Introduction

There has been a recent surge of international interest in health-related small area studies. Much of the relevant literature comes from Britain where small areas (that is areas as small as electoral wards or enumeration districts) have been used for the past two decades or more to explore the relationship between the socioeconomic and health characteristics of populations (Carstairs 1981; Carstairs and Morris 1989; Mays and Chin 1989; Curtis 1990; Reading et al. 1993; Haining et al. 1994; McLoone and Boddy 1994; Maheswaran et al. 1997). Similar studies have also been undertaken in other high-income countries (e.g. in New Zealand by Salmond et al. 1999) and one such study has been undertaken in a middle-income country (Lozano et al. 2001). A key use of the British research has been to inform the allocation of health care resources between geographic areas, by considering the interrelationship between deprivation and health care utilization. In particular, the Jarman Underprivileged Area (UPA) score was included in the Resource Allocation Working Party’s (RAWP) health care formula (Jarman 1983; DHSS 1986). Recent research projects in New Zealand (Crampton et al. 2000) and Mexico (Lozano et al. 2001) have also mapped deprivation to serve as a guide to health managers about which small areas to prioritize when allocating resources. Importantly, the World Bank is also encouraging the use of such analysis to facilitate accurate targeting of poverty reduction programmes by mapping the distribution of poverty within countries (Bigman and Fofack 2000; Bigman et al. 2000; Fofack 2000; Hentschel et al. 2000). This approach is seen as a valuable tool in the World Bank’s Poverty Reduction Strategy Programs (PRSPs), in which one important component is health sector development.

This paper seeks to contribute to the growing discussion of the methods and contributions of health-related small area studies, with particular reference to low- and middle-income countries (LMICs), in which relatively limited research of this nature has been conducted to date. It presents the methods and findings of a South African study, the objective of which is to assess the value, and feasibility, of measuring relative deprivation between small areas as a basis for resource allocation decision-making in data-poor environments. Although the study draws on some of the research outlined above, it has three key distinguishing features.

Geographic patterns of deprivation in South Africa: informing health equity analyses and public resource allocation strategies

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There is a growing interest in the use of small area analyses in investigating the relationship between socioeconomic status and health, and in informing resource allocation decision-making. However, few such studies have been undertaken in low- and middle-income countries (LMICs). This paper reports on such a study undertaken in South Africa. It both looked at the feasibility of developing a broad-based area deprivation index in a data scarce context and considered the implications of such an index for geographic resource allocations. Despite certain data problems, it was possible to construct and compare three different indices: a general index of deprivation (GID), compiled from census data using principal component analysis; a policy-perspective index of deprivation (PID), based on groups identified as priorities within policy documents; and a single indicator of deprivation (SID), selected for relevance and feasibility of use. The findings demonstrate clearly that in South Africa deprivation is multi-faceted, is concentrated in specific areas within the country and is correlated with ill-health. However, the formula currently used by the National Treasury to allocate resources between geographic areas, biases these allocations towards less deprived areas within the country. The inclusion of the GID within this formula would dramatically alter allocations towards those areas suffering from human development deficits. The area in which analysis was undertaken was not, however, sufficiently small to identify pockets of deprivation within the less deprived metropolitan areas. These findings suggest that it is feasible to conduct small area analyses in LMICs but that specific attention needs to be given to the size of the geographic unit used in analysis. In addition, they highlight the importance of considering deprivation in resource allocation mechanisms if vertical equity goals are to be promoted through resource allocation, particularly within decentralized health systems.

Key words: vertical equity, deprivation, resource allocation, South Africa
First, this study does not focus on poverty in the narrow sense of insufficiency of income. Although poverty-mapping exercises sometimes consider the distribution of variables such as potable water infrastructure, the touchstone of the analyses is always that of income insufficiency. This study is based on a broader concept of deprivation and is, thus, more closely associated with previous studies in Britain, New Zealand and Mexico. Townsend (1987) 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 that which is usually available or experienced in society. The concept of deprivation used in this study is closely related to Sen’s human capabilities approach (Sen 1984, 1985) and can be described as the inability to achieve an adequate level of capabilities relative to that which usually exists within that society.

