquing the quantitative deprivation indices we have so far created (see discussion section). In addition, their potential future use in constructing another index that might better reflect perceptions of poverty will be considered.

2.3 Key issues in small area studies

The deprivation indices described above, particularly those in high-income countries and in Mexico, have been primarily used for undertaking small area studies. Despite the fact that a number of alternative deprivation indices have been developed within South Africa (only one of which was specifically designed for a health-related study), none of them have been applied within the context of small area analyses.

To date, very few small area studies have been undertaken in low- or middle-income countries. The only two published studies that could be identified are: 1) a relatively limited small area analysis undertaken in South Africa as part of a Health Expenditure Review which only used income data rather than a broader deprivation index (McIntyre *et al.* 1995); and 2) a more extensive study undertaken recently in Mexico (Lozano *et al.* 2000).

2.3.1 What is the focus and what are some of the advantages of small area studies?

The majority of these studies have used small areas as a mechanism for exploring the relationship between socio-economic and health characteristics. Some studies have explicitly focused on the use of small area analyses to identify locations with the greatest health need, for health care resource allocation purposes. One benefit of such an approach is that it is relatively easy to target health (and other social sector) resources to small areas, given that resource allocation mechanisms and social service delivery planning is usually geographically based (Carstairs 1981b; Curtis 1990; Haining *et al.* 1994). Another advantage is that politicians may be more likely to support initiatives to secure and target additional resources (and/or for relative resource redistribution) when confronted with evidence of differentials in health need between geographic areas. This particularly applies to politicians who represent relatively disadvantaged constituencies (Personal Communication with B. Zurita - feedback on impact of the Mexican study).

2.3.2 What constitutes a small area?

A range of different sizes of areas (both in terms of physical and population size) have been used in what are classified as "small area" studies. The literature highlights both the problems of "going too small" and of "not going small enough". The main concern with relatively large areas is that they are less likely to contain a homogenous population and that areal aggregates will obscure potentially wide variation within areas (Dolk *et al.* 1995; Bajekal *et al.* 1996; Taylor 1998). Thus, while an area may on average have relatively good socio-economic indicators, it may contain pockets of extreme deprivation.

The problem of areal averages obscuring pockets of extreme deprivation is more likely to occur in densely populated metropolitan areas. Stephens (1996) and Stephens *et al.* (1997) have recently highlighted the extreme socio-economic and health disparities that exist within cities, particularly in low- and middle-income countries. In many of these countries, areal analyses that don't identify deprived urban communities through the use of sufficiently small areas may result in relative disadvantage being viewed primarily as a rural-urban issue. Stephens (1996: 12) highlights that some "… policies based on this [urban-rural] divide [have] exacerbated the fragility of the urban poor." Thus, it is important that special attention is paid to the areal size selected for analysis in metropolitan areas.

In the current study, magisterial districts have been used as the small area unit of analysis. This is partly attributable to the fact that census data and vital statistics data are available in this format. In addition, magisterial districts are sufficiently small to contain a relatively homogenous population (with the possible exception of those located in metropolitan areas) while being sufficiently large to provide data which can be subjected to statistical analysis. Finally, while magisterial districts do not represent an administrative entity in relation to social service delivery, they are the component areas for health districts (i.e. the vast majority of health districts in South Africa comprise of a number of magisterial districts).

2.3.3 What are some of the potential problems of small area studies?

The literature consistently refers to problems that may occur in small area studies associated with what is termed the "ecological fallacy". However, there appears to be some confusion in the literature as to the precise nature of this problem. As noted by Richardson (1992: 196), "Several related problems have been discussed under this generic term [ecological fallacy], leading some authors, sometimes, to argue at cross-purposes." Diez-Roux (1998: 218) provides a clear overview of a range of problems that can arise in areal studies and defines and illustrates this issue as follows: "The ecological fallacy is the fallacy of drawing inferences at the individual level based on group-level data. Suppose a researcher finds that, at the country level, increasing per capita income is associated with increasing motor vehicle-related mortality. If the researcher infers that, within countries, increasing income is associated with increasing motor vehicle-related mortality, she or he may be committing the ecological fallacy because, within countries, motor vehicle-related mortality may always be higher in low-income than in high-income persons." Thus, the ecological fallacy is more likely to occur in small area studies which attempt to infer an individual-level relationship between socio-economic and health characteristics. As this is not the purpose of the current study, the problem of ecological fallacy is unlikely to arise.

An important drawback of studies, such as the current one, which merely focus on areal level analysis, is that, while they are able to identify areas with relatively high levels of mortality, the factors contributing to this health experience are not explored in detail (Reading *et al.* 1994). It is clearly helpful to understand "the complexity of interactions between socio-economic, environmental, and behavioural influences on

health" (Reading *et al.* 1994: 192), in order to design more appropriate health-promoting interventions. These may include a range of health service interventions, changes in other social services or economic policies, all of which could be directed either at individuals or the small area itself (e.g. making available more sports facilities within the area rather than merely encouraging individuals to undertake regular physical exercise (Macintyre *et al.* 1993)).

This suggests that the current study should be regarded as a first step; that it will serve to identify areas with great need for health and other social services as well as for strategies to address economic deprivation. It would be advisable to undertake other studies thereafter that attempt to explore the factors contributing to ill-health in these areas in greater detail, to refine social and economic policy interventions. A particular focus in future could be that of multilevel or contextual analyses (i.e. those where individual-level dependent variables, and a combination of group- and individual-level independent variables are used) (Diez-Roux 1998). One variable in these analyses that is receiving considerable attention at present is that of social capital (see for example Kawachi *et al.* 1999).

In addition to multilevel or contextual analyses, it may also be advisable to undertake detailed studies within the small areas identified as being disadvantaged in terms of their health and socio-economic status, to evaluate the "features of local areas which might be health damaging or health promoting" (Macintyre *et al.* 1993: 217). This should not only focus on "the physical environment" but also on "the social, cultural or economic environment" (Macintyre *et al.* 1993: 217) and the *opportunities* which are available in these areas "for health promoting activities" (Ellaway *et al.* 1997: 307).

2.4 Conceptual framework, aims and objectives of the study

Drawing on the findings of the literature review, the following issues relating to the conceptual and methodological framework of this study can be summarised:

- A vertical equity approach is used in this analysis. Thus, the focus is on prioritising those who are most deprived to benefit from resource allocation decisions, both within the health sector and more broadly. The ultimate goal is to preferentially promote well-being, including improved health status, among the most deprived in order to reduce the massive disparities inherited from the apartheid government. In order to operationalise this approach, a mechanism must be found for identifying the most deprived or dis-advantaged.
- Deprivation is viewed as individuals or households being dis-advantaged relative to others in society, not only in access to material resources, but also in a range of social aspects. This understanding of deprivation informs the variables considered for inclusion in a general deprivation index in this study.
- Various indices have been developed internationally to measure deprivation. These indices generally include socio-economic, demographic and physical household characteristics. The literature stresses the importance of developing an indicator that is appropriate to the goals of the study and the country context. For this reason, considerable effort has been devoted in the current study to exploring specific alternative indices that are appropriate in relation to the above vertical equity goals.
- The literature also provides guidelines for the development of deprivation indices. In particular, the variables included in an index must be additive and should be given differential weightings. As indicated in section 2.2.2, principal component analysis (PCA) ensures additivity and differential weighting, and thus the PCA methodology has been adopted in this study.
- While a deprivation index assists in identifying the most dis-advantaged in

society, it needs to do so in a way that will facilitate the preferential allocation of resources to them. As it is easier to direct government resources to geographic areas than to individuals, the analysis of relative dis-advantage between small areas is a key component of this study's analysis.

On the basis of a review of the key concepts and methodological issues, the following aims and objectives were developed.

The aim of the study is to evaluate the usefulness of an analysis of small areas in developing deprivation indices as a tool for informing the allocation of government resources (health and more broadly), taking a vertical equity perspective.

The specific research objectives were to:
1. Draw on the international literature to inform the appropriate identification of small areas and development of deprivation indices;
2. Construct and evaluate alternative indices of deprivation for the small areas;
3. Compare deprivation and mortality in small areas;
4. Compare the distribution of public sector primary health care services and deprivation (and if feasible mortality) between small areas, to assess the extent to which resources for these services are currently being allocated in support of vertical equity goals; and
5. Explore mechanisms for using the analysis of deprivation in small areas for resource allocation and planning purposes, in order to contribute to policy debates about current resource allocation approaches.

