

# Small Area Indices of Multiple Deprivation in South Africa

Michael Noble · Helen Barnes · Gemma Wright · Benjamin Roberts

Accepted: 2 March 2009 / Published online: 26 March 2009  
© Springer Science+Business Media B.V. 2009

**Abstract** This paper presents the Provincial Indices of Multiple Deprivation that were constructed by the authors at ward level using 2001 Census data for each of South Africa's nine provinces. The principles adopted in conceptualising the indices are described and multiple deprivation is defined as a weighted combination of discrete dimensions of deprivation. The methodological approach used is outlined and key findings are presented for one province—the Eastern Cape. The paper summarises the ways in which the research is being developed further and the potential uses of these tools for policy and research.

**Keywords** Multiple deprivation · Indices · South Africa

## 1 Introduction

It is important for governments, aid agencies and non-governmental organisations to be able to accurately identify and target the most deprived areas in order to help them meet some of the United Nations Millennium Development Goals (MDGs), and to constantly refine the targeting of interventions contained in Poverty Reduction Strategy Papers and other programmes. Good quality detailed information on a number of different issues, including income poverty, health, education and access to services is vital for these efforts.

---

M. Noble · H. Barnes (✉) · G. Wright  
Department of Social Policy and Social Work, University of Oxford,  
Barnett House, 32 Wellington Square, Oxford OX1 2ER, UK  
e-mail: helen.barnes@socres.ox.ac.uk

M. Noble  
University of Fort Hare, Alice, South Africa

M. Noble  
Policy Analysis Unit, Human Sciences Research Council, Cape Town, South Africa

B. Roberts  
Child, Youth, Family and Social Development, Human Sciences Research Council,  
Durban, South Africa

Since the beginning of the post-apartheid era, a key objective of the South African government has been the improvement of the quality of life of all South Africans and the reduction of poverty and social inequality (African National Congress 2004; Republic of South Africa 1994). The South African constitution requires the government to ensure that financial resources are distributed equitably among provincial and sub-provincial governments, based partly on levels of poverty and disadvantage (Alderman et al. 2003). In order to fulfil this requirement, robust measures are needed that quantify the nature and extent of social deprivation at sub-national level and thereby accurately identify the areas of greatest need (i.e. the most deprived areas).

The measurement of poverty and deprivation and the changing nature of these phenomena over time has been the subject of much debate in South Africa in recent years (Bhorat and Kanbur 2006; Meth 2007; Noble et al. 2007b; Roberts 2004). In 2000, Statistics South Africa released a report which stated that in addition to thinking about poverty in terms of levels of income and expenditure, there is also a need to consider poverty more broadly: 'It is seen as the denial of opportunities and choices most basic to human development to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-esteem and respect from others' (Statistics South Africa 2000, p. 54). This is reflected in a recent consultation document issued by the National Treasury and Statistics South Africa. As well as proposing an official money-metric poverty line for the country, the document states that a 'poverty barometer' will be considered in line with the recommendations included in the Programme of Action following the African Peer Review Mechanism. The aim of such a tool is to 'bring together a range of complementary social and economic indicators of household wellbeing' (Statistics South Africa and National Treasury 2007). This demonstrates that the multidimensional nature of poverty and deprivation is now widely acknowledged in South Africa.

The purpose of this paper is to provide an outline of the development and application of small area level indices of multiple deprivation in South Africa. The objective of creating an index (or indices) to measure deprivation at the local level, to identify priority areas and target programmes more effectively, has been a consistent feature of government policy in many developed countries since the 1960s (Noble et al. 2006c) but is only beginning to be introduced in developing countries. Recent work in South Africa is a prime example.

This paper begins by providing a brief review of current approaches to measuring small area deprivation and/or multiple deprivation in South Africa (Sect. 2). The concept of multiple deprivation that was used in the South African work is then described (Sect. 3) and the statistical techniques used to construct the indices are outlined (Sect. 4). The geography of deprivation for an example province is then presented (Sect. 5) and current developments of the index work are highlighted (Sect. 6).

## 2 Multidimensional Deprivation Measurement in South Africa

Most work on small area poverty measurement in developing countries focuses on income and/or expenditure patterns, often ignoring the multidimensionality of deprivation which is now recognised in both the Copenhagen Declaration (United Nations 1995) and the United Nations MDGs. This has prompted a renewed interest in, and experimentation with, multidimensional poverty analysis and a critical examination of how these add to our understanding of the nature and causes of poverty and inform thinking on appropriate policy action (Kakwani and Silber 2008). In South Africa there are several examples of country level, area type level (e.g. urban/rural), and case study level analyses of multiple

deprivation, as well as certain small area level analyses of multiple deprivation or particular components of multiple deprivation. These are briefly reviewed here.

An early example of a national level index of multiple deprivation in South Africa is the composite index of deprivation which was constructed using the 1993 *South Africa Living Standards and Development Survey* (Vichi 1997). This was produced for the country as a whole and was then broken down by area type (urban/rural). Using the same data source, Klasen (1997, 2000) constructed a deprivation index comprising education, income, wealth, housing, water, sanitation, energy, employment, transport, financial services, nutrition, health care, safety and perceived well-being indicators. This national index was broken down by certain aggregate area types (e.g. urban, rural, and metropolitan areas).

Mattes et al. (2003) developed a Lived Poverty Index (LPI) that focuses on peoples' ability to obtain basic necessities, drawing from *Afrobarometer* data (and see *Afrobarometer* 2005). The LPI is a combination of responses to questions on how often the respondent or their family went without seven basic necessities in the year prior to interviewing: a cash income, food, medical treatment, home fuel, water, electricity and home safety. Five further indices were produced relating to ill-health, development infrastructure, community services, agricultural activity, and access to schools. The LPI can be compared across several countries in Africa, and an expanded derivation has been developed by Hamel et al. (2006) based on the 2003 *Survey of South Africans at 10 Years of Democracy*.

The South African Advertising Research Foundation's Living Standards Measure (LSM) and Universal LSM (e.g. Van Aardt 2005) have been constructed since 1997 using *All Media and Products Surveys*, and are broken down by province. Although used initially for the primary purpose of market segmentation, the measure is essentially a form of asset index in the tradition of that developed by Sahn and Stifel (2000) and Filmer and Pritchett (2001).

A national and province level proportional deprivation index has recently been constructed which measures the lack of items defined as essential for an acceptable standard of living by a nationally representative sample of the population (Wright 2008). This draws from the 2006 *South African Social Attitudes Survey*, which is a nationally representative survey that has been conducted annually by the Human Sciences Research Council since 2003.