The authors support Sen’s (1985: i) argument ‘in favour of focusing on the capability to function, i.e. what a person can do or can be, and against the more standard concentration on opulence (as in ‘real income’ estimates)’. Goods and services, and the income needed to access them, are a means of enhancing human capabilities, and the extent to which commodities actually translate into capabilities is influenced by a range of demographic, socioeconomic and other factors (Sen 1984). On this basis, we would argue that it is essential to focus on these demographic, socioeconomic and other factors that ultimately influence whether or not individuals are able to achieve an adequate level of capabilities relative to others in society, rather than purely on income insufficiency. This conceptual approach has informed our efforts to compile a deprivation index, in that we have focused on those demographic and socioeconomic variables that are most likely to influence one’s capability to lead a long and healthy life, the opportunity to be educated and other human capabilities.

The importance of the distinction in South Africa between standard measures of poverty and a broader conceptualization of deprivation was highlighted in a recent study (Klasen 1998). This found that approximately 30% of the deprived people, as identified by a multi-faceted deprivation index, were not identified by an income poverty measure. Thus, poverty mapping and targeting will result in a very different resource allocation pattern than allocations based on the quantification of the distribution of deprivation within a country. A focus on deprivation is appropriate in the South African context, given the disadvantage faced by certain race groups under apartheid, which has translated into vast inequities, not only in the distribution of income but also in the full range of human capabilities (Gilson and McIntyre 2001). However, the nature of poverty and the extent of inequities within many LMICs suggest that the focus on deprivation is also of international relevance.

The second distinguishing feature of this study is that it adopts a vertical equity approach (i.e. the unequal but equitable treatment of unequals) to resource allocation strategies instead of using an approach of narrowly targeting resources on the poorest communities with explicit efforts to minimize ‘leakage to the nonpoor’ (Bigman and Fofack 2000). While the vertical equity perspective prioritizes human development benefits for the most disadvantaged (Mooney 1996; McIntyre and Gilson 2000), it does this through the differential allocation of government resources on the basis of relative disadvantage, rather than only (or largely) being concerned about the worst-off group. While there are considerable debates around the concept of equity and which definition of equity is most appropriate, the vertical approach is arguably the most appropriate means of effectively and speedily achieving equity gains in South Africa given that it recognizes that different groups within our society have very different starting points and therefore require differential treatment (McIntyre and Gilson 2000). The focus on deprivation within a vertical equity approach also raises an important question about the poverty-targeting approach being adopted in PRSPs: is human development in Sen’s terms better served by an approach focusing on poverty alleviation versus an approach focusing on narrowing the range of relative deprivation?

In order to operationalize the vertical equity approach, a mechanism for identifying groups with different levels of deprivation is required. Small area analysis is particularly appropriate in this regard for this study because overall public sector resource allocation in South Africa is largely geographically based. This points to the third distinguishing feature of this research. It does not focus simply on the allocation of health care resources, but considers the implications of the distribution of deprivation for overall public sector resource allocation. This focus is relevant because the form of decentralization in South Africa is that of devolution, with considerable responsibility for social service provision resting at sub-national level (with provinces). Most centrally collected government resources in South Africa are allocated to provinces through general purpose or unconditional grants on the basis of what is termed the ‘equitable shares’ formula. Provinces then have relative autonomy in allocating this grant between health and other sectors (a process that has been termed fiscal federalism). Although the focus is on general purpose grants, this has considerable relevance to health equity issues. For example, budget allocations to provincial health departments are heavily dependent on the size of the general purpose grants received by each province. Hence, equity in the allocation of general purpose grants ultimately influences equity in public sector health care (and other social service) spending. In addition, general purpose grants received by provinces are also used to provide education and social welfare services, all of which have an important influence on health.

Decentralization is also one of the central components of the health reform programmes being implemented within many LMICs (Cassels 1995; Gilson and Mills 1995; Gilson and Travis 1997), and a growing number of countries are, like South Africa, opting for devolution (decentralization of responsibility to provincial/regional and/or local government) rather than deconcentration (decentralization of service responsibilities within a sector, e.g. creation of a district health system). Given that the allocation of resources...
within decentralized systems is one of the most important influences over the impact of decentralization on equity (Collins and Green 1994; Kohlemainen-Aitken and Newbrander 1997), identifying mechanisms that promote equity in the allocation of general purpose grants within fiscal federal systems is of international importance.