3. METHODS

3.1 Key issues about deprivation indices and small areas

3.1.1 Broad description of the deprivation indices constructed in this study

Indices of deprivation will vary depending on the choice of variables for inclusion. In using indices to investigate equity in health and health care resource allocation, the choice of variables could reflect policy makers' or community views about what should influence health care resource allocation, or could come through exploring the relationships in the socio-economic and health data itself. In this study, four possible indices of deprivation are compared.

Two indices were developed using PCA methods, the first a general measure of deprivation and the second a measure of health-related deprivation which combines health status and potential major socio-economic influences on health status. A policy-perspective index was also developed using governmental documentation. Lastly, a single variable measure of deprivation was identified.

These indices are calculated for small areas in South Africa. The relationship of these indices with each other, as well as with measures of health status, is assessed both for all small areas in South Africa and for separate urban and rural subsets.

3.1.2 The use of small areas

Many studies measuring deprivation have shown that the use of relatively small areas such as enumeration areas, produces differing results from analysis performed on larger areas using the same underlying data (Carstairs 1981b). This can be attributed to the increasing homogeneity between individuals and households within

smaller areas, which may decrease with widening geographical divisions.

In South Africa, the smallest areas by which routine household survey and census data are represented are enumeration areas (EAs). It was, therefore, initially intended to conduct analysis at this level using the census database. In practice, however, it was not feasible to conduct EA level analysis, partially due to the fact that the number of registered deaths at the EA level in the vital statistics database was too small to have confidence in any results produced.

As a result, the research team decided instead to use magisterial district level data in this analysis. Magisterial districts combine a number of EAs, and are an historic administrative areal construction (each of these districts had a magistrate). There are currently 354 magisterial districts in South Africa, which differ substantially in size, ranging from 3,819 people in the Sutherland district of the Northern Cape to 904,166 people in Soweto, Gauteng. These differences are largely due to population density differences; Sutherland in fact covers a substantially larger physical area than Soweto. As will be discussed later, given the vast differences in population sizes in different magisterial districts, it ultimately would be preferable to use EAs in metropolitan areas and MDs in non-metropolitan areas.

3.2 Data Sources

3.2.1 Socio-economic variables

A number of routine surveys (including the annual October Household Survey and the less regular Income and Expenditure Survey and the census) are conducted in South Africa generating data that might be used in assessing deprivation. In this study the 1996 census was chosen as the source of socio-economic information for a number of reasons. Firstly, this is a comprehensive survey of all South African residents and so fully representative of the population. Secondly, it is the first population-wide data collection exercise since the democratic elections in 1994. It is, therefore, important to examine its usefulness as an information source for investigations such as those into equity, which should be of high policy priority for the new government. Thirdly, it should in principle, if only in the future, be possible to conduct EA-level analysis with this database.

Table 3.1 outlines the socio-economic variables drawn from the census that were used in determining the various deprivation indices developed in this study.

Table 3.1: Overview of census-based socio-economic variables used in this study

Variable name	Definition Rationale
DISAB	The proportion of a district's population suffering from any disability There is an assumption that those with a disability may require additional household resources to support their lives; therefore it may be an important reflection on the level of available income in a district. Disability may also reflect deprivation from a social exclusion perspective.
NOSCHOOL	The proportion of adults 25 and over with no schooling in a district. Lack of formal education affects both the ability to earn income and to make the most effective household and health related decisions
UNEMP	The proportion of adults between 25 and 59 classified as both not working and looking for work or not working and not looking for work. As this has a negative effect both on the ability to earn income to purchase goods and services but also a separate detrimental psychological factor from not working.
OWNER	The proportion of houses that are occupied by their owners Previous studies have shown lack of owner occupation to be an important deprivation variable
HOUSE	The proportion of houses in a district that are traditional dwellings, shacks or tents These forms of housing tend to offer less environmental protection to its inhabitants
ROOMS	Proportion of houses that have no or only 1 living room (including bedrooms) Used as a proxy for overcrowding, shown in previous studies to be an important measure of deprivation (overcrowding itself could not be measured due to limitations in the census data).
WATER	Proportion of households that do not have piped water in the house or on site Self-explanatory
TOILET	Proportion of households that use a pit or bucket latrine Self-explanatory
REFUSE	Proportion of households that have no access to any form of refuse disposal Self-explanatory
PHONE	Proportion of households that have no access to a phone nearby or at all Included in some studies (e.g. Vella and Vichi 1997) as a possible measure of deprivation
LIGHT	Proportion of households that use candles or paraffin as their household lighting source Lack of access to electricity for lighting, and for cooking, can create health-related environmental hazards
FEMHD	Proportion of households that have a female head Female headed households may have access to fewer economic resources, and may also experience social exclusion aspects of deprivation
ELDHD	Proportion of households whose head is 60 year or over As for female headed households
NOSCHD	Proportion of households where the head of the household has no formal education Similar reasons to that for NOSCHOOL variable
UNHD	Proportion of households in the district where the head is unemployed Similar reasons to that for UNEMP variable

In addition to the above variables, selected demographic characteristics of districts were also considered because they have been given emphasis by national policy-makers in recent policy documentation. Table 3.2 outlines the demographic variables from the 1996 census survey also included in this study.

Table 3.2: Demographic characteristics of magisterial districts included in the study

Variable name	Definition
FEMALE	% of the district's population who are female
CHILD	% of a district's population who are under five
ELDERLY	% of a district's population who are 60 or older
BLACK	% of a district's population who are black

RURAL	% of a district's population who live in non-urban or rural enumeration areas

3.2.2 Health status information

In this study, health status information is restricted to mortality as morbidity data within small areas are not routinely available in South Africa. Mortality data were obtained from the vital registration statistics database.

There was considerable discussion within the research team and with mortality data experts about the mortality variables to use in this study. It is widely known that there is significant under-reporting of deaths in South Africa, particularly in rural areas (see for example Bradshaw *et al.* 1995). We, thus, explored possible indicators of mortality that may be less vulnerable to the under-reporting of deaths. For this reason, data on the potential years of life lost (PYLLs), the number of deaths, the percentage of deaths due to infectious diseases and the percentage of deaths due to 'ill-defined' causes were extracted for each magisterial district for the following reasons:

- PYLLs per death was used as it was assumed that it would reflect differences in mortality burden due to death at a relatively early age, and as both the numerator and denominator were drawn from the vital statistics database, would not be as prone to under-reporting distortions;
- the percentage of deaths due to infectious diseases was used to indicate differences between areas in deaths due to potentially preventable diseases, which could be addressed through primary care services (thus reflecting health need), and which tend to be related to socio-economic deprivation;
- the percentage of deaths due to ill-defined causes was assumed to reflect poor death registration practices and poor access to health services (where the cause of death could be adequately investigated). Thus, this measure is partially a health service indicator as well as a mechanism for identifying areas where there tends to be under-reporting of deaths.

3.3 Creation of the deprivation indices

This section briefly describes the methodology used to develop each of the four deprivation indices.

3.3.1 General Index of Deprivation (GID)

In order for PCA to produce a useful, interpretable solution the variables included in the analysis should show a high correlation with each other (Alderman and Morris 1967; Tabachnick and Fidell 1996). To investigate this correlation in our data, Spearman rank correlations were performed between all the socio-economic and demographic variables listed above. Variables which showed high correlation with all other socio-economic and demographic variables (defined as significant at 1% level) were included in the factor analysis used in determining this general index, to ensure that spurious results were avoided as far as possible (Alderman and Morris 1967). This reduced the data set to 17 variables with 'TOILET', 'ROOMS' and 'OWNER' dropping out due to the inconsistent behaviour of these variables with other socio-economic indicators.

Variables were initially explored using a principal component method of extraction and Varimax rotation. The number of components to be extracted was determined via the investigation of Scree plots. Any variable considered to be duplicating

information and thereby violating the principle of additivity, was dropped from the final analysis. The component explaining the greatest percentage of variance in the correlations, (by method, the first), was used as the basis for the GID.

Component score coefficients were determined through use of the regression technique available in SPSS, to act as weights in the final index. Standard scores were then calculated on variables that contributed significantly to the component. A weighted summation of these scores provided the GID, which can be mathematically represented as follows:

$$GID = \Sigma w_i z_i$$

where: w = weight (i.e. the component score coefficient);
z = the z-score of each variable; and
i = 1 to total number of variables included

Districts were, finally, ranked by this index.

3.3.2 Health-related Index of Deprivation (HID)

To develop an index of health-related deprivation, variables that correlated highly both with other socio-economic or demographic variables as well as the health status variables used in the analysis were retained for analysis. Investigation showed, however, that all socio-economic indicators showed negative correlation with all indicators of health except the variable 'percentage of deaths from infectious disease' (PINFECT). This is probably due to the lower number of deaths registered in rural areas. PINFECT was therefore the only health variable that could be used to develop an index of health-related deprivation that might be applied countrywide.