The South African Human Development Index (HDI) is a combination of measures of life expectancy, education and per capita GDP, and is complemented by a Human Poverty Index, Gender Empowerment Index, and Service Deprivation Index (UNDP 2003). However, it does not purport to be a measure of multiple deprivation and, whilst promoting the use of non-income dimensions of wellbeing, it has been criticised variously for its choice of components, weighting approach, estimation protocol, and aggregation rules (Klasen 2000; Ravallion 1997).

In addition, an HDI has been constructed specifically for the Western Cape province (Department of Health and Social Services of the Western Cape 1999). Terming their index a Provincial Human Development Index, four indicators from the 1996 Census—income, employment status, literacy and water supply—were combined with equal weight to form a composite index. This work has been further developed using the 2001 Census to produce an HDI at municipality level for the Western Cape and a City Development Index at census main place level (Department of the Premier of the Western Cape 2005).

As will become evident in the section below, income is an important dimension of deprivation and as such, work on small area level income deprivation is of relevance here.

Commonly, this approach uses nationally representative income/expenditure surveys and household censuses to produce estimates of households falling below an expenditure poverty line and has been applied in a number of countries (e.g. Elbers et al. 2003; Ghosh and Rao 1994; Hentschel and Lanjouw 1996). In South Africa, Alderman et al. (2000) combined the 1995 *Income and Expenditure Survey*, the 1995 *October Household Survey* and the 1996 Census to construct estimates of household expenditure. Households with expenditure below the threshold set by the Department of Local Government were deemed to be living in poverty. The results yielded estimates of the proportion of households living in poverty at various geographical levels, although with declining precision for small sub-units of major administrative divisions (Alderman et al. 2003). Food security has also been mapped at a small area level using such an approach (e.g. Drimie et al. 2005).

Small area level estimates of deprivation generated using household level survey data are *estimates* only, and not a direct measure of deprivation. The assumption is that the associations found in the national survey will hold across all areas in a consistent form. This is unlikely to be the case: although the estimates overall will have a fairly high level of precision, there is likely to be bias in some areas. Thus, to build local measurement *purely* on small area estimation could be misleading in some areas and it has been argued that small area estimation may not necessarily be a 'gold standard' technique (Davis 2003).

One alternative is to measure the components of multiple deprivation using dedicated surveys in case study areas. For example, in the early 1980s, pioneering research was undertaken to produce a 'quality of life' measurement system for an area called Elsies River near Cape Town (Ellis and Erlank 1983). The indices generated in this study were based on a set of objective and subjective indicators that were obtained using a household survey in that area. Additionally, in 2001, an *Essentials of Life Survey* was run in three case study areas of South Africa to explore the capabilities approach (Qizilbash and Clark 2005).

Another alternative is to draw from census data which does permit sub-provincial analysis of deprivation. For example, Hirschowitz et al. (2000) constructed provincial level 'development indices' for South Africa. Average monthly household expenditure and ten other indicators from the 1996 Census were combined using factor analysis. Two indices were identified: the Infrastructure Index was based on eight variables relating to the state of housing, access to services, education and expenditure, and the Circumstances Index was based on the remaining three variables relating to unemployment, household size and number of children.

McIntyre et al. (2000, 2002) produced four deprivation indices which focused on the relationship between deprivation and health inequalities. These were constructed at magisterial district level using the 1996 Census and principal components analysis was used for two of the indices (the general index of deprivation and the health-related index).

A difficulty with these approaches, though, is that the combination processes do not first take into account different domains of deprivation, and so the resultant indices may be unnecessarily biased by the number of indicators that were incorporated relating to different types of deprivation. So for example, for the indices constructed by Hirschowitz et al., five of the eleven variables entered into the factor analysis relate to access to services, while the remaining six relate to housing, education, employment, expenditure and household demographics. This results in far greater importance (or weight) being given to the issue of access to services than to the other aspects of social disadvantage.

This paper presents findings from an index of multiple deprivation which was constructed for each of the nine provinces in South Africa at ward level using the 2001

Census, and was published in March 2006 as the Provincial Indices of Multiple Deprivation 2001 (PIMD 2001; Noble et al. 2006a). These indices draw conceptually and methodologically on work undertaken to construct small area level indices of multiple deprivation in England (Noble et al. 2000a, 2004, 2008), Wales (Noble et al. 2000b), Scotland (Noble et al. 2003), Northern Ireland (Noble et al. 2001, 2005a), and Bangladesh (Smith et al. 2005).

Each of the studies referred to in the above review contributes to the debates about multiple deprivation in South Africa. The purpose of this paper is to introduce the PIMD 2001. Space does not permit us to undertake detailed comparisons between the PIMD and the other South African indices mentioned above. In any event, such comparisons would be limited, as none of the other indices were produced at such a low level of spatial aggregation. The innovations of the PIMD are that (a) a distinct and explicit conceptual approach has been used (see below); (b) the combination method occurs in two stages (first to produce domains and then the index of multiple deprivation) which both articulates the conceptual framework and sharpens the focus on the weighting process; and (c) the indices are presented at a relatively small area level (electoral ward).

### 3 Conceptual Framework

It is important that indices of multiple deprivation are underpinned by a clear conceptual framework. The PIMD 2001 and its international predecessors follow in the path of a strong tradition internationally which considers deprivation as unmet needs across different aspects of social and economic life (Townsend 1979, 1987). Townsend distinguishes between social and material deprivation and lays down the foundation for articulating multiple deprivation as an accumulation of single deprivations, a formulation which is the starting point for the model of small area deprivation.

It is possible to measure single deprivations, such as health deprivation or education deprivation at an area level and state that a certain proportion of the population experiences one type of deprivation or a proportion experiences some other form of deprivation, and at an area level describe the combination of single deprivations as area level multiple deprivation. Multiple deprivation, we argue, is not a separate form of deprivation but is simply a weighted combination of specific forms of deprivation.

Income deprivation is a central component of the definition of multiple deprivation, but is not the only measure of area deprivation as other dimensions contribute important additional information about an area. In the PIMD 2001, deprivation is conceived in a broad way, by taking into account issues relating to income, employment, health, education and the quality of the environment in which people live. The concept of separate domains of deprivation enables the researcher to explicitly control the weights assigned to each of the domains.

An area (a ward in the case of the PIMD 2001) can be characterised as deprived relative to other areas in a particular dimension of deprivation on the basis of the proportion of people in the area experiencing the type of deprivation in question. Though the area itself is not deprived, the presence of a concentration of people experiencing deprivation in an area may give rise to a compounding deprivation effect, measured by reference to those individuals.

To what extent can the same people or households be represented in more than one of the dimensions of deprivation? The approach taken was that if an individual, family or area experiences more than one form of deprivation, this is worse than experiencing only one

deprivation. Double counting between (but not within) domains was therefore allowed, in order to identify that people are deprived in more than one way. In terms of whether deprivation in one dimension cancels out the lack of deprivation in another, we treated multiple deprivation as a cumulative phenomenon and therefore restricted the cancellation effects between domains.