This study, therefore, attempts to offer insights to those exploring the potential and relevance of small area studies in relation to resource allocation in LMICs. By offering a different analytical approach to that which the World Bank is proposing for use within PRSPs, it also seeks to encourage debate about how best to support health policy change that is directed towards meeting the needs of the most vulnerable groups in any society.

**Methods**

**Small areas**

Magisterial districts were used as the small area unit of analysis in this study. Magisterial districts are an historic administrative areal construction (each of these districts had a magistrate) and are used as the basis for many of the current administrative boundaries (e.g. the vast majority of health districts in South Africa comprise a number of magisterial districts). The use of magisterial districts in this study is partly attributable to the fact that census, household survey and vital statistics data are routinely available at this level. 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 that can be subjected to statistical analysis. There are currently 354 such districts in South Africa.

**Construction of deprivation indices**

The international literature provides useful guidelines on how to embark on constructing a country-specific (and study-specific) deprivation index. In particular, there is growing consensus in the literature that a deprivation index should meet two criteria, namely that component variables should be additive (i.e. someone with two of the characteristics reflected in the variables should be more likely to experience deprivation than a person with only one of the characteristics) and that differential weighting should be assigned to variables to reflect their relative contribution to overall deprivation (Gordon 1995).

In this study, a range of alternative deprivation indices was constructed and analyzed, the three key indices being a general index of deprivation (GID), a policy-perspective index of deprivation (PID) and a single indicator of deprivation (SID). All three indices used data from the 1996 census.

The GID was compiled using principal component analysis (PCA). PCA is a statistical technique that generates subsets of variables (called components) within each of which the selected variables are highly inter-correlated. These components then reflect underlying relationships between all the variables but are relatively independent of one another. While PCA is purely a statistical technique, and in that sense does not ‘explain’ deprivation, the variables that were initially selected for possible inclusion in the GID were based on the author’s conceptual understanding of deprivation, as outlined in the introduction. Thus, in the context of this study, PCA was used to identify those socioeconomic, demographic and physical household characteristics, identified as being conceptually relevant to deprivation in the South African context, that are most highly correlated with each other in contributing to deprivation (for more information on PCA see: Kline 1994; Tabachnick and Fidell 1996). PCA was also used to assign weights to each variable according to its relative contribution to overall deprivation and thus meeting the above-mentioned criteria of differential weighting. All demographic and socioeconomic variables in the census dataset that were judged to be relevant to deprivation, based on our conceptual understanding, and highly correlated with each other (significant at the 1% level using Spearman rank correlations), as recommended by Alderman and Morris (1967), were included in the PCA to determine the General Index of Deprivation. For variables that were thought to measure the same characteristic, such as unemployment and proportion of households headed by an unemployed individual, only one was included to preserve additivity. The GID is the sum of each variable’s z-score multiplied by its factor score coefficient, which is produced through regression analysis. The output of the PCA is shown in Table 1, with the first component being taken as the basis for the GID, given that it explains the largest proportion of the variance.

Income was not incorporated into the development of this index as it was too crudely categorized (i.e. using very wide income categories) in the census data. Though consumption and expenditure data are available in the Income and Expenditure Survey, coding differences between the two datasets meant that they could not be combined.

The PID was developed by identifying those groups emphasized within health sector and other policy documents as being particularly disadvantaged or as groups that should receive priority in social service delivery. The groups most frequently referred to in these documents were: Africans, the elderly, children, women and rural dwellers. The z-scores of variables reflecting these demographic and socioeconomic characteristics by area were obtained from the 1996 census. 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.

The purpose of the SID was to explore whether the use of a single variable would, in addition to being far simpler to work with, be as effective as composite indices in identifying disadvantaged groups. Two criteria were used to select a suitable single variable to indicate deprivation. First, the variable should correlate strongly with other variables of interest (i.e. other variables found to be important in the GID). Secondly, data on the variable should be routinely
updated (i.e. should be available from the household surveys conducted on an annual basis in South Africa). In our analysis, lack of access to piped water was found to be the most appropriate variable for use in the SID. Not only are data on access to piped water collected in an annual household survey, but this variable was consistently highly correlated with variables included in the GID.