PINFECT was therefore included as a variable within the PCA, together with the full range of socio-economic and demographic variables listed above. The component used as the basis for the HID was that which had the highest loading on the health variable, PINFECT (Kline 1994).

A weighted summation of key variables for the HID was undertaken, as described for the general index in section 3.3.1, and districts were ranked using this index.

3.3.3 Policy-perspective Index of Deprivation (PID)

South African government policy documents since 1994 have consistently stated that resources should be directed to those who are most vulnerable. In such documents, vulnerability is generally defined as encompassing the poor, black, elderly, women and children and those living in rural areas (see Table 3.3 below).

Table 3.3: Dis-advantaged groups identified in recent policy documents

Document (source)	Priority groups						
	Poor	rural pop	peri-urban pop	Black	women	Disabled	Elderly	Children
Reconstruction and Development Programme 1994	√	√		√		√	√	√
Employment Equity Act 1998				√	√	√		
White Paper for the Transformation of the Health System 1997	√		√	√	√	√		√

Source: McIntyre and Gilson (2000), based on information drawn from African National

Congress (1994); South Africa (1997); and the Employment Equity Act of 1998.

Variables reflecting these demographic and areal characteristics were therefore obtained from the 1996 census. For each, standard scores were calculated and transformed to reduce skewness. These were then summed without weighting to produce the PID. This approach, which in effect attaches equal importance to each variable, was seen as appropriate because the policy documentation does not give particular priority to any of these perceived dimensions of vulnerability. Again districts were ranked according to the value of the index.

3.3.4 Use of a single variable

In this study, the selection of a single indicator was based on consideration of its correlation with health status (in this case the percentage of deaths recorded due to infectious disease, PINFECT). The variable found to have the greatest correlation with PINFECT was WATER, the percentage of houses with no access to running water. Districts were then ranked according to this percentage - now viewed as the single index of deprivation or SID.

3.3.5 Comparison of the alternative indices

District rankings obtained for each index were compared with each other using Spearman rank correlation analysis. In addition, quintiles of districts were produced for each of the deprivation indices. The percentage of the population in each province living in districts falling within each quintile was calculated and is presented in bar chart format. This study also presented the number and physical area of districts in each province according to deprivation quintile in the form of maps (the maps are not presented in this report but may be obtained from the authors). The characteristics of the districts in each quintile of each index were also investigated and compared.

3.4 Exploring the relationship between health and deprivation (Rural/Urban analysis)

A correlation analysis of the four deprivation indices and the alternative mortality measures was undertaken. Many previous studies have found that appropriate indicators of deprivation and health vary between urban and rural areas (see for example McLennan 1998). The data set was therefore separated into rural and urban districts, where urban districts were defined as those in which greater than 75% of the population lived in enumeration areas classified as urban, and similarly for rural. A hundred districts were included in the rural data set and 79 in the urban, with 175 districts falling into neither category. PCA was then used to develop a general index of deprivation for urban areas only, to explore possible differences in the experience of deprivation in urban and rural areas and to consider the relationship between ill-health and deprivation.

3.5 Analysing the implications for inter-provincial resource allocation

An important consideration in this research is the relevance of deprivation indices to resource allocation policies. As noted in the introduction, a key resource allocation process in South Africa is the decision about how to allocate block grants between provinces. To investigate the degree of vertical equity promoted through the current

approach to resource allocation, a population weighted provincial index value was calculated for each province, using the GID and the PID. Thus, the index value for each magisterial district in a province was multiplied by the proportion of the provincial population living in that district, and these values were then summed. These provincial indices were then normalised against the value for the least deprived province (Gauteng for both the GID and the PID). The normalised values were then used to weight the provincial populations and this weighted population was included as one component of the overall inter-provincial resource allocation formula (see later sections for a more detailed discussion of the formula).

3.6 Problems and limitations

3.6.1 Socio-economic characteristics

Not all variables that are likely to be of interest in quantifying deprivation at a district level could be included in this analysis. Probably the most important gap in this analysis is the lack of income data. The most valid source of income data in South Africa is that collected by the Income and Expenditure Survey (IES), which is conducted every five years. The most recent of these surveys for which data are available is the 1995 IES. However, a major problem with this data set is that it includes incorrect population weightings derived from the 1991 census. New weightings based on the 1996 census are required in order to combine the 1995 IES and 1996 census databases.

Another important data constraint in this study is that variables based on the combination of data at an individual or household level could not be produced from the census database, due to its structure. Certain of these variables, such as overcrowding, have been shown to be important in past studies of deprivation in South Africa (Vella and Vichi 1997; Klasen, 1998).

3.6.2 Measures of health need

Problems with vital registration of deaths in the rural areas of South Africa have been noted in the past. The under-reporting of deaths in these areas has undermined our analysis, particularly of the correlation of deprivation and health, from the outset. More generally, the measures of health status relate only to mortality. The degree to which mortality relates to levels of morbidity, and therefore provides a more valid reflection of total health need, is debatable. In a number of studies, mortality has proved to be a useful proxy for morbidity and health need, whereas others show that its use may underestimate the need for health care resources in deprived areas (see summary in Mays and Chinn 1989).

3.6.3 Small areas used

Previous studies using small area analysis have suggested a preference for using areas as small as electoral wards or enumeration areas in investigating health and socio-economic inequities, due to the greater homogeneity in personal and household characteristics at this level (Gordon 1995; Crayford *et al*. 1995). In this study, however, analysis was restricted to magisterial districts for the reasons outlined in section 3.1.2. To investigate potential benefits of using smaller areas in similar research in South Africa in the future, it may be useful to aggregate data across two or three years to provide sufficient numbers of events for results to be valid.

4. RESULTS

4.1 General Index of Deprivation: All areas

4.1.1 Selecting the variables for analysis

As highlighted in the methodology (see section 3.3.1), in order to ensure that the factor analysis produced interpretable results, socio-economic variables included in this analysis were restricted to those showing bivariate Pearson correlation coefficients significant at the 1% level (Alderman and Morris 1967). The variables that were significantly correlated with other socio-economic variables, and which were therefore included in the first run of the Principal Component Analysis (PCA), are shown in Table 4.1.

Interestingly, the variable reflecting the proportion of houses occupied by the owner (as opposed to a renting tenant) was excluded from the PCA as it was found to be a predictor of *low* socio-economic status. This is contrary to most international literature, where owner occupation is found to correlate highly with many indicators of *high* socio-economic status. It was in fact on the basis of this positive correlation that Townsend included 'living in rented accommodation' as one of the four variables in his Index of Material Deprivation (Townsend *et al.* 1988). The apparent anomaly in South Africa may reflect the ownership of shacks and traditional dwellings (as there was a 0.585 correlation between home ownership and these types of dwellings), a phenomenon unique to a developing country setting. The 'proportion of houses with less than two rooms' and the 'proportion of households using a pit or bucket latrine' variables were also removed due to unusual correlation patterns.

An interesting issue arising from Table 4.1 is the particularly high correlation between access to a phone and a number of other variables (including access to water, energy source or fuel, refuse disposal access and rural location). Access to water has a similarly high correlation with a range of other variables.

Table 4.1: Pearson correlation coefficients between socio-economic and demographic variables

	FEMALE HOUSE	CHILD WATER	RURAL REFUSE	BLACK PHONE	NOSCHOOL LIGHT	UNEMP FEMHD	DISAB ELDHD	UNHD		
CHILD	0.633	1.000								
RURAL	0.470	0.740	1.000							
BLACK	0.312	0.411	0.500	1.000						
NOSCHOOL	0.547	0.770	0.690	0.488	1.000					
UNEMP	0.564	0.608	0.431	0.669	0.530	1.000				
DISAB	0.232	0.093	0.116	0.599	0.218	0.513	1.000			
HOUSE	0.371	0.578	0.576	0.704	0.553	0.591	0.298	1.000		
WATER	0.564	0.733	0.816	0.665	0.697	0.678	0.294	0.758		
	1.000									
REFUSE	0.434	0.626	0.606	0.482	0.656	0.488	0.178	0.665		
	0.733	1.000								

PHONE	0.511	0.734	0.801	0.572	0.681	0.579	0.245	0.717		
	0.865	0.804	1.000							
LIGHT	0.477	0.673	0.726	0.610	0.654	0.616	0.291	0.737		
	0.849	0.681	0.825	1.000						
FEMHD	0.686	0.726	0.713	0.640	0.647	0.719	0.333	0.637		
	0.839	0.652	0.798	0.732	1.000					
ELDHD	0.635	0.424	0.471	0.186	0.471	0.475	0.262	0.287		
	0.559	0.433	0.540	0.510	0.620	1.000				
UNHD	0.516	0.664	0.558	0.745	0.555	0.901	0.458	0.680		
	0.769	0.568	0.678	0.676	0.833	0.397	1.000			
NOSCHD	0.477	0.656	0.639	0.476	0.936	0.470	0.218	0.444		
	0.598	0.507	0.517	0.543	0.528	0.405	0.473			

4.1.2 Constructing the General Index of Deprivation

The variables presented in Table 4.1 were used in a preliminary PCA to explore general deprivation relationships. It was found that there were high 'loadings' on both the head of household characteristics (proportion of household heads who were elderly, unemployed or with no schooling) and the corresponding variable measured in the general district population (overall proportion of elderly, unemployed and adults with no schooling). This implies that if a greater percentage of a district's population is unemployed it follows that a greater percentage of that district's household heads will be unemployed. This should therefore not be given additional weighting in any measure of deprivation and for this reason these household head variables were removed from further analysis. The exception to this is the proportion of households with a female head.