In summary, the PIMD 2001 was conceptualised as a series of domains of deprivation which could be combined, with selected weights, into an index of multiple deprivation for each province that took into account the accumulation of different types of deprivation at a small area (ward) level.<sup>1</sup> The issues of collating indicators and selecting statistical techniques to construct the indices are best addressed only after one has considered how to conceptualise small area level multiple deprivation. The intention was therefore that the construction of the indices was driven neither by the availability of data nor by statistical techniques, but rather by the conceptual model itself.

## 4 Methodology

The construction of the PIMD involved a number of steps which are outlined here:

### 4.1 Select the Geographical Unit

The aim was that each PIMD should be constructed at the smallest workable spatial scale and that the selected geographical units would have relatively even sized populations. At a sub-provincial level, there were various options for the geography for the PIMD, including municipalities, main places, sub places and wards.<sup>2</sup> Wards have the least diversity in population size; they give a more coherent geography than main places or sub places as they are contiguous; they nest within municipalities; and the boundaries change little over time.<sup>3</sup> As such, the ward was selected as the main unit of analysis. There are 3,799 wards in South Africa.<sup>4</sup> Provinces with large wards would have been under-represented in national indices of deprivation due to the variation in ward sizes between provinces—for example, wards have a mean population size of 5,000 in the Northern Cape compared to 20,000 in Gauteng. This informed the decision to construct an index of multiple deprivation for each province (i.e. the nine PIMDs). These indices facilitate intra-provincial comparisons rather than allowing comparison across provincial boundaries, an issue which is discussed further below. Though wards have their weaknesses, they are nevertheless a useful unit of analysis as they are known political boundaries that people can identify with, and they have ward councillors who are elected during local government elections. This further justifies the appropriateness of such a choice as the index could provide a tool for ward councillors to assess performance in their area, or to enable them to argue for resources for their area.

---

<sup>1</sup> A more detailed account of the conceptual framework underpinning the PIMD 2001 and the methodology used can be found in Noble et al. (2006c).

<sup>2</sup> There are several paths to the hierarchical structure of the Census geography, two of which are: South Africa→province→district municipality or metro→municipality→main place→sub place; and South Africa→province→district municipality or metro→municipality→electoral ward.

<sup>3</sup> An important consideration for measuring change in levels of deprivation over time.

<sup>4</sup> District Management Areas and fragments of those wards split between province boundaries where the population was less than 100 were eventually omitted from each PIMD.

## 4.2 Select Domains of Deprivation and Indicators for each Domain

After a series of discussions with experts in the field and among the research team, several domains or dimensions of deprivation were identified as important in the South African context. Five of the domains of deprivation that were identified could be constructed using data from the 2001 Census: income and material deprivation, employment deprivation, health deprivation, education deprivation and living environment deprivation. One of the main dimensions identified which could not be measured at ward level using either the census or administrative data was the incidence of crime, though work is underway to produce such a domain for future indices. The goal for each domain was to include a parsimonious collection of indicators that comprehensively captured the deprivation for each domain, but within the constraints of the data available from the census. Three further criteria were kept in mind when selecting indicators: they should be ‘domain specific’ and appropriate for the purpose (as direct as possible measures of that form of deprivation); they should measure major features of that deprivation (not conditions just experienced by a very small number of people or areas); and they should be statistically robust (i.e. have small standard errors).

Another issue to take into account is the threshold of deprivation for each of the indicators (i.e. at what point does a person become deprived on this indicator?). The important criterion for the purpose of the PIMD was that each indicator should have discriminatory power across the range of wards in each province: for the purposes of the indices it would not be meaningful to select a threshold that captures almost no-one or that captures almost everyone across the province. Where possible, thresholds were selected using national or international standards (e.g. 40% of mean equivalised income in the income domain). Where there has been debate in the literature, for instance whether to use the official or expanded definition of employment, then sensitivity testing was undertaken to ensure that the selection of one or other of the indicators did not introduce major bias in terms of the *relative ranking* of wards in a province.

Figure 1 summarises the domains and indicators that were included in the PIMD (see Noble et al. 2006a, b for further details about the selection and construction of the indicators).

## 4.3 Combine Indicators into Domains

For each domain of deprivation the aim was to obtain a single summary measure that could be easily interpreted (e.g. proportions of people or of households experiencing that form of deprivation). Apart from the health deprivation domain, all of the other domains were created as simple rates. This avoided the issue of weighting indicators which is necessary when combining indicators into a single measure. The health deprivation domain was more complex as it had to be age standardised. Furthermore, because of the relatively small numbers, the standard errors were higher than for the other domains and so the technique of shrinkage estimation<sup>5</sup> was applied to ensure robustness. Every ward within a province was assigned a score on each domain, after which the scores were standardised by ranking, providing a relative picture of each dimension of deprivation in each province.

<sup>5</sup> Shrinkage estimation (i.e. empirical Bayesian estimation) is a technique that can be applied to a score to deal with unreliability due to large standard errors. The effect of shrinkage is to move the score for a small area towards the average score of a larger area, for example moving a ward score towards the average score for the municipality in which the ward is located. The extent of movement depends on the reliability of the indicator and the heterogeneity of the larger areas. A robust score will move a negligible amount as it is related to the standard error. Areas may become more or less deprived depending on their deprivation score in relation to the municipality mean.

**Income and Material Deprivation Domain**

- Number of people living in a household that has a household income (need-adjusted using the modified OECD equivalence scale) that is below 40% of the mean equivalent household income; or
- Number of people living in a household without a refrigerator; or
- Number of people living in a household with neither a television nor a radio.

**Employment Deprivation Domain**

- Number of people who are unemployed (using official definition); plus
- Number of people who are not working because of illness or disability.

**Health Deprivation Domain**

- Years of Potential Life Lost

**Education Deprivation Domain**

- Number of 18-65 year olds (inclusive) with no schooling at secondary level or above

**Living Environment Deprivation Domain**

Number of people living in a household without piped water inside their dwelling or yard or within 200 metres; or

- Number of people living in a household without a pit latrine with ventilation or flush toilet; or
- Number of people living in a household without use of electricity for lighting; or
- Number of people living in a household without access to a telephone; or
- Number of people living in a household that is a shack; or
- Number of people living in a household with two or more people per room.