Analyses undertaken

The three deprivation indices described above were then used in various analyses. First, they were used to consider the geographic distribution of deprivation in South Africa. For each index, magisterial districts were ranked according to the index value, and the percentage of the population in each province living in districts falling within each quintile (with quintile 1 representing the 20% of districts with the greatest deprivation) was calculated and presented in bar chart format. The number and physical area of districts in each province according to deprivation quintile was also presented in the form of maps (the maps are not presented in this article but may be obtained from the authors). The characteristics of the districts in each quintile of each index were also investigated and compared to understand the patterns and dimensions of deprivation. District rankings obtained for the different indices were compared with each other using Spearman rank correlation analysis to investigate whether the use of different indices would produce similar results in terms of the distribution of deprivation.

Secondly, the correlation of deprivation and ill-health was investigated. As indicated previously, although the distribution of deprivation is used in this study to analyze the allocation of inter-provincial general purpose grants, these grants are used by provinces primarily for providing health, education and social welfare services, all of which have a substantial influence on health status. Given the lack of morbidity data, mortality data from the vital registration database were used. It is widely recognized that there is significant under-reporting of deaths in South Africa, particularly in rural areas (see, for example, Bradshaw et al. 1995). The research team, thus, used indicators of mortality that may be less vulnerable to the under-reporting of deaths. The first indicator was the potential years of life lost (PYLLs) per death. This indicator reflects 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 second ill-health indicator used was the percentage of deaths due to infectious diseases: a measure of the differences between geographic areas in deaths due to potentially preventable diseases that can be addressed through primary care services. Given the under-reporting of deaths in rural areas, the relationship between deprivation and ill-health was explored within urban districts only.

Finally, the implications of the geographic distribution of deprivation for government resource allocation policies were evaluated. As noted in the introduction, a key resource allocation process in South Africa is the decision about how to allocate general purpose 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 summed. These provincial indices were then normalized against the value for the least deprived province (Gauteng for both the GID and the PID). Finally, the normalized values were used to weight the provincial populations and this weighted population was included as one component of the overall inter-provincial resource allocation formula in testing the impact of its inclusion on the pattern of resource allocation.

Table 1. Components arising from the General Index of Deprivation principal component analysis

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>0.556</td>
<td>0.262</td>
<td>0.599</td>
</tr>
<tr>
<td>Child</td>
<td>0.872</td>
<td>0.075</td>
<td>0.077</td>
</tr>
<tr>
<td>Rural</td>
<td>0.876</td>
<td>0.055</td>
<td>0.020</td>
</tr>
<tr>
<td>Black</td>
<td>0.488</td>
<td>0.744</td>
<td>-0.281</td>
</tr>
<tr>
<td>No school</td>
<td>0.800</td>
<td>0.163</td>
<td>0.111</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.529</td>
<td>0.672</td>
<td>0.097</td>
</tr>
<tr>
<td>Disabled</td>
<td>-0.006</td>
<td>0.915</td>
<td>0.100</td>
</tr>
<tr>
<td>House</td>
<td>0.721</td>
<td>0.404</td>
<td>-0.238</td>
</tr>
<tr>
<td>Water</td>
<td>0.877</td>
<td>0.334</td>
<td>0.043</td>
</tr>
<tr>
<td>Refuse</td>
<td>0.503</td>
<td>0.151</td>
<td>0.021</td>
</tr>
<tr>
<td>Phone</td>
<td>0.892</td>
<td>0.223</td>
<td>0.063</td>
</tr>
<tr>
<td>Light</td>
<td>0.820</td>
<td>0.316</td>
<td>0.010</td>
</tr>
<tr>
<td>Female head</td>
<td>0.782</td>
<td>0.405</td>
<td>0.235</td>
</tr>
<tr>
<td>Elderly</td>
<td>-0.033</td>
<td>-0.067</td>
<td>0.914</td>
</tr>
<tr>
<td>% total variance explained</td>
<td>50.056</td>
<td>18.305</td>
<td>10.208</td>
</tr>
</tbody>
</table>

