Social Indicators Research
https://doi.org/10.1007/s11205-023-03062-4

ORIGINAL RESEARCH

Re-examining the Multidimensional Poverty Index of South Africa

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Accepted: 3 January 2023

Abstract
The persistently high level of poverty remains one of the main socio-economic issues in South Africa since the democratic transition in 1994. Many South Africa studies focused on using money-metric measures to examine poverty levels and rates, but in recent years there has been an emergence of studies that examined multidimensional non-money-metric poverty. Nonetheless, some poverty indicators are still ignored. Thus, this study re-examined the extent of multidimensional poverty in South Africa with the derivation of a Multidimensional Poverty Index (MPI) by considering the various overlooked indicators. Upon analysing Statistics South Africa's 2018 General Household Survey data, the empirical findings indicated that deprivation was most profound for African females living in rural areas in Eastern Cape and Limpopo, in households headed by those who were not employed. Deprivation was also the highest in the transport assets, sanitation type, refuse removal frequency, water and receipt of post/mail indicators. With regard to poverty decomposition by dimension, the top three dimensions representing the greatest share of MPI poverty were access to services and facilities (31%), asset ownership (22%) and dwelling (17%), with the isolation dimension following closely (15%). Lastly, the indicators which contributed most to MPI poverty were transport assets, sanitation type, refuse removal frequency and water source.

Keywords Multidimensional poverty · MPI · Non-income welfare · South Africa

1 Introduction

Alleviating poverty remains one of the most important socio-economic goals the government faces in South Africa since the advent of democracy. This initiative is reflected in the implementation of numerous economic policies and new legislative acts since 1994, such as the Reconstruction and Development Programme (RDP) of 1994 and the Growth,

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Published online: 13 January 2023

Employment and Redistribution (GEAR) strategy adopted in 1996. Looking at the more recent policies, the Accelerated and Shared Growth Initiative for South Africa (AsgiSA) introduced in 2006 aimed at reducing poverty by half by 2014, whereas the National Development Plan introduced in 2011 aimed at completely eliminating income poverty from 39% to zero by the year 2030.

Many South African empirical studies analysed poverty using the money-metric approach. However, factors other than income are important to welfare (Rogan, 2016). In recent years, some local studies made use of the non-money-metric approach more specifically by adopting the Multidimensional Poverty Index (MPI) method. The MPI approach measures the incidence and intensity of poverty, that is, this approach not only determines the proportion of poor population but also investigates the extent of poverty (Santos & Alkire, 2011).

The global MPI consists of three dimensions and 10 indicators, with the most common non-money-metric dimensions being health, education and living standards, whereas the commonly included indicators include child mortality, years of schooling and sanitation (Alkire, Chatterjee, Conconi, Seth & Vaz, 2014). Given the flexibility of the MPI approach (to be explained later), it is possible to add other dimensions and indicators. This is demonstrated by the South African Multidimensional Poverty Index (SAMPI) constructed by Statistics South Africa (Stats SA). To coincide with growing international trends toward assessing poverty beyond money-metric approaches, the SAMPI revised the global MPI approach by adding an additional dimension, i.e. economic activity (Stats SA, 2014). Furthermore, several South African studies (to be reviewed later) modified the method further by adding more dimensions and indicators. As the General Household Survey (GHS) asked a wider range of questions relating to non-income welfare, it is used in this study to re-examine the MPI in South Africa by constructing an MPI that includes dimensions and indicators utilised in previous studies but also numerous overlooked indicators.

The main research objective is to use the 2018 GHS data to re-examine the extent of multidimensional poverty in South Africa upon including the overlooked indicators. The more specific objectives are as follows: (1): Conduct descriptive statistics to examine multidimensional poverty; (2): Compare multidimensional poverty by various characteristics, such as gender, age, population group, educational attainment, province and area type; (3): Distinguish key dimensions and indicators accounting for multidimensional poverty.