**Fig. 1** Domains and indicators included in the PIMD 2001

#### 4.4 Combine Domains into an Overall Index of Multiple Deprivation

The domain deprivation measures were then combined into an index of multiple deprivation for each province. This involved three key processes, namely standardisation, transformation and weighting. The domain indices were standardised by ranking the scores in each domain and were then transformed to an exponential distribution. The exponential distribution was selected for two main reasons. First, it transforms each domain so that they each have a common distribution, the same range and identical maximum/minimum value, so that when the domains are combined into a single index of multiple deprivation the weighting is explicit. Second, it effectively spreads out the part of the distribution in which there is most interest; that is the most deprived wards in each domain. When transformed scores from different domains are combined by averaging them, the characteristics of the exponential distribution reduce the extent to which deprivation on one domain is cancelled by lack of deprivation on another. The particular exponential transformation that was selected for standardising the domains in the ward level PIMD ‘stretches out’ the most deprived 25% of wards in each province.<sup>6</sup>

<sup>6</sup> The actual distribution employed is one of a family of similar distributions. In the UK indices, the most deprived 10% of wards are stretched out, but in South Africa, with much higher levels of deprivation it was thought that it was appropriate to spread out the most deprived quarter of the distribution.



#### 4.5 Weighting

In order to combine the domains, a weight—a measure of the importance of the component—has to be attached to each domain. Weights can be arbitrary or selected using research evidence, empirical evidence, government policy priorities, government expenditure, or public consultation. These have been explored in some detail in Noble et al. (2004) and Dibben et al. (2007). Research in the UK has shown that, for the English Indices of Deprivation 2004 (Noble et al. 2004), the weights that were constructed by drawing from the academic literature on deprivation in combination with the research team's work and a consultation process, were similar to the weights derived from a survey approach, a revealed preference approach and a discrete choice experiment (Dibben et al. 2007). However, no such study has been undertaken yet in South Africa. Weighting always takes place when elements are combined together: even summing the domains together means they are given equal weight. For each PIMD, equal weights were assigned to the exponentially transformed domains, as there was no compelling evidence that alternative weights should be used.

This process resulted in each ward within each province being given a score and a rank for the overall index of multiple deprivation (the PIMD).<sup>7</sup> The domain ranks and PIMD ranks show how a ward compares to all the other wards *within* the province and are easily interpretable.

### 5 The Geography of Deprivation: Eastern Cape Province

The PIMDs provide many useful tools for examining the geographical distribution of deprivation within each province in South Africa. However, it should be noted that even the least deprived areas may contain deprived people within them and the most deprived areas may contain some non-deprived people. Furthermore, even where an area is not considered deprived, if it is large in size, it may still contain higher numbers of deprived people than in a smaller area that is classified as more deprived. This is why the geographical units are so important, as will be highlighted further below.

A brief analysis of one of the PIMDs—the Eastern Cape<sup>8</sup>—is presented below. This province is of interest because it is one of the most deprived provinces in the country and contains two of the former homeland areas created during the apartheid era: the Ciskei and the Transkei.

The Eastern Cape contains 604 wards. All wards fall in the most deprived 25% on two or more domains, and more than a quarter of the wards (27%) fall in the most deprived 25% on all five domains. These 41 highly deprived wards are located in the municipalities of Qaukeni (10), Mbizana (10), Port St Johns (5) and Ntabankulu (4), and the remaining 12 are spread across six other municipalities.

Figure 2 presents a map of the Eastern Cape PIMD 2001. The wards have been divided into ten equal groups ('deciles'). The most deprived wards of the Eastern Cape are mainly concentrated within the former Transkei homeland area in the municipalities of Mbizana,

<sup>7</sup> A key goal of the project was to make the data domains (ranks) and PIMD (scores and ranks) publicly available. The data can be downloaded from <http://www.casasp.ox.ac.uk/imd.html> or [http://www.hsrc.ac.za/Research\\_Programme-Page-64.phtml](http://www.hsrc.ac.za/Research_Programme-Page-64.phtml).

<sup>8</sup> This province contains the cities or large towns of Port Elizabeth, East London and Mthatha.

Qaukeni, Ntabankulu and Port St Johns (in the east of the province). The areas to the west of the province, and particularly wards around Port Elizabeth and East London are relatively less deprived.

Table 1 presents the 10 most deprived wards in the Eastern Cape. Qaukeni municipality features prominently, having the six most deprived wards. At a higher level of aggregation—district municipality or metro<sup>9</sup>—the concentration of the most deprived wards in certain areas is noticeable: almost half of the province's wards that fall in the most deprived 25% on the PIMD are located in the O. R. Tambo district municipality, with 17 and 15% in the Chris Hani and Alfred Nzo district municipalities. Interestingly, these are three of the four areas in the Eastern Cape designated (prior to publication of the PIMD) as urban and rural development nodes for the Urban Renewal and Integrated Sustainable Rural Development (ISRSD) programmes.<sup>10</sup> This indicates that the most deprived areas in South Africa are being identified in a consistent way, and demonstrates how the PIMD could be usefully employed in future for spatial targeting, a point which is further discussed in the next section.

In Fig. 3 the range of multiple deprivation in a municipality for each ward—as measured by the ward level PIMD—is illustrated. The range of ward ranks for a particular municipality is shown by the vertical line. A rank of 1 is given to the most deprived ward on the PIMD, and the least deprived ward is given a rank of 604. The box indicates the range of the middle 50% of wards in each municipality (the interquartile range). If the box is relatively short this indicates that wards are concentrated in a narrow range. If the box is located towards the bottom of the chart it tells us that wards in the municipality are concentrated in the most deprived part of the provincial distribution. If the box sits towards the top of the chart it tells us that wards are concentrated in the least deprived part of the provincial distribution.