Table 2. General Index of Deprivation

<table>
<thead>
<tr>
<th>Weight/variable</th>
<th>Variable – proportion of the population in each district who:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.190</td>
<td>Live in a rural area</td>
</tr>
<tr>
<td>0.181</td>
<td>Are children under the age of 5 years</td>
</tr>
<tr>
<td>0.152</td>
<td>Have no access to a phone</td>
</tr>
<tr>
<td>0.151</td>
<td>Have no access to any formal refuse disposal</td>
</tr>
<tr>
<td>0.141</td>
<td>Are older than 25 years and have no schooling</td>
</tr>
<tr>
<td>0.117</td>
<td>Do not have access to electricity for lighting</td>
</tr>
<tr>
<td>0.124</td>
<td>Have no piped water in their house or on site</td>
</tr>
<tr>
<td>0.091</td>
<td>Live in a traditional dwelling, informal shack or tent</td>
</tr>
<tr>
<td>0.072</td>
<td>Live in households headed by a woman</td>
</tr>
<tr>
<td>0.040</td>
<td>Are unemployed</td>
</tr>
<tr>
<td>0.028</td>
<td>Are female</td>
</tr>
</tbody>
</table>
Results

Overview of deprivation indices findings

The GID resulting from the principal component analysis includes variables (such as education status) commonly regarded as important indicators of socioeconomic 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 disadvantage. The variables comprising the GID and each variable’s weight or coefficient, produced through regression analysis, are summarized in Table 2.

Figure 1 shows the percentage of each province’s population that lives within magisterial districts that fall within quintiles 1 to 5 according to the GID scores. The highest percentage of population located in the most deprived quintile (20%) 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). Forty-four per cent of the overall South African population live in the most deprived quintiles of districts (i.e. quintiles 1 and 2). Given the differences in population size of the provinces, KwaZulu-Natal has the highest share of the deprived population (12.1% of residents of quintile 1 and 2 districts live in this province), followed by the Northern Province (11.2%), Eastern Cape (10.2%), North West (5%) and Mpumalanga (4.2%). Thus, over 76% of the total population living in quintile 1 and 2 districts reside in three provinces, namely KwaZulu-Natal, Northern Province and Eastern Cape. As populations within magisterial districts are relatively homogenous, it can be concluded that the vast majority of deprived South Africans live in these three provinces.

The PID and SID produced a very similar picture of the distribution of deprivation between magisterial districts and provinces (see Figure 2 for the distribution using the SID). Consistently, the Northern Province and Eastern Cape were identified as the most deprived provinces, and Gauteng and the Western Cape as the least deprived using the different deprivation indices.

This pattern reflects the fact that the alternative deprivation indices are highly correlated with each other. The GID and SID are most highly correlated (0.889), and the PID correlates well with both the GID (0.852) and SID (0.728).

Relationship between deprivation and ill-health

As indicated previously, given the poor death reporting in rural areas, the relationship between deprivation and
ill-health was only investigated within urban districts. The general index of deprivation is positively correlated with both mortality indicators selected for this analysis, namely PYLLs per death (0.569; p < 0.01) and percentage of deaths due to infectious diseases (0.306; p < 0.01). The PYLLs per death correlation suggests that urban dwellers who have the highest levels of deprivation, die at a younger age than more advantaged urban residents. The other mortality indicator suggests that a greater proportion of the more deprived urban residents die from potentially preventable infectious diseases than those who are less deprived.

Implications of the distribution of deprivation for resource allocation

The 'equitable shares' formula used by the South African National Treasury to allocate resources between provinces has seven individual components, each of which is given a specific and different weight. The social service components (health, welfare and education components) are based on basic indicators of relative need for such services (e.g. size of population in each province estimated to be dependent on different types of welfare grants). Among the other components, two deserve particular mention, namely the economic activity and backlogs components. The economic activity component is based on each province's contribution to the economy (estimated by the gross geographic product of each province) and so benefits the provinces containing the major metropolitan areas (particularly Gauteng). The backlogs component was, however, introduced recently to account for relative backlogs in physical infrastructure (based on estimates of the relative need for new, and repairs to existing, health and education facilities) and favours the more rural and historically disadvantaged provinces. While the economic activity component receives an 8% weighting in the overall formula, the backlogs component receives only a 3% weighting. The relative weighting assigned to the two components is essentially a political decision made by the national and provincial Ministers of Finance.