The remaining variables were used in a second PCA to create a General Index of Deprivation (GID). The removal of the above mentioned household head characteristics did not change the general structure of the final GID. The socio-economic and demographic variables ultimately included in the index are those that the PCA has identified as being highly correlated with each other, or expressed differently those variables that interact with each other to explain a dimension of deprivation.

In this study, the resulting index includes variables commonly regarded as important indicators of socio-economic status. In addition, the proportion of the district population who are female, children or live in rural areas also appear to drive this dimension of deprivation or dis-advantage. The index is calculated using weights or coefficients produced through regression analysis, and can be represented in simplified terms as follows (where each of the variable labels now represent the z-score of that variable and the index is the sum of each variable's z-score multiplied by its coefficient):

General Index of Deprivation

WEIGHT / COEFFICIENT	VARIABLE
0.190	Rural
0.181	Child
0.152	Phone
0.151	Refuse
0.141	No School
0.117	Light
0.124	Water
0.091	House
0.072	Female Headed Household

0.040	Unemployed
0.028	Female

Figure 4.1 below shows the percentage of each province's population that lives within magisterial districts which fall within quintile 1 (highest level of deprivation) to quintile 5 (lowest level of deprivation) according to the GID scores. The highest percentage of population located in the most deprived quintile (twenty percent) of districts is found in the Northern Province, followed by the Eastern Cape and KwaZulu-Natal. Gauteng and the Western Cape have the highest percentage of provincial population living in the least deprived districts (quintiles 5 and 4).

Figure 4.1: Distribution of provincial populations between GID quintiles

Five provinces account for all 20% of the most deprived districts in the country. Over 70% of these quintile 1 districts are found in the Eastern Cape (42%) and KwaZulu-Natal (31%). A further 18% are found in the Northern Province, with 3 districts each in Mpumalanga and North West, accounting for the remaining 9%.

One issue of concern arising from the mapping component of these studies (maps not included in this report), is that magisterial districts within the metropolitan areas of the Western Cape, Gauteng, Eastern Cape, KwaZulu-Natal and the Free State consistently fall within quintile 5 (or sometimes quintile 4). Anecdotal evidence and observation indicate that there are peri-urban areas within the large metropoles that have relatively high levels of deprivation. These pockets of deprivation are being obscured at the magisterial district level, suggesting that an enumerator area level analysis may be more appropriate within metropolitan locations.

4.2 Policy-perspective Index of Deprivation

As indicated in the methodology section, the general Index of Deprivation may be contrasted to the groups who appear to be of greatest concern to policy makers, that is, those who are black, elderly, children, female and/or live in rural areas. Thus, an *unweighted* Policy-perspective Index of Deprivation (PID) was calculated as follows (where components are the z-scores for each variable and each variable is assumed to have an equal weighting):

PID = BLACK + ELDERLY + CHILD + FEMALE + RURAL

Figure 4.2 shows the distribution of each province's population between the different quintiles based on the PID scores. There is a very similar pattern in the PID distribution to that for the GID. For example, the Northern Province and Eastern Cape have the highest deprivation levels while Gauteng and the Western Cape have the lowest deprivation levels.

Figure 4.2: Distribution of provincial populations between PID quintiles

4.3 Use of a single variable Index of Deprivation

As indicated previously, there are benefits associated with using a single variable index to identify districts that are deprived for resource allocation and monitoring purposes. In particular, it can be routinely updated using annual household survey data (where this exists) rather than being reliant on less frequent census data. In addition, a composite index requires the use of complex statistical techniques, and its composition will vary over time (Folwell 1995). In this analysis, two criteria for selecting a suitable single variable to indicate deprivation were used:

- The variable should be highly correlated with an indicator of ill-health, given that a key concern of this study is to promote resource allocation that will redress health inequities; and
- Data on the variable should be routinely available from the household surveys conducted on an annual basis in South Africa.

Thus, we evaluated which single variable(s) appeared to be most related to ill-health, as measured by the percentage of deaths resulting from infectious disease (PINFECT). The two variables that were most highly correlated with ill-health were access to a phone and access to water. As a question on access to water is included in the annual October Household Survey (OHS), while access to a phone is not, the water variable was selected as the Single variable Index of Deprivation (SID).

The relationship between access to potable water and infectious diseases is one that has been extensively documented internationally. It is important to note that water access is not only highly correlated with this particular form of ill-health, but also with other variables that are included in the General Index of Deprivation (GID) (see Table 4.1). This strengthens the case for using access to water as the SID, as it reflects ill-health as well as overall socio-economic deprivation.

Figure 4.3 indicates the percentage of each province's population residing in SID quintiles of magisterial districts. While once again the vast majority of the population in the Western Cape and Gauteng reside in the least deprived two quintiles of districts, the Western Cape appears to be in a better position than Gauteng in contrast to the GID and PID distributions. The Eastern Cape has the highest percentage of its population residing in the most deprived quintile of districts of all provinces, which again is slightly different to the GID and PID distributions, but the Northern Province still has the highest percentage of its population in quintiles 1 and 2 relative to other provinces. KwaZulu-Natal and North West once again feature as relatively deprived provinces using the SID scores.

Figure 4.3: Distribution of provincial populations between SID quintiles

4.4 Health-related Index of Deprivation

The incorporation of an indicator of ill-health, in the form of percentage of deaths due to infectious diseases, into the principal component analysis results in a considerably different index to the GID. The Health-related Index of Deprivation (HID) derived from this PCA can be represented in simplified terms as follows (where the index is the sum of each variable's z-score multiplied by its coefficient:

Health-related Index of Deprivation

WEIGHT / COEFFICIENT	VARIABLE
0.550	Disability
0.323	Black
0.274	Unemployed
0.216	% deaths due to infectious diseases
0.067	Female headed household
0.065	House
0.001	Water

It appears that the relationship between socio-economic variables and ill-health is driven by the proportion of the district population who are disabled, black and/or unemployed. A lower contribution is made by bad housing conditions, lack of access to water and having a female household head together with a consideration, obviously, of the health status measure itself.

Figure 4.4 shows the distribution of the population of each province according to HID quintiles of magisterial districts. While the pattern of distribution of deprivation between provinces was broadly similar when the GID, PID and SID scores are used, a different pattern emerges using the HID scores. The Eastern Cape, Free State, North West and Mpumalanga have the highest percentage of their populations residing in the most 'health deprived' districts compared to other provinces. The Northern Province appears to have a relatively low level of 'health deprivation', while Gauteng has a higher level of health than general deprivation. This appears to be counter-intuitive as it suggests that those with the highest level of general deprivation have somewhat better health status, and *vice versa*. The extent to which this pattern may be attributable to poor mortality data is explored in the following section.

Figure 4.4: Distribution of provincial populations between HID quintiles

4.5 Comparison of the indices with each other and with ill-health indicators

Each of the above indices were compared with three measures of health status, namely child mortality, potential years of life lost per death (PYLLs per death) and percentage of deaths due to infectious diseases. These correlations are shown in Table 4.2 below.

Table 4.2: Correlation of deprivation indices with ill-health indicators

	Child Mortality		PYLLs per death		PINFECT	
	GID	PID	SID			
PYLLs per death	0.492	1.000				
PINFECT	0.277	0.258	1.000			
GID	-0.398	-0.127	0.199	1.000		
PID	-0.546	-0.372	0.089	0.852	1.000	
SID	-0.363	-0.116	0.207	0.889	0.728	
	1.000					
HID	-0.201	-0.032	0.370	0.623	0.552	
	0.649					

The first point to note from Table 4.2 is that the general, policy-perspective and single-variable deprivation indices are highly correlated with each other. There is a lower correlation between the health-related and other deprivation indices. This correlation pattern shows that the inter-provincial deprivation distribution using the

GID, PID and SID is similar, but that there is a somewhat different distribution under the HID.