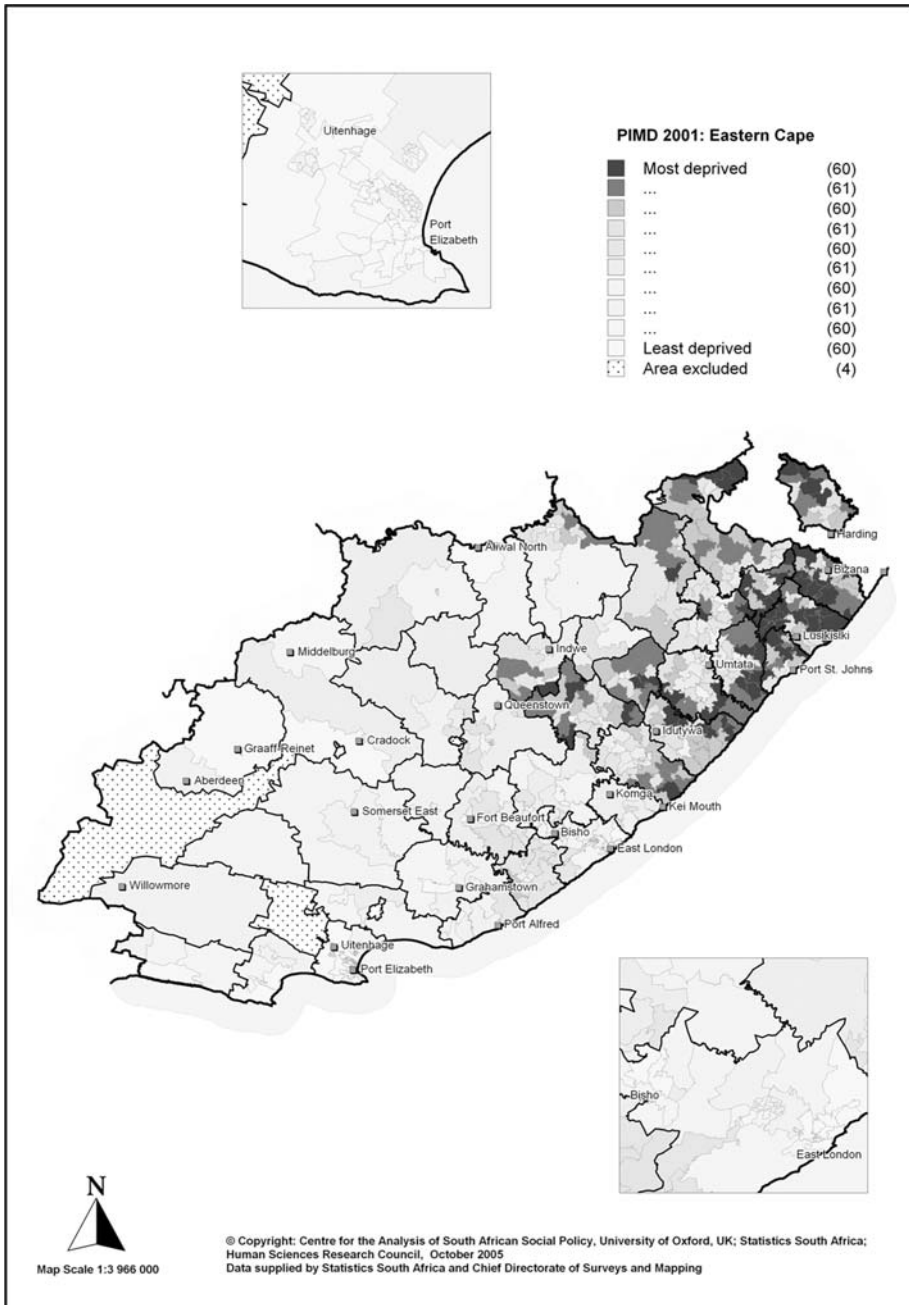
The middle 50% of wards in Mbizana, Ntabankulu, Port St Johns and Qaukeni municipalities are concentrated in a narrow range and towards the most deprived end of the distribution. King Sabata Dalindyebo and Mquma municipalities have a fairly wide range of multiple deprivation among their wards, while Blue Crane Route, Camdeboo and Kouga municipalities have a small range. The middle 50% of wards in Buffalo City, Camdeboo, Kouga, Makana and Nelson Mandela are concentrated towards the least deprived end of the distribution.

Table 2 shows the correlation between the five domains for the Eastern Cape PIMD. The income domain and living environment domains correlate the highest (0.9) and the lowest inter-domain correlation is between the employment domain and the health domain (0.6).

Figure 4 shows a scatter plot of the ward level scores for the income and employment domains in the Eastern Cape. The figure is shown here because it demonstrates that some wards are less employment deprived than might be expected if unemployment and low

<sup>9</sup> Metropolitan areas (of which there are six in South Africa) and district councils (of which there are 47) are at a level below provinces in the geographical hierarchy. The district councils sub-divide into local municipalities or district management areas.

<sup>10</sup> At the time of the 2001 Census, Alfred Nzo district municipality included Umzimkhulu local municipality. However, following a recent process of municipal demarcation, the municipality has been reassigned to Sisonke district municipality in KwaZulu-Natal province. For the purposes of reporting, and following the lead of spatial initiatives such as the ISRSD programme, we have treated Umzimkhulu as part of Alfred Nzo district municipality. Of the 23 most deprived wards falling into the Alfred Nzo district municipality, 10 are wards in Umzimkhulu.

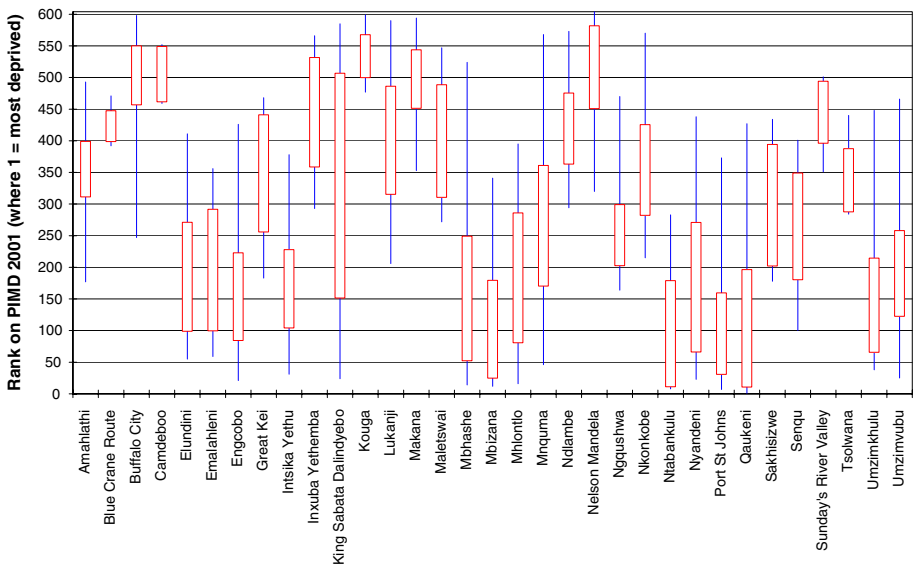


**Fig. 2** Eastern Cape PIMD 2001 at ward level (provincial deciles)

income were perfectly correlated (i.e. some areas have high levels of income deprivation but lower levels of employment deprivation), highlighting the fact that in some areas people are in very low-paid employment and are thus ‘earning their poverty’.