1.1 Literature Review

Being poor means being hungry, lacking shelter and clothing, being sick and uncared for, and being uneducated and unschooled. Thus, an individual is defined as poor if he/she is unable to meet the minimum basic needs of goods and services considered reasonable in society. Moreover, the existing traditional view of poverty not only considers low income and consumption but also encompasses material deprivation such as low educational attainment and health. Furthermore, the notion of poverty is broadened to include vulnerability and exposure to risk (such as crime and violence), as well as voicelessness and powerlessness (such as low levels of trust, participation and responsiveness) (World Bank, 2001: 19–21).

Poverty theories are usually grouped into two types: cultural and structural. Theories concerning cultural perspectives look at the traits (attitude and behavioural patterns) of the poor themselves to explain poverty, whereas structural theories of poverty explain poverty in terms of the poor's living conditions, such as inadequate education and poor health

(Elesh, 1970). There are compelling reasons to think of poverty as lack of fundamental capabilities rather than simply lack of money (Sen, 1999). The capabilities approach evaluates people's well-being in terms of their functioning's and capabilities, which are described as an individual's actual and potential activities, as well as their state of being (Kuklys & Robeyns, 2004). Moreover, Sen defines functioning's as a person's success, or what he or she is able to do or be, by encompassing an individual's activities and state of being, such as good health, enough shelter, mobility and education. Capability is a derived concept that represents the many functions he or she might possibly perform, and the individual's choice to select between different ways of living. The concept is inherently multidimensional (Conconi & Viollaz, 2017). Hence, poverty incorporates both monetary and non-monetary aspects. The former dimension, measured monetarily by means of a money-metric poverty line, is defined as a shortfall in family or personal income that falls below a minimum threshold.

Other than the commonly included non-monetary dimensions (e.g. asset ownership and access to services), rarely used dimensions such as isolation and vulnerability are overlooked. Isolation relates to inadequate quality and quantity of social relations with others (Samuel, Alkire, Zavaleta, Mills & Hammock, 2017); it includes, amongst others, inadequate access to roads and basic services, long travel distances to visit health institutions, place of work, and access to potable water, from where one resides (Bird, Mckay & Shinyeka, 2010). According to Samuel et al., (2017), Sen draws on Adam Smith's insight that the inability to freely connect with others is a deprivation that relates to the importance of participating in communal life. Thus, one is considered poor when he/she is unable to survive in the short term and participate in society as a full citizen (National Treasury, 2007).

Vulnerability is defined as the threat of being poor, which is related to both the future likelihood of suffering poverty and the severity thereof (Gallardo, 2020). Chambers, (1989) refers vulnerability to being exposed to unforeseen events and stress, as well as having difficulties dealing with them. Vulnerability includes two aspects: an external side of risks, shocks, and stress to which an individual or family is exposed, and an internal side of defencelessness, which refers to a lack of resources to deal without suffering irreversible loss (e.g. physically weaker, monetarily poor, socially reliant, humiliated or mentally damaged).

Multidimensional poverty incorporates numerous non-monetary dimensions that capture the multidimensionality of poverty. Thus, a multidimensional non-income-welfare poverty index can be derived to determine if an individual is multidimensionally poor. There is a wide range of statistical methods that can be used to derive this index. These methods include, amongst others, the well-known Foster-Greer-Thorbecke (FGT) indices, the Principal Component Analysis (PCA), Multiple Correspondence Analysis (MCA), Factor Analysis (FA) and Fuzzy Sets approach. Numerous South African studies adopted the above-mentioned approaches to examine non-money-metric poverty, such as Bhorat & Van der Westhuizen, (2013), Bhorat, Stanwix & Yu, (2014) and Ntsalaze & Ikhide, (2018). In recent years, the MPI method has emerged as an alternative approach in South Africa and these studies are reviewed below.