The GID, PID and SID have a negative or relatively low correlation with the different measures of ill-health. All of the deprivation indices correlate more highly with the percentage of deaths due to infectious disease than with any of the other measures of ill-health. The health-related deprivation index has the strongest relationship with deaths due to infectious disease, which is to be expected as this ill-health variable is one of the components of the index itself. Relatively low correlation between this health variable and the other indices is worrying however, and the persistent negative correlations between child mortality and PYLLs per death with the deprivation indices, very abnormal.

This apparent anomaly is likely to be largely attributable to the poor quality of the mortality data available in South Africa. The ill-health statistics used in the study are taken from the official vital statistics database. It is known that the registration of deaths is far lower in rural areas (which Table 4.1 indicates is highly correlated with low socio-economic status) than in urban areas (Bradshaw *et al.* 1995).

The death registration problem in rural areas is confirmed by a significant correlation between the proportion of the district population who live in rural areas and the proportion of deaths which are registered as having an 'ill-defined' cause of death (see Table 4.3). Thus, the more rural an area is, the higher the proportion of deaths where no cause of death is determined. A high level of 'ill-defined' causes of death suggests that there is a low level of operational efficiency of vital registration in that area; not only are deaths under-reported, but when they are reported, little effort is devoted to accurately determining the cause of death.

Table 4.3: Correlation between ill-health indicators and rural residence

	Child mortality	PYLLs per death	PINFECT	% rural
PYLLs per death	0.492**	1.000		
PINFECT	0.277**	0.258**	1.000	
% rural	-0.414**	-0.159**	-0.094	1.000
% ill defined death	-0.322**	-0.169**	-0.071	0.416

**

** denotes those correlations significant at the 1% level

Table 4.3 also indicates that there is a negative correlation between the three other indicators of ill-health and the rural residence variable. This implies that the greater the proportion of the district population living in a rural area, the lower the mortality. Given the high correlation between rural residence and poor socio-economic status (see Table 4.1), this finding is counter-intuitive.

It is worthwhile giving further consideration to the role of poor death registration in rural areas in producing the unexpected negative relationship between rural areas and ill-health, using available data. Table 4.4 considers the same relationships within more urban districts (given the higher quality of death registration in these areas), where an urban district is defined as one where more than 75% of its population are living in areas that are classified as urban. Thus, the table below considers whether those who live in rural parts of districts which are primarily urban in nature, tend to have higher levels of ill-health.

Table 4.4: Correlation between ill-health indicators and rural residence - Urban districts

	Child mortality	PYLLs per death	PINFECT	% rural
PYLLs per death	0.333**	1.000		
PINFECT	0.451**	0.282*	1.000	
% rural	0.106	0.161	0.329**	1.000
% ill defined death	-0.092	0.351**	-0.091	-0.315**

** denotes those correlations significant at the 1% level; * indicates significance at the 5% level

When only considering the largely urban districts, there is a clear positive correlation between rural dwellers and mortality, although this correlation is only significant for the proportion of deaths due to infectious diseases. Thus, rural dwellers have relatively higher levels of mortality than their urban counterparts within these districts.

Due to the overwhelming deficiencies in the vital statistics data in rural areas, analysis of the relationship between socio-economic status and ill-health, to inform the possible targeting of resources, will be restricted to data for urban districts.

4.6 Deprivation and ill-health in urban areas

The same criterion used previously for selection of socio-economic variables to be included in the PCA, that is that correlations between variables must be significant at the 1% level, was used for this smaller data set. The variables that were significantly correlated with other socio-economic variables, and which were therefore included in the PCA of the urban district data, are presented in Table 4.5. It is of interest that the demographic variables (e.g. female, child and elderly) were no longer important variables in identifying deprivation.

Table 4.5: Correlations between socio-economic variables (urban districts only)

	BLACK	NOSCH	UNEMP	DISAB	HOUSE	WATER	PHONE	LIGHT	UNHD
NOSCH	0.475	1.000							
UNEMP	0.748	0.599	1.000						
DISAB	0.754	0.685	0.710	1.000					
HOUSE	0.741	0.304	0.541	0.470	1.000				
WATER	0.615	0.491	0.486	0.477	0.599	1.000			
PHONE	0.562	0.731	0.576	0.737	0.379	0.460	1.000		
LIGHT	0.701	0.551	0.555	0.614	0.695	0.776	0.642	1.000	
UNHD	0.825	0.483	0.871	0.666	0.714	0.539	0.529	0.631	1.000
NOSCHD	0.511	0.971	0.583	0.688	0.289	0.521	0.706	0.568	0.483

It is interesting to compare Table 4.1 (which includes data for all magisterial districts in South Africa) with Table 4.5 (which presents data for urban districts only). In urban areas, there is an even stronger relationship between race, unemployment and disability than for the entire population. There are also some noteworthy differences in terms of household head characteristics. Female headed households appears to be an important predictor of deprivation in rural areas as there are consistently higher correlations between this variable and other socio-economic variables in the

overall population than in urban areas (to the extent that this variable was removed from the urban PCA). In contrast, a household head with no schooling appears to be a stronger predictor of deprivation in urban areas. Certain physical household characteristics, most notably access to water, have lower correlations with other socio-economic variables in urban areas than for the overall population. This is important to bear in mind, given that access to water was previously selected as the most appropriate indicator to use in the single variable Index of Deprivation. Thus, the use of the SID in resource allocation decisions may relatively disadvantage those with low socio-economic status in urban areas.

Importantly, there are now significant positive correlations between many of these socio-economic variables and ill-health (see Table 4.6). This supports the previously expressed view that the negative relationship between socio-economic status and ill-health in the overall South African population is more a reflection of extremely poor mortality data in rural areas than a counter-intuitive relationship which would be unique by international standards. The results presented in Table 4.6 provide more promise for the development of a health-related deprivation index.

Table 4.6: Correlation of key socio-economic indicators and measures of ill-health (urban districts)

	PYLLs per death	% deaths due to infectious disease
% with no schooling	0.388	0.556
Unemployment rate	0.429	0.336
% with bad housing	0.534	

All correlations significant at the 1% level

Using the variables listed in Table 4.5, a PCA was undertaken to explore the relationship between socio-economic variables in urban districts. The resulting General Index of Deprivation for urban areas only (GIDU) can be represented in simplified format as:

General Index of Deprivation for Urban areas only

WEIGHT / COEFFICIENT	VARIABLE
0.394	House
0.256	Water
0.234	Unemployed head of household
0.233	Light
0.201	Black

Thus, in urban areas, race, physical household characteristics (shack dwellings, lack of access to potable water and lack of electricity for lighting) and unemployment of the household head are the key indicators of deprivation.

The GIDU is positively correlated with both the percentage of deaths due to infectious diseases (0.306) and PYLLs per death (0.569). Both of these correlations are significant at the 1% level. The PYLLs per death correlation indicates that urban dwellers who have the highest levels of deprivation die at a younger age than more advantaged urban residents. This may be attributable to relatively high levels of mortality due to violence (primarily affecting young, unemployed, black men) in deprived peri-urban communities.

4.7 Deprivation and health service provision

Comparison of public sector health service distribution and deprivation is hampered by the lack of disaggregated data. It was, thus, not possible to undertake a comprehensive analysis of the distribution of public sector health services between small areas. However, a recent study provides information on the distribution of expenditure on district level services between health districts in the Eastern Cape, which can be used for illustrative purposes (Makan *et al.* 1997). Unfortunately, the Eastern Cape study did not indicate expenditure for each magisterial district, but the health district level analysis (where health districts include a number of magisterial districts) does highlight general trends.

Two maps are presented here to explore the relationship between deprivation (see first map) and the distribution of public health services (see second map). The first map indicates the distribution of magisterial districts in the Eastern Cape province between the GID quintiles. Magisterial districts falling within quintile 1 (i.e. the most deprived districts) are represented in black, those in quintile 2 are depicted in dark grey, quintile 3 in medium grey, quintile 4 in light grey and quintile 5 (least deprived) in white.