**Table 1** The ten most deprived wards in the Eastern Cape

	Ward code	Municipality name	Population in 2001 to nearest 1,000	PIMD score
1	21503002	Qaukeni	5,000	459.48
2	21503001	Qaukeni	6,000	442.52
3	21503017	Qaukeni	14,000	439.45
4	21503021	Qaukeni	15,000	431.04
5	21503022	Qaukeni	7,000	430.68
6	21503003	Qaukeni	10,000	429.59
7	21504001	Port St Johns	10,000	429.30
8	21502007	Ntabankulu	15,000	423.60
9	21502001	Ntabankulu	10,000	415.75
10	21504012	Port St Johns	15,000	415.67



**Fig. 3** Eastern Cape PIMD 2001—the interquartile range

**6 Discussion**

This paper has provided an account of the key principles that were taken into consideration when constructing the recent Provincial Indices of Multiple Deprivation 2001. The various methodological steps involved in constructing the index were described and ward level results from the PIMD for one province in South Africa were also presented.

The PIMD 2001 provide a tool for people to identify the most deprived areas within each province, a *starting point* from which to consider small area level deprivation, which can be used alongside local up-to-date information. The five domain scores can be used as tools for specific programmes. However, many programmes target deprivation in a more

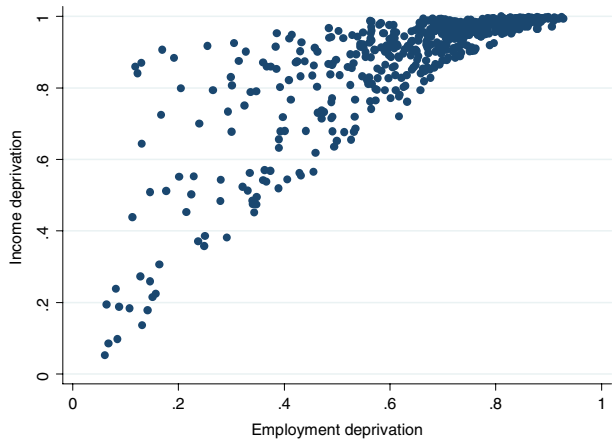
**Table 2** Ward level correlations between the domains in the Eastern Cape PIMD

	Income	Employment	Health	Education	Living Envnt.	PIMD
Income	1					
Employment	0.8465*	1				
Health	0.6665*	0.5598*	1			
Education	0.8588*	0.6487*	0.6263*	1		
Living Envnt.	0.8974*	0.7680*	0.6790*	0.7953*	1	
PIMD	0.9601*	0.8551*	0.7905*	0.8879*	0.9291*	1

Obs = 604

\*  $p < .001$

**Fig. 4** The ward level income and employment domains in the Eastern Cape PIMD 2001



general sense, and for these, the multiple deprivation score can be used. Possible uses include:

- Allocating resources and informing detailed service planning by national, provincial and local governments (thereby increasing transparency and accountability, and reducing the use of anecdotal evidence that is not evidence-based).
- Policy related and academic research (e.g. a sampling frame for in-depth studies or pilot studies; a tool for contextualising other empirical research).
- Targeting resources provided by donor agencies, companies, voluntary bodies and charities.

Since the PIMD 2001 was placed in the public domain, it has been used by various South African organisations for spatial targeting. These include the African Peer Review Mechanism, the Department of Water Affairs and Forestry as an input for its planning, and the Department of Social Development as a tool for informing the Expanded Public Works Programme, and for targeting areas to improve take up of social grants.

The indices have also been used as a planning tool at the municipality level. For example, the PIMD has begun to be used in the preparation of the latest generation of municipality level Integrated Development Plans (IDPs). The IDP was introduced by legislation in 1996 as a comprehensive and strategic approach to promoting local development in South Africa. More specifically, it represents an instrument designed to provide strategic guidance to

municipalities to link and coordinate the many different sectoral plans and planning processes at the local government level. In its conception, the IDP was also partially cast as a means of supporting more efficient financial and resource allocation at the municipality level (Harrison 2001). The use of the PIMD to guide development planning at the local government level is especially apparent in the Western Cape province, with examples including the Central Karoo, Theewaterskloof and Witzenberg IDPs for 2007–2011.<sup>11</sup>

There are many other potential applications for the PIMD. In the UK, such indices are used for a wide range of purposes including targeting area regeneration, distributing resources to deprived areas, and as part of the allocation formula for the National Health Service (see Appendix 3 of Neighbourhood Renewal Unit 2002). The current PIMD is only useful for within-province allocations at present. A South Africa-wide set of indices could potentially be of greater use for national allocations of resources to deprived areas, and these are currently being developed by the authors for the National Department of Social Development.

At present, the PIMD is not up-to-date (using as it does 2001 Census data). As an almost common set of questions to the 2001 Census was included in the South African Community Survey in 2007 (CS 2007) it is possible, at least at municipality level, to produce an updated version for 2007. A full update will be possible following the 2011 Census, which will enable tracking to be undertaken over time to measure long-term performance on policy. The authors are currently working on a municipality level 2007 index and are exploring the possibilities for using synthetic estimation to model the CS 2007 down to a sub-municipality level.

Due to the infrequency of censuses, similar indices internationally have moved towards using administrative data for indicators within the domains (Noble et al. 2008). There are a number of advantages to using administrative data: it is already being collected and therefore there are no additional costs of collection; it is regularly updated; it can relate to a recent time period, or if historical extracts are retained, it can also provide information about the past; it contains 100% of the records in question; and it is likely to be collected in a consistent way (if a national system) and subject to rigorous quality checks. However, the information collected is restricted to what is required for administrative purposes, which may change over time. An additional challenge is the extent to which the administrative data can be satisfactorily geocoded, though some datasets are already sufficiently well geocoded to enable sub-provincial level analysis (Noble et al. 2005b). Appropriate precautions also need to be set in place to guarantee confidentiality, as with survey data. A recent review of microdata in South Africa (Barnes et al. 2007) highlights a number of potential administrative data sources that could be used in future updates, and a joint project to pilot the use of administrative data to update the PIMD is currently being undertaken by the Centre for the Analysis of South African Social Policy and the Human Sciences Research Council for the City of Johannesburg.

Further developments have also been identified, including the construction of a sub-ward level statistical geography to address the problems of population size variation associated with wards.<sup>12</sup> There is also scope for further research on the selection of domain weights.

<sup>11</sup> See [http://www.capegateway.gov.za/Text/2008/3/idp\\_ck\\_central\\_karoo\\_district\\_2007.pdf](http://www.capegateway.gov.za/Text/2008/3/idp_ck_central_karoo_district_2007.pdf), <http://www.twk.org.za/Development/pdf/IDP2007-11.pdf>, and <http://www.witzenberg.gov.za/IDP/AdoptedIdp20072011.pdf>, respectively.

<sup>12</sup> Research is currently underway to design a statistical geography—'datazones'—across South Africa which are homogenous areas that have a more even population size and nest within municipality boundaries.