Finn, Leibbrandt & Woolard, (2013) derived an MPI which comprised of nine indicators across three dimensions (education, health, and standard of living). The authors analysed the 1993 Project for Statistics on Living Standards and Development (PSLSD) and 2010 National Income Dynamic Study (NIDS) data. MPI poverty declined between the two survey years, while sanitation and water were the two indicators with the highest deprivation. Rogan, (2016) measured a snapshot of MPI poverty by gender by analysing the 2008

NIDS data. The MPI included nine indicators from the same three dimensions as the above 2013 Finn et al. study. For females, child mortality and education, accompanied by a shortage of sanitation and clean water, were the factors that contributed most to multidimensional poverty. Nutrition, on the other hand, accounted for the greater proportion of MPI in men, followed by inadequate sanitation, water, electricity and safe cooking fuels.

Statistics South Africa (StatsSA), (2014) developed a Multidimensional Poverty Index for South Africa (SAMPI) by utilising the 2001 and 2011 Census data. The SAMPI consisted of four dimensions (health, education, living standards and economic activity) and 11 indicators. The authors focused on the results at provincial level, and found that there was a decline in MPI poverty over time, and the main contributors to multidimensional poverty were unemployment, years of schooling and source of heating. In both years, the standard of living dimension contributed almost 50% to MPI poverty, while Eastern Cape, KwaZulu-Natal, Limpopo and North West provinces were associated with the highest MPI scores.

Fransman & Yu, (2019) derived the MPI by analysing the Census 2001 and 2011 as well as Community Survey (CS) 2007 and 2016 data. The study included 12 indicators from the same four dimensions as the above StatsSA study before examining the MPI poor, with specific focus on what happened by district council and province. The authors found a sustained but significant reduction in MPI poverty, and the indicators that contributed most to MPI poverty were unemployment, years of education and disability status. The findings also revealed a steady decline in multidimensional poverty for African females living in rural areas in districts located in the Eastern Cape and KwaZulu-Natal provinces.

Moving on to South African studies that focused on particular population sub-groups, Frame, De Lannoy & Leibbrandt, (2016) derived the MPI for youths aged 15–24 years. The authors used the 2011 Census data and considered 11 indicators from the abovementioned four dimensions to derive the youth MPI. The empirical findings indicated a highly unequal spatial distribution of youth multidimensional poverty. Moreover, three indicators had the largest contributors to the youth MPI, namely educational attainment, adult household employment and individuals who were not in education, employment or training. Omotoso & Koch, (2017) rather focused on children aged 0–17 years; they utilised the 2002 and 2014 GHS data and considered 18 indicators from the same four dimensions to derive the MPI. It was found that child poverty decreased over time whereas economic activity had the largest contribution to the overall child MPI.

Mushongera, Zikhali & Ngwenya, (2017) examined MPI poverty in Gauteng by including nine indicators from four dimensions (standard of living, food security, economic activity and education). The study used the 2011 and 2013 Quality of Life (QoL) Survey data to derive the MPI. The empirical findings indicated that areas with low levels of economic activity exhibited high levels of multidimensional poverty. Also, MPI in the province as a whole was low but varied markedly by municipality and ward, as well as income groups. Ebenezer & Abbyssinia, (2018) investigated what happened in Eastern Cape with the aid of the 2014 GHS data. The MPI consisted of 13 indicators from three dimensions (health, education and standard of living). Descriptive analyses indicated that the majority of households who were considered poor or severely poor had household heads with low educational attainment and were located in rural areas of the province. Moreover, the econometric analysis showed that livelihood diversification did not significantly influence MPI poverty in the province.

The research gap has been identified from the empirical literature reviewed above; of the few local studies that utilised the MPI approach, the most common dimensions are education, health, the standard of living and economic activity. However, some indicators

from these popular dimensions are excluded (to be explained later). In addition, indicators from the isolation dimension were completely ignored in these past empirical studies. This study, therefore, adds dimensions and indicators that are hardly used to re-examine the extent of multidimensional poverty in South Africa.