The second map illustrates the distribution of expenditure on public health services in the Eastern Cape (for the 1996/97 financial year, which is thus comparable to the 1996 census data used in constructing the deprivation indices). Four categories of health care expenditure are used:

- Very highly resourced, where per capita expenditure in the health district is more than 50% above the average per capita expenditure for all health districts (unshaded areas on the map);
- Relatively highly resourced, where per capita expenditure in the health district up to 50% above the average per capita expenditure for all health districts (lightly shaded areas);
- Relatively poorly resourced, where per capita expenditure in the health district is up to 50% below the average per capita expenditure for all health districts (medium shading); and
- Very poorly resourced, where per capita expenditure in the health district is more than 50% below the average per capita expenditure for all health districts (darkly shaded areas).

When comparing the GID quintile map for the Eastern Cape with the overlaid health service distribution map, the picture is not entirely consistent. This is largely due to the fact that the health service data are aggregated at the health district level and thus obscure variations between magisterial districts within the health district. However, it is evident that the majority of magisterial districts within quintile 1 of the GID are classified as very or relatively poorly resourced, while the majority of districts in quintiles 4 and 5 are classified as very or relatively highly resourced. An important aspect of future research would be to obtain sufficiently disaggregated data on the distribution of primary health care services between magisterial districts, to assess whether the pattern of relative under-resourcing in the most socio-economically deprived areas occurs throughout South Africa.

5. DISCUSSION

Considerable difficulties were experienced in accessing and analysing data during this study. A particular problem was the lack of compatibility of different (e.g. census and vital statistics) databases in terms of coding systems for, and delineation of, certain areas, which had to be accordingly adjusted. Other data problems that limited the extent of analysis that could be undertaken include the poor quality of mortality data and the unavailability of routine health system data at a sufficiently disaggregated level. Despite these data limitations, the analyses undertaken in this study have produced results of considerable interest, particularly in relation to current resource allocation debates.

5.1 Review of alternative deprivation indices

5.1.1 Key issues in relation to the deprivation indices

Four key deprivation indices were calculated for South Africa; the General Index of Deprivation (GID), Policy-perspective Index of Deprivation (PID), Single variable Index of Deprivation (SID) and the Health-related Index of Deprivation (HID). Comparison of Figures 4.1, 4.2, 4.3 and 4.4 show that there are broadly similar patterns in the distribution of provincial populations between quintiles according to the GID, PID and SID, but somewhat different patterns under the HID. Table 4.2 indicates that the GID and SID are most highly correlated, and that both the GID and SID correlate well with the PID. In contrast, there is a lower correlation between the

HID and all of the other deprivation indices. As indicated previously, it appears that the different pattern produced by the HID is largely attributable to the poor quality of mortality data available from the vital statistics database. For this reason, the HID is not regarded as an appropriate deprivation index to use in South Africa until the quality of death registration information has improved dramatically.

The high correlation between the GID and SID is of considerable importance, as it suggests that a single-variable index may be as effective in identifying the most dis-advantaged households and communities as a composite deprivation index, the composition of which will change over time as newly available databases are analysed. Given that PCA is a complex statistical procedure and is relatively time consuming, a single-variable index will be more user friendly for health and other social service planners. It is also easier to routinely monitor changes in a single variable than a composite index. However, the main concern with the single-variable identified within this study, namely access to water, is that the correlation between water and other potential indicators of deprivation is far greater in the overall population (see Table 4.1) than in urban areas (see Table 4.5). This suggests that the use of the SID in resource allocation decision-making may relatively disadvantage deprived communities within large urban areas.

The research team is concerned that there is insufficient homogeneity within magisterial districts in the metropolitan areas, and therefore pockets of deprivation in these areas are not being identified as the average index scores in metropolitan magisterial districts reflect low levels of deprivation in all cases. For this reason, it would be advisable to conduct an analysis using enumerator area (which cover much smaller areas than magisterial districts) data in metropolitan areas and magisterial district data in non-metropolitan areas. This will enhance the degree of homogeneity within the small area analysis. Such an analysis would indicate whether access to water is the most appropriate indicator for use in the SID from the perspective of ensuring that the most deprived communities, whether in rural or peri-urban areas, are identified.

It is also of interest that the PID correlates well with the GID and SID. Firstly, this suggests that policy-makers have reasonably accurately identified groups who are relatively dis-advantaged, even though they have used broad demographic and areal categorisations. Secondly, it highlights again that simple indices containing a few variables with no weightings may be effective in identifying small areas with high deprivation levels. However, in comparing the PID and the GID, it can be seen that household level characteristics, such as the quality of housing, access to basic services (water, refuse and electricity as an energy source) and the gender of the household head, which are ignored in the PID, are important variables underlying deprivation as measured by the GID. Other socio-economic variables such as education and unemployment are also important in measuring relative dis-advantage.

5.1.2 Using perceptional information to critique the indices

Comparison of the variables considered for inclusion in our general, single-variable and health-related deprivation indices and available perceptional data suggest that some facets of these deprivation perceptions are already being captured. The most relevant variables are the proportions of: people over 24 with no schooling, head of household with no schooling, female headed households, people living in shacks or traditional dwellings, households without access to electricity and/or inadequate access to water, unemployed economically active people and unemployed heads of household. Although being disabled was not clearly identified in the perceptional data as a facet of poverty or deprivation, it may reflect an aspect of social isolation.

However, although large numbers of children within a household were seen as important in perceptions, a high proportion of area residents being children (included as identified in policy statements) was not (see below as well).

While there is some degree of commonality between the quantitative variables and perceptions of deprivation, the perceptional data cannot justify the specific weights attached to these different variables in the indices constructed through PCA. Of even greater importance, however, is that the wider range of poverty or deprivation dimensions and, in particular, the dominant theme of social isolation raised in the perceptional data, are poorly reflected in the set of variables considered for inclusion in the deprivation indices. This primarily reflects the fact that social isolation has been overlooked as a dimension of health-related deprivation in both international literature (i.e. expert opinion), and South African policy statements, the two rationales for identifying variables for consideration within this study's deprivation indices. In addition, it reflects problems with the available data (see methods section) and it may reflect the nature of the perceptional data which focuses on broadly defined poverty rather than health-related deprivation.

One approach to tackling the divergence between poverty perceptions and the variables considered here might be to construct an independent social isolation index - including features of individuals, households and communities - and to explore its use in health resource allocation in place of the deprivation indices proposed here. Despite the substantial methodological problems likely to be faced, this could represent a fruitful additional and future avenue of investigation, that might better capture the poor's own perceptions of poverty or deprivation to drive health and other resource allocations. In addition, it would be important to critically review resource allocation processes and to consider ways in which communities, particularly in the most deprived areas, could contribute actively to these decision-making processes.

Thus, finally, the perceptional data emphasise that any index will inevitably be a simplification of anyone's understanding of poverty or deprivation. It will never be possible to create the 'perfect' index even though deprivation indices can and do play useful roles as policy and monitoring tools as indicated in the literature review. Instead, their use should be supplemented by qualitative enquiries into people's own perceptions of their circumstances and needs. A further avenue of future investigation might be to consider when and how to use the two different approaches within resource allocation decision-making.

5.2 Comparison of deprivation, mortality and health service distribution

The comparison of the various deprivation index scores and mortality indicators proved difficult due to the extremely poor quality of the vital statistics data in South Africa, particularly for rural areas. However, when a deprivation index was specifically compiled for urban areas and this index and individual socio-economic variables were compared with mortality data for urban areas only, there was a consistent and significant positive correlation between mortality and deprivation. It is very likely that the same significant positive correlation would be found in the overall analysis of all small areas if there were routinely available, *accurate* mortality data for the whole of South Africa, which is particularly dependent on improved death registration in rural areas. Thus, the urban data do suggest that there is a relationship between ill-health and deprivation in South Africa.

The limited analysis of health service distribution between small areas, in comparison with deprivation levels in these areas, indicates that government primary care resources are currently inequitably distributed. In order to achieve the vertical equity goal that guides this analysis, this pattern of resource distribution needs to be

reversed through giving greater consideration to deprivation in social service planning and in resource allocation decision making.

5.3 Implications for planning and resource allocation

Given the preceding analysis, this section focuses on how deprivation measures can be taken into account in the inter-provincial allocation of block grants as well as the allocation of provincial resources (for health and other social services) between small geographic areas within provinces.

5.3.1 Inter-provincial resource allocation issues

As indicated in the introduction, South Africa has a fiscal federal system. Centrally collected resources are first allocated according to spheres of government (i.e. divided between central, provincial and local government levels), a process called the vertical division. The overall budget for the provincial sphere is then allocated to individual provinces using an "Equitable Shares" formula developed by the Department of Finance (DoF) in what is termed the horizontal division. Provinces then have autonomy in deciding on the distribution of resources between sectors.