Figure 3 compares the current allocation under the National Treasury formula with the base expenditure levels in each province at the time the formula was introduced (1997/98 financial year). It indicates that the use of the Treasury formula has resulted in a declining share of government resources being allocated to some of the most deprived provinces (e.g. Eastern Cape and North West) while others (like Northern Province) have experienced marginal increases. However, the provinces that have received the greatest increases in the share of government resources over base expenditure levels are Gauteng (which contains the major metropolitan areas of the country) and KwaZulu-Natal, with Mpumalanga receiving a somewhat smaller increase.

Various analyses were undertaken to assess the impact of replacing the current infrastructural backlogs component with the GID, a reflection of human development backlogs, within the ‘equitable shares’ formula. In one scenario, the current 3% weighting for this component was retained, while in the second, the weightings for the economic activity component were switched with those of the backlogs/GID component. The reasoning behind the second scenario is that the relative weightings of the backlogs and economic activity components are essentially arbitrary, and it could be argued that the extent of deprivation and disparities inherited from the apartheid era justify significant investments in human development and an emphasis on vertical equity (i.e. to prioritize areas with the greatest share of deprived population in resource allocation decisions in order to rapidly redress human development disparities).

Figure 3 also shows the results of the second scenario (i.e. using the GID as the basis of the backlogs component and assigning it a weight of 8% and the economic activity component of 3%). It compares the potential provincial budget allocations under this scenario with the current allocation under the National Treasury’s formula and with the base expenditure levels in each province at the time when the formula was introduced (1997/98 financial year). The figure indicates the dramatic effect of this scenario on resource allocation patterns. Very deprived provinces (notably the Northern Province, Eastern Cape and KwaZulu-Natal) see quite dramatic potential budgetary increases and the least deprived provinces (Gauteng and Western Cape) see equally dramatic budget decreases. Importantly, when this potential
Variables identified through the statistical analysis of census data undertaken in this study and community perceptions of aspects of relative disadvantage (such as lack of education, poor access to water, adequate housing and safe energy sources, and unemployment) (May 1996). Income is rarely, if ever, directly mentioned as a dimension of disadvantage within community views. However, the dominant theme in perceptive studies, that of social isolation, is poorly captured by census-based variables and so is not adequately incorporated in the GID. This suggests that the use of deprivation indices as a tool in understanding patterns of deprivation should be supplemented by qualitative enquiries into people’s own perceptions of their circumstances and needs.

### Measuring deprivation

An important finding of this study is that it is feasible to undertake deprivation measurements in data poor contexts. Although we were fortunate in having access to census data that included a range of important socioeconomic variables not routinely compiled via the census in most other LMICs (such as access to water, sanitation and electricity), it would have been possible to undertake such analysis using an annual South African household survey which uses a relatively large and representative sample. Such household surveys exist in many other LMICs, whether conducted by the country’s own statistical agency or by the World Bank in the form of a Living Standards Measurement Survey (LSMS). However, in using such surveys, it is important to think carefully about the appropriate ‘small area’ to use in analysis. If the household survey has a relatively small sample size, it may be necessary to use relatively large geographic areas in order to ensure that the data can be subjected to statistical analysis. However, a problem with using larger areas is that the population is likely to be more heterogeneous, which may obscure pockets of deprivation. The use of household survey data in analyses of deprivation would also be facilitated either by ensuring the combined collection of socioeconomic variables and health data in one routine survey or by consistent coding between surveys to allow data merging.