The PIMD 2001 adds to the body of literature on multiple deprivation at the small area level in developing countries. Similar work could be carried out in other countries in the Southern Africa Development Community (SADC) region, and a recent feasibility study (Noble et al. 2007a) suggests that this would contribute to an emerging evidence-base for monitoring poverty across the region. In April 2008 the SADC International Consultative Conference on Poverty and Development took place in Mauritius, with the overarching purpose of being 'a strategic dialogue that recognises the necessity of regional multi-dimensional strategies and approaches to tackling poverty' (SADC Secretariat 2007). One of the notable aspects of the conference was the substantive commitment that was made to the development of a regional poverty observatory.

Yet, in spite of this commitment, charting emerging patterns in relation to poverty and inequality in Southern Africa continues to be a significant analytical challenge, owing specifically to issues of data availability, but more broadly to the capacity constraints that face national statistical agencies in regularly monitoring social phenomena such as poverty. At the same time it is important to recognise that, from a historical perspective, never has there been such a wealth of data with which to craft evidence-based policies. Not only is there an increasing commitment to international data collection and dissemination standards, with key surveys being periodically and routinely conducted (e.g. household income and expenditure surveys every five years), but there have also been important experimental methods aimed at facilitating the rapid production of poverty statistics in between the larger, more technically demanding surveys.

One of the key areas where there has been concerted effort at intra-regional statistical harmonisation is in relation to census data. The SADC Millennium Census Data Analysis Project, which officially ended in December 2005, aimed to harmonise all 2000-round census-taking activities and to develop more comparable indicators of demographic characteristics across the SADC region. At the same time, countries remained free to add their own country specific topics to the regional 'core' set. The implication of this initiative has been that the potential exists for extending the index of multiple deprivation work undertaken in South Africa to form the basis for indices of multiple deprivation in other countries across the SADC region (Noble et al. 2007a).

**Acknowledgments** The PIMD 2001 project was undertaken by the Centre for the Analysis of South African Social Policy at the University of Oxford in collaboration with the Human Sciences Research Council and Statistics South Africa. The research team comprised Professor Michael Noble and (in alphabetical order) Miriam Babita, Helen Barnes, Chris Dibben, Wiseman Magasela, Stefan Noble, Phakama Ntshongwana, Heston Phillips, Sharmla Rama, Benjamin Roberts, Gemma Wright and Sibongile Zungu. An earlier version of this paper was presented at the UNU-WIDER conference 'Frontiers of Poverty Analysis' in September 2008.

## References

- African National Congress. (2004). *Manifesto 2004: A people's contract to create work and fight poverty*. Johannesburg: African National Congress.
- Afrobarometer. (2005). *Lived poverty in South Africa. Afrobarometer Briefing Paper No. 13*. Retrieved November 26, 2008, from <http://www.afrobarometer.org/papers/AfrobriefNo13.pdf>.
- Alderman, H., Babita, M., Demombynes, G., Makhatha, N., & Ozler, B. (2003). How low can you go? Combining census and survey data for mapping poverty in South Africa. *Journal of African Economies*, 11(2), 169–200.
- Alderman, H., Babita, M., Lanjouw, J., Lanjouw, P., Makhathatha, N., & Mohamed, A. (2000). Combining census and survey data to construct a poverty map of South Africa. In R. Hirschowitz, et al. (Eds.), *Measuring poverty in South Africa*. Pretoria: Statistics South Africa.

- Barnes, H., Noble, M., Dibben, C., Meth, C., Wright, G., & Cluver, L. (2007). *South Africa microdata scoping study*. Report to the ESRC Research Resources Board. Oxford: Centre for the Analysis of South African Social Policy, University of Oxford.
- Bhorat, H., & Kanbur, R. (Eds.). (2006). *Poverty and policy in post-apartheid South Africa*. Cape Town: HSRC Press.
- Davis, B. (2003). *Choosing a method for poverty mapping*. Rome: Food and Agricultural Organisation of the United Nations.
- Department of Health and Social Services of the Western Cape. (1999). *Poverty in the Western Cape: An analysis of poverty in the Western Cape as enumerated in the 1996 census*. Cape Town: Department of Health and Social Services of the Western Cape.
- Department of the Premier of the Western Cape. (2005). *Measuring the state of development in the province of the Western Cape*. Cape Town: Department of the Premier, Provincial Government of the Western Cape.
- Dibben, C., Atherton, I., Cox, M., Watson, V., Ryan, M., & Sutton, M. (2007). *Investigating the impact of changing the weights that underpin the index of multiple deprivation 2004*. London: Department for Communities and Local Government.
- Drimie, S., Rule, S., Aird, R., Faber, M., Germishuys, T., Jordaan, A., et al. (2005). *Report on survey in Sekhukhune to pilot the development of a food insecurity and vulnerability modelling system for South Africa*. Cape Town: Human Sciences Research Council.
- Elbers, C., Lanjouw, J. O., & Lanjouw, P. (2003). Micro-level estimation of poverty and inequality. *Econometrica*, 71(1), 355–364.
- Ellis, G. F. R., & Erlank, D. (1983). *A quality of life and basic needs measurement system with application to Elsie's River*. SALDRU Working Paper No. 56. Cape Town: South African Labour and Development Research Unit, University of Cape Town.
- Filmer, D., & Pritchett, L. (2001). Estimating wealth effects without expenditure data—or tears: An application of educational enrollment in states of India. *Demography*, 38(1), 115–132.
- Ghosh, M., & Rao, J. N. K. (1994). Small area estimation: An appraisal. *Statistical Science*, 9(1), 55–76.
- Hamel, E., Brodie, M., & Morin, R. (2006). Research notes: A survey of South Africa ten years into the new democracy. *International Journal of Public Opinion Research*, 18(3), 351–363.
- Harrison, P. (2001). The genealogy of South Africa's Integrated Development Plan. *Third World Planning Review*, 23(2), 175–193.
- Hentschel, J., & Lanjouw, P. (1996). *Constructing an indicator of consumption for the analysis of poverty: Principles and illustrations with reference to Ecuador*. LSMS Working Paper 124. Washington DC: World Bank.
- Hirschowitz, R., Orkin, M., & Alberts, P. (2000). Key baseline statistics for poverty measurement. In Statistics South Africa (Ed.), *Measuring poverty in South Africa*. Pretoria: Statistics South Africa.
- Kakwani, N., & Silber, J. (2008). Multidimensional poverty analysis: Conceptual issues, empirical illustrations and policy implications. *World Development*, 36(6), 987–991.
- Klasen, S. (1997). Poverty, inequality and deprivation in South Africa: An analysis of the 1993 SALDRU survey. *Social Indicators Research*, 41(1), 51–94.
- Klasen, S. (2000). Measuring poverty and deprivation in South Africa. *Review of Income and Wealth*, 46(1), 33–58.
- Mattes, R., Bratton, M., & Davids, Y. D. (2003). *Poverty, survival and democracy in Southern Africa*. Afrobarometer Paper No. 23. Cape Town/Accra/East Lansing: Afrobarometer.
- McIntyre, D., Muirhead, D., & Gilson, L. (2002). Geographic patterns of deprivation and health inequities in South Africa: Informing public resource allocation strategies. *Health Policy and Planning*, 17, 30–39.
- McIntyre, D., Muirhead, D., Gilson, L., Govender, V., Mbatsha, S., Goudge, J., et al. (2000). *Geographic patterns of deprivation and health inequities in South Africa: Informing public resource allocation strategies*. University of Cape Town, University of the Witwatersrand, London School of Hygiene and Tropical Medicine, and National Department of Health.
- Meth, C. (2007). Rational ignorance and South African poverty statistics. *Africanus*, 37(2), 81–110.
- Neighbourhood Renewal Unit. (2002). *Updating the indices of deprivation 2000: Stage 1 consultation report*. London: Neighbourhood Renewal Unit, Office of the Deputy Prime Minister.
- Noble, M., Babita, M., Barnes, H., Dibben, C., Magasela, W., Noble, S., et al. (2006a). *The provincial indices of multiple deprivation for South Africa 2001*. Oxford: Centre for the Analysis of South African Social Policy, University of Oxford.
- Noble, M., Babita, M., Barnes, H., Dibben, C., Magasela, W., Noble, S., et al. (2006b). *The provincial indices of multiple deprivation for South Africa 2001: Technical report*. Oxford: Centre for the Analysis of South African Social Policy.