The impact of the current DoF "Equitable Shares" formula is shown in Figure 5.1, which compares each province's target share of the government budget, determined through the 2000/01 DoF formula, with their baseline expenditure level and population share. It indicates that the Department of Finance's (DoF) formula results in a relatively higher percentage of resources being allocated to provinces with the highest levels of deprivation (see for example Figure 4.1) than if the allocation were purely based on provincial population size. Thus, the percentage share in the horizontal division in provinces such as the Eastern Cape and Northern Province (and to a lesser extent Mpumalanga) is higher than their population share, and is lower than the population share in less deprived provinces such as Gauteng and the Western Cape. It is of concern that KwaZulu-Natal, which was shown to have relatively high levels of deprivation, is not receiving any additional resources above what they would receive if their provincial population share were used as the basis of inter-provincial resource allocation decision-making.

However, it is also important to compare the DoF target shares (to be reached by 2003/04) with current spending levels, using expenditure in the 1997/98 financial year, which represents spending at the time that the DoF began phasing in its target allocations (compare the 'base' spending levels with DoF formula columns in Figure 5.1). It is evident from this comparison that some of the most deprived provinces are faced with a declining share of government resources (e.g. Eastern Cape and North West) while others (like Northern Province) will only experience marginal increases. The provinces that are set to receive the greatest increases in the share of government resources over current expenditure levels, in terms of the Department of Finance formula, are Gauteng and KwaZulu-Natal, with Mpumalanga receiving a somewhat smaller increase. Given the fiscal policy of reducing the budget deficit coupled with low economic growth, overall government budgets are declining in real per capita terms. This translates into declining real per capita budgets for all provinces, with the greatest declines being faced by provinces such as the Western Cape, Eastern Cape, North West and Free State.

Figure 5.1: Provincial budget share using 2000/01 DoF formula, compared with base spending levels and population share

It could be argued that this resource allocation pattern is not adequately promoting vertical equity principles. According to the definition of equity underlying this analysis, there should be substantial shifts in resource allocation in favour of those areas/provinces with the highest levels of deprivation. The provinces which were consistently shown to have the highest levels of deprivation, whether the GID, PID or SID is used, were the Northern Province, Eastern Cape and KwaZulu-Natal, followed by North-West and Mpumalanga. From a vertical equity perspective, these provinces should be receiving budget allocations considerably above their provincial population share to account for their relative deprivation levels.

Thus, it is necessary to examine the DoF formula in some detail to consider the factors currently driving resource allocation. The formula is largely based on basic indicators of 'need' for different social services, particularly the relative size of the population dependent on these services in each province. However, there are two formula components that deserve specific consideration in relation to vertical equity, which are the 'economic activity' and the 'backlog' components.

The 'economic activity' component is used to allocate part of central government tax funds to provinces in proportion to their contribution to the country's economic outputs. The Department of Finance argues that "*This component acknowledges the link between investment and infrastructure needs and related economic services, and the level of economic output in a province*" (Department of Finance 1998: E22). However, the effect of this component is to offset, at least partially, the redistributive aspects of the rest of the formula. If a vertical equity approach were adopted, it could be argued that areas with low economic activity, particularly if related to past inequitable policies, should be granted additional allocations to develop appropriate infrastructure and promote investment opportunities in these areas (McIntyre and Gilson 2000). Economic development in deprived areas could contribute to addressing certain of the underlying factors contributing to deprivation which were highlighted in the GID (such as unemployment, access to basic services, etc.). The exact impact on deprivation would depend on whether economic growth in these areas was accompanied by redistributive policies.

The Department of Finance introduced the 'backlog' component into the formula in the 1999/2000 financial year in order *"…to address criticisms that the formula failed to take account of the significant backlogs faced by some provinces. Its three sub-components recognise the need for capital spending on rural infrastructure and facilities in the health and education sectors"* (Department of Finance 1999: 267). This component goes some way to addressing vertical equity concerns as it promotes increased allocations to provinces which currently face the highest level of deprivation. However, the DoF uses a very narrow definition of backlogs in that this component only includes measures of *physical infrastructure* backlogs. Indicators of *human development* backlogs, such as those incorporated in our deprivation indices (particularly the GID) through consideration of a broad range of socio-economic factors and household level variables, are effectively ignored in the DoF's backlogs component. Possibly of even greater importance is that the Department of Finance has chosen to weight the economic activity component by 8% and the backlog component by a mere 3% (the smallest weighting of all the formula components). These relative weightings appear to suggest that the inclusion of the backlog component may pay only lip-service to concerns about historic backlogs, even the narrowly defined infrastructural ones.

Figure 5.2 shows the effect of using an indicator such as the GID or the PID, which are based on a broader conceptualisation of the nature of historical backlogs in South Africa, in the inter-provincial block grant allocation formula. The first bar indicates the percentage share of resources allocated from central government level, according to the current DoF formula, for each province. The second and third bars indicate the impact of using the PID or GID as the measure of backlogs in the DoF formula respectively, leaving all other formula components and the relative component weightings unchanged. While the changes in budget allocations using the PID and GID are relatively small, there would be higher allocations to provinces found in this study to have high levels of deprivation (such as the Northern Province and the Eastern Cape), and lower budget allocations to provinces with the lowest deprivation levels (such as Gauteng and the Western Cape) than under the DoF formula. As the PID is based on indicators of groups which health sector and other South African policy-makers have recommended should receive priority in redistribution policies, this analysis suggests that the current allocation of resources is not in line with expressed policy concerns.

Figure 5.2: Provincial budget share using 2000/01 DoF formula, compared with potential budget share using GID and PID in the backlogs component

The main reason why the use of the GID or PID in the backlogs formula component has such a limited effect on modelled budget allocations between provinces is that the DoF only assigned this component a weight of 3%. The last bar indicates the inter-provincial resource allocation patterns that would result if the economic activity component were removed from the formula, and the backlogs component, based on the GID, given a weight of 11% (i.e. the combined weightings currently assigned to the economic activity and backlogs components). The removal of the economic activity component is based on the argument presented above that in a country with vast disparities, such as South Africa, a vertical equity approach would favour investment in economic development in those areas which are currently dis-advantaged in this respect. Increasing the weighting of the backlogs component in this way has a dramatic effect on resource allocation patterns, with very deprived provinces (notably the Northern Province, Eastern Cape and KwaZulu-Natal) seeing dramatic potential budgetary increases and the least deprived provinces (Gauteng and Western Cape) seeing equally dramatic budget decreases. Importantly, when the budget allocation using the GID as the backlogs component with an 11% weighting is compared with current expenditure levels, there would be dramatic budget increases and decreases over current expenditure for these provinces respectively, in contrast to the current outcome of the DoF formula (see Figure 5.1).

The above analysis has highlighted the deficiencies of the current inter-provincial resource allocation formula from a vertical equity perspective. In particular, the DoF formula is not resulting in dramatic increases in the allocation of resources to the most deprived provinces. This is partly attributable to the inclusion of the economic activity component, which is questionable from an equity perspective, and the relatively low weighting assigned to the backlogs component (McIntyre and Gilson 2000). Of particular significance, in the context of this study, is the limited notion of backlogs that the DoF is using by focussing only on infrastructural backlogs. Our analysis suggests that the full array of human development backlogs should be taken into consideration if one is to promote vertical equity goals in the allocation of limited government resources. Deprivation indices, which include a range of indicators of relative socio-economic and household level dis-advantage, are an appropriate approach in this regard.

It should, however, be noted that the redistribution of financial resources towards the

most deprived provinces is not sufficient. Budget allocations need to be translated into other social service provision resources, such as personnel, supplies etc., in order to achieve health and other human development equity gains.

5.3.2 Intra-provincial resource allocation and service planning issues

It is also important to take deprivation into account when allocating resources between geographic areas within provinces. If progress in redressing current inequities is to be achieved, limited provincial health care resources have to be actively redistributed towards those districts that have the greatest level of deprivation. This could be facilitated by the use of a weighted resource allocation formula, which includes some measures of deprivation along with other indicators such as relative population size in each geographic area. The database we have compiled can also be used to calculate deprivation scores for health districts (by combining the respective magisterial districts and/or enumerator areas in each health district). These deprivation scores can then be used to inform the allocation of provincial health budgets to the relevant geographically defined decentralised health authority. Even though these decentralised health authorities (whether health districts or local governments) comprise a number of magisterial districts, the magisterial district level deprivation analysis is still important from the perspective of informing detailed service planning and resource allocation decision-making *within* health districts or local government areas.