### Discussion

#### Key factors contributing to deprivation in South Africa

The PCA undertaken within this study clearly indicates that a range of demographic, socioeconomic and areal variables contribute to deprivation in South Africa. The analysis suggests that rurality is one of the most important variables, as are the percentage of a district’s population under 5 years of age and the percentage of the population 25 years or older who have no education. Access to basic services, such as refuse removal, piped water supplies, electricity and good quality housing also play an important role. Surprisingly, access to a telephone is also of considerable importance in the South African context, perhaps again reflecting differential availability of services between urban and rural areas. Unfortunately, the lack of accurate, disaggregated data prevented consideration of the relative importance of income to deprivation in this study. Thus, further analysis must allow for the inclusion of income in deprivation measures.

Interestingly, there is considerable commonality between the variables identified through the statistical analysis of census...
are of equal importance, the high correlation of the PID with the GID suggests that it may be an acceptable alternative to the more statistically complex GID. As it includes variables which policy-makers themselves have identified as important, the PID is also likely to hold great appeal for policy-makers. In the case of South Africa, the significant correlation between the PID and the GID indicates that policy-makers have reasonably accurately identified groups who are relatively disadvantaged, even though they have used broad demographic and areal categorizations.

Implications of the distribution of deprivation for resource allocation

The magisterial district analysis indicates that deprivation in South Africa is heavily concentrated in a few provinces, particularly the Northern Province, KwaZulu-Natal and Eastern Cape, with relatively high levels of deprivation in Mpumalanga and North-West. Gauteng has the lowest levels of deprivation followed by the Western Cape. Given this distribution of deprivation, the analysis presented here (Figure 3) also shows that the vertical equity goal of giving relatively greater priority to the most disadvantaged areas is not being met by the current Treasury ‘Equitable Shares’ formula. For example, the Eastern Cape is subject to budget cuts over its current spending levels while Gauteng is receiving considerable budgetary increases. The incorporation of the GID into the resource allocation formula would actively promote vertical equity through awarding the largest budget increases to the most deprived provinces and reducing the relative share of limited national resources for the least deprived provinces.

Small area deprivation information can also be used to guide resource allocation decision-making within provinces. This study produced maps for each province, indicating the deprivation quintile into which each magisterial district of each province falls. These maps (or the list of magisterial districts’ deprivation scores) could be used by provincial social service managers to identify the districts that should receive relative priority in the allocation of sectoral resources and in terms of developing capacity to absorb these resources appropriately (Brijlal et al. 1997; Mooney 2001). This is particularly important, as merely amending an inter-provincial resource allocation formula does not automatically translate into use of resources to promote vertical equity objectives within that province.

From the perspective of intra-provincial resource allocation it is worrying 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) in this analysis. Anecdotal evidence and observation indicate, rather, that there are peri-urban areas within the large metropoles that have relatively high levels of deprivation. Other researchers have also highlighted the problem of average measures obscuring pockets of extreme deprivation in densely populated metropolitan areas in LMICs (Stephens 1996; Stephens et al. 1997). The use of relatively large areas in small area studies may, thus, lead to 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.’ In order more appropriately to inform intra-provincial resource allocation strategies in South Africa, it will be important to conduct an analysis at enumerator area level within metropolitan areas.

Conclusions

This study provides some insights into how to strengthen resource allocation in pursuit of vertical equity goals within South Africa. It also has relevance to other LMICs that are interested in redressing human development or capability inequities through the differential allocation of government resources on the basis of relative disadvantage or deprivation, rather than focusing policy interventions on poverty alleviation targeting approaches as proposed by the World Bank. The resource allocation implications of this study have particular relevance to countries that have pursued a devolution approach to decentralization.

The study has demonstrated 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. Also of importance is the finding that relatively simple indices, such as the PID (which is an unweighted simple additive index) or the SID (which consists of a single variable), may be as effective as more sophisticated indices derived through statistical methods (such as the GID) in identifying disadvantaged small areas.

Finally, the research presented here has gone some way towards reviewing the usefulness of small area studies of deprivation in promoting equitable resource allocation in South Africa. Additional research is needed to strengthen the arguments presented here and provide more refined intra-provincial deprivation information, particularly for provinces containing metropolitan areas. However, the greatest remaining challenge is to assess the extent to which policymakers and service managers find the small area deprivation analysis approach useful in guiding decision-making in pursuit of vertical equity goals.

References


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