2 Methods and Data

2.1 MPI Method

Alkire and Foster first proposed the MPI strategy to measure poverty in 2011 (Alkire & Foster, 2011). The Global MPI was created to assess acute poverty and severity of poverty by assessing the deprivations that people face at the same time. It has three dimensions (health, education and living standards) and consists of 10 indicators within these dimensions. The health dimension accounts for nutrition and child mortality; the education dimension includes years of schooling and school attendance; and lastly, the living standards dimension consists of the cooking fuel, water, sanitation, electricity, floor material and asset ownership indicators (Santos & Alkire, 2011).

There is a deprivation cut-off z_i for each indicator, which is described as a certain degree of satisfaction. Thus, the i-th person is deprived in an indicator if his/her achievement $x_i$is less than a specific deprivation cut-off point, that is, if $x_i < z_i$. Each dimension is assigned an equal weighting of 1/3 and each indicator within each dimension is also evenly weighted. The sum of weights equals to one, that is, $\sum_{i=1}^{d} W_i = 1$ where indicator i weight as W_i (Santos & Alkire, 2011).

Once the indicators and weights are chosen, the poverty cut-off is determined to identify the poor, derived by two cut-off points. The first cut-off point, the deprivation score, is denoted by C_i and means the sum of each deprivation multiplied by its weights, that is,$C_i = W_1 I_1 + W_2 I_2 + \ldots + W_d I_d$, where $I_i = 1$ if the person is deprived in indicator i and $I_i = 0$ if a person is not deprived in any indicator. The second cut off identifies the multidimensional poor, known as the poverty cut-off, noted with K (where $K = 1/3$), is the proportion of (weighted) deprivations that an individual must have in order to be considered multidimensionally poor. Thus, if an individual's deprivation score is equal to or higher than the poverty cut-off, he/she is considered poor, $C_i \geq K$. To be considered MPI poor, the individual deprivation score has to be equal to or greater than 1/3. Deprivation scores below the poverty cut-off are replaced with zero; this is known as censoring in poverty measurement. The censored deprivation score is denoted by $C_i(K)$ to differentiate it from the original deprivation score. That is, when $C_i \geq K$, then $C_i(K) = C_i$ but if $C_i < K$, then $C_i(K) = 0$.

To derive the MPI, information on two components is required. The first component measures the proportion or incidence of people who experience multiple deprivations, known as the headcount ratio (H) where $H = \frac{q}{n}$, where q represents the number of people who are identified as multidimensional poor and n the total population. The second component determines the average deprivation score of the multidimensional poor, known as the intensity of poverty denoted by A, where $A = \frac{\sum_{i=1}^{n} C_i(K)}{q}$, $C_i(K)$ is the censored deprivation score of individuals and q the number of people who are multidimensional poor. Thus, MPI is the product of the multidimensional headcount ratio (H) and intensity of poverty (A), or $MPI = H \times A$ (Santos & Alkire, 2011).

This study re-examines MPI poverty in South Africa by including 26 indicators from seven dimensions, as shown in Table 1. Two original dimensions (education and health) remain unchanged in the revised MPI. However, the standard of living dimension is split into three distinctive dimensions. Whilst recent studies added the economic activity dimension, isolation remains the key dimension that has been seriously ignored. Thus, this study involves drastic changes in the inclusion of dimensions and indicators, deprivation cut-offs as well as weights. Furthermore, the last column of the table shows that all dimensions are equally weighted, each receiving a weighting of 1/7, and indicators within each dimension are also equally weighted.

2.2 Decomposition of the MPI

As MPI contains large amounts of information, it is imperative to break down the composition of poverty in greater detail. Thus, the MPI may be analysed by population sub-groups, dimensions and indicators (Santos & Alkire, 2011). First, it is possible to decompose the MPI by sub-groups such as gender and population group. Formally, the first step is to decompose the MPI of the country as follows: $MPI_{COUNTRY} = \sum_{i=1}^{i} \frac{n_i}{n} \times MPI_i$. For each sub-group