As has been highlighted by other studies, it is insufficient to merely redistribute budgetary resources; careful attention must be paid to improving the capacity of currently under-resourced health authorities to absorb the increased budget allocations (Brijlal *et al*. 1997; Gilson *et al*. 1997; Makan *et al*. 1997). Usually, the most under-resourced areas have the least management capacity and it is, thus, important that provincially supported capacity development initiatives prioritise these areas. Management capacity development initiatives should not only focus on ensuring that an adequate number of managers with appropriate skills are recruited or trained, and possibly more importantly retained, but also improved access to health information systems, improved knowledge of the public sector institutional context to equip managers to effectively negotiate bureaucratic procedures, etc. (Brijlal and Gilson 1997).

Given that salaries account for over two-thirds of health care expenditure in South Africa, in order to translate budget increases into improved service delivery on the ground, health personnel must be redistributed (de Bruyn *et al*. 1998; McIntyre *et al*. 1998). At present, there is a lack of appropriate staff relocation strategies within the civil service regulations which should be addressed as a matter of urgency. It will be necessary to develop a range of appropriate incentives to encourage staff to work in severely deprived areas.

Finally, but importantly, community participation is critical to address community health needs and to prioritise uses for any additional budget resources.

6. CONCLUSIONS

In this study, four potential deprivation indices were developed, drawing on insights from the international literature on the construction of such indices. Three of the indices, the General Index of Deprivation (GID), Policy-perspective Index of Deprivation (PID) and the Single variable Index of Deprivation (SID), were highly correlated, while the Health-related Index of Deprivation (HID) showed a lower

correlation with the other three indices. A range of analyses undertaken in this study highlighted the extremely poor quality of mortality data in South Africa. As the HID is composed of variables that are highly correlated with current mortality estimates, it is inadvisable to use the HID until the quality of mortality data has improved. Given the potentially misleading results of the HID, it would be preferable to use the GID, PID or the SID for resource allocation and health service planning purposes. The international literature unanimously points to the inter-relationship of deprivation (material and social) and ill-health. Thus, it is feasible to use general deprivation indices as a proxy measure of relative need for public sector health services (both in relation to the differential incidence of ill-health and ability to pay for health care). In addition, given that health is influenced by a range of factors other than health services, efforts to redress relative socio-economic and other forms of dis-advantage are likely to have positive implications for health status.

The GID was used to map the distribution of relative dis-advantage between small areas in South Africa and to illustrate the implications of accounting for deprivation in resource allocation decisions. The GID, which was constructed from a principal component analysis, highlights the most important socio-economic and demographic variables contributing to deprivation in South Africa. As it is a weighted index, it also reflects the relative importance of each variable to overall deprivation. Thus, based on the available data, the GID represents the most comprehensive and accurate expression of deprivation in South Africa. As the interaction between different socio-economic and demographic variables in contributing to deprivation will change over time, it is necessary to reconstruct the GID and recalculate the GID values as and when more recent datasets become available. A disadvantage of the GID, particularly for long-term planning, monitoring and evaluation purposes, is that it requires the use of quite complex statistical techniques for its compilation. It is, thus, not very ‘user friendly’ for public sector decision-makers.

For this reason, the PID (which is an unweighted simple additive index) or the SID (which consists of a single index) may be preferred for use by decision-makers. Although the international literature argues against the use of unweighted indices, as they have an implicit and often incorrect assumption that all variables included in the index are of equal importance, the PID was highly correlated with the GID suggesting that it may be an acceptable alternative to the more sophisticated GID. In addition, as it includes variables which policy-makers themselves have identified as important in targeting relatively dis-advantaged groups, the PID may hold great appeal for policy-makers. The potential problem with the long-term use of the PID is that it uses relatively broadly defined groups (such as rural dwellers, women and children) as the key variables. Over time, it is likely that differentials within these groups will increase which would reduce the correlation between the PID and an updated GID.

The SID is also a potentially useful alternative to the GID, particularly given its very high correlation (0.889) with the GID compared with the slightly lower correlation (0.852) between the GID and PID. There are a number of examples within the international literature of single variables being found to be as effective as composite indices in identifying the most dis-advantaged. The SID would be easy to use for planning and monitoring purposes as it could be routinely updated. However, further investigation of the most appropriate variable to use in the SID is required, given the concern that the current variable selected (access to water) may not be as effective in identifying the dis-advantaged in peri-urban areas as it is within rural areas. In addition, the appropriateness of the selected single variable requires reconsideration at regular intervals.

In summary, while it is evident that the HID is not an appropriate indicator to use in the context of poor mortality data, no clear conclusion can be drawn on which of the other three indices should be used. The GID, PID and SID each have relative

advantages and disadvantages. However, given the ease of use of a single variable, there will be considerable value in identifying a variable that has a high correlation with the GID when the small area analysis is undertaken using enumerator areas for the metropoles and magisterial districts in non-metropolitan areas.

The GID, PID and SID all identified the Northern Province and Eastern Cape as having the highest proportion of their populations residing in the two most deprived quintiles of magisterial districts, followed by KwaZulu-Natal, North West and Mpumalanga. It is these provinces, and the most deprived districts within them, which should receive priority in the allocation of public resources. The only remaining concern in the current analysis is that deprived communities within large metropolitan areas, who should also benefit from preferential resource allocation strategies, are not being identified with the use of magisterial districts as the unit of small area analysis.

Unfortunately, the poor quality of available mortality data prevented a comprehensive analysis of the relationship between deprivation and ill-health. However, an analysis of urban areas, where death registration is more comprehensive, showed a significant correlation between deprivation and mortality.

It was also not possible to explore the relationship between public sector primary care provision and deprivation in detail, due to the lack of sufficiently disaggregated health system data. However, a limited analysis in the Eastern Cape province, which has a high proportion of its population living in the most deprived magisterial districts, indicated an inverse relationship between deprivation and health service provision. Per capita district level health expenditure was below average in those areas with high levels of deprivation, and considerably above average in areas with the lowest levels of deprivation.

These findings suggest that public resources are not currently being allocated preferentially towards the most deprived geographic areas. The resource allocation policy implications of the distribution of deprivation between small areas are among the most important findings of this study. The analysis presented here indicates that accounting for deprivation in inter- and intra-provincial resource allocation processes is important in redressing the apartheid inheritance of massive health and health system inequities.

The inclusion of a measure of deprivation in the formula used for the allocation of central government budgetary resources between provinces would substantially alter current resource allocation patterns. Although the current Department of Finance (DoF) formula includes a ‘backlogs’ component, this merely focuses on infrastructural backlogs rather than broader human development backlogs. In addition, it is only assigned a 3% weighting which translates into a marginal influence on the overall formula. Instead, the DoF assigns more weight (8%) to an economic activity component which gives additional budget allocations to the most economically productive, and least deprived, provinces. From a vertical equity perspective, it could be argued that the economic activity component, which at least partially offsets the redistributive effects of the remainder of the formula, should be removed from the formula. In addition, the backlogs component should be based on a broader indicator of human development backlogs, such as the deprivation indices developed in this study, and given a higher weighting. This would strengthen the preferential allocation of limited government resources to the most deprived areas, in line with the vertical equity goal established to guide analysis in this project.

The analysis of deprivation in relation to small areas is particularly useful in informing detailed service planning and resource allocation within provinces. If budgets are allocated preferentially towards the most deprived areas, and if these financial

resources are translated into service delivery improvements on the ground (through the redistribution of other service resources such as personnel and through management capacity improvements), significant progress towards health equity in South Africa could be achieved.

However, while the international literature motivates for the usefulness of small area analyses in informing policy-making and service planning (see section 2.3.1), this remains to be demonstrated within the South African context. Thus, the process of dissemination of key research findings from this study will be critical. Dissemination activities should be accompanied by an assessment of the extent to which the small area deprivation results are actually used by policy makers, public sector managers and by a range of other groups in stimulating public debate about resource allocation strategies.

Finally, this study has relevance to other countries in that it demonstrates that small area analyses of deprivation can be undertaken in data poor contexts, even though data constraints will limit the extent of the analysis that can be undertaken. Of particular importance in other low- and middle-income countries is the conclusion that, in the absence of good quality health status data, the use of general socio-economic and demographic indicators of deprivation is valuable in promoting the equitable allocation of limited government resources. These findings are especially relevant for guiding decision-making in decentralised systems, where equity in resource allocation has been shown to be a particular challenge.

This study has gone some way towards reviewing the usefulness of small area studies of deprivation in promoting equitable resource allocation, with the ultimate goal of significantly reducing gaps in health status within South Africa as rapidly as possible. A range of additional research will strengthen the arguments presented here. However, the greatest remaining challenge is to assess the extent to which policy-makers and service managers find the small area deprivation analysis approach useful to guide decision-making in pursuit of vertical equity goals.

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