- Noble, M., Barnes, H., Smith, G. A. N., McLennan, D., Dibben, C., Avenell, D., et al. (2005a). *Northern Ireland multiple deprivation measures 2005*. Belfast: Northern Ireland Statistics and Research Agency.
- Noble, M., McLennan, D., Wilkinson, K., Whitworth, A., Barnes, H., & Dibben, C. (2008). *The English indices of deprivation 2007*. London: Department for Communities and Local Government.
- Noble, M., Smith, G. A. N., Penhale, B., Wright, G., Dibben, C., Owen, T., et al. (2000a). *Measuring multiple deprivation at the small area level: The indices of deprivation 2000*. London: Department of the Environment, Transport and the Regions.
- Noble, M., Smith, G. A. N., Wright, G., Dibben, C., & Lloyd, M. (2001). *The Northern Ireland multiple deprivation measure 2001. Occasional Paper No 18*. Belfast: Northern Ireland Statistics and Research Agency.
- Noble, M., Smith, G. A. N., Wright, G., Dibben, C., Lloyd, M., & Penhale, B. (2000b). *Welsh index of multiple deprivation*. London: National Statistics.
- Noble, M., Whitworth, A., Allen, J., Wright, G., & Roberts, B. (2007a). *Developing small area indices of multiple deprivation in Southern Africa: A scoping study*. Draft Report for the Southern Africa Trust.
- Noble, M., Wright, G., Barnes, H., Noble, S., Ntshongwana, P., Gutierrez-Romero, R., et al. (2005b). *The child support grant: A sub-provincial analysis of eligibility and take up in January 2005*. Pretoria: Department of Social Development.
- Noble, M., Wright, G., Dibben, C., Smith, G. A. N., McLennan, D., Anttila, C., et al. (2004). *The English indices of deprivation 2004*. London: Neighbourhood Renewal Unit, Office of the Deputy Prime Minister.
- Noble, M., Wright, G., Lloyd, M., Dibben, C., Smith, G. A. N., Ratcliffe, A., et al. (2003). *Scottish indices of deprivation*. Edinburgh: Scottish Executive.
- Noble, M., Wright, G., Magasela, W., & Ratcliffe, A. (2007b). Developing a democratic definition of poverty in South Africa. *Journal of Poverty*, 11(4), 117–141.
- Noble, M., Wright, G., Smith, G. A. N., & Dibben, C. (2006c). Measuring multiple deprivation at the small-area level. *Environment and Planning A*, 38(1), 169–185.
- Qizilbash, M., & Clark, D. A. (2005). The capability approach and fuzzy poverty measures: An application to the South African context. *Social Indicators Research*, 74(1), 103–139.
- Ravallion, M. (1997). Good and bad growth: The human development reports. *World Development*, 25, 357–382.
- Republic of South Africa. (1994). *White paper on reconstruction and development*.
- Roberts, B. (2004). 'Empty stomachs, empty pockets': The dynamics of poverty, inequality and wellbeing during the first decade of democracy. In J. Daniel, R. Southall, & J. Lutchman (Eds.), *State of the nation: South Africa 2004–2005* (pp. 479–510). Cape Town: HSRC Press.
- Sahn, D., & Stifel, D. (2000). Poverty comparisons over time and across countries in africa. *World Development*, 28(12), 2123–2155.
- SADC Secretariat (2007). *Workshop on regional dimensions of poverty in the SADC region: Bridging the gap between national and regional dimensions of poverty – the concept note*. Gaborone: Southern Africa Development Community Secretariat. Retrieved March 17, 2009, from <http://www.sadc.int/conference/content/english/Regional%20Dimensions%20of%20Poverty%20Concept%20Note.pdf>.
- Smith, G. A. N., Seeley, J., Ali, Z., & Ryan, S. (2005). *Measuring millennium development goals at the local level: Measuring multiple deprivation in Bangladesh*. Report to the Department for International Development.
- Statistics South Africa. (2000). *Measuring poverty in South Africa*. Pretoria: Statistics South Africa.
- Statistics South Africa and National Treasury. (2007). *A national poverty line for South Africa*. Pretoria: National Treasury.
- Townsend, P. (1979). *Poverty in the United Kingdom*. Harmondsworth: Penguin.
- Townsend, P. (1987). Deprivation. *Journal of Social Policy*, 16(2), 125–145.
- UNDP. (2003). *South Africa: Human development report 2003. The challenge of sustainable development in South Africa: Unlocking people's creativity*. Cape Town: Oxford University Press Southern Africa.
- United Nations (1995). *Report of the world summit for social development*.
- Van Aardt, C. J. (2005). *Forecast of the adult population by living standards measure for South Africa, 2005–2015*. Research report No. 348. Pretoria: Bureau of Market Research, University of Pretoria.
- Vichi, M. (1997). *Identifications of standards of living and poverty*. Pescara: University of Chieti.
- Wright, G. (2008). *Findings from the indicators of poverty and social exclusion project: A profile of poverty using the socially perceived necessities approach*. Key report 7. Pretoria: Department of Social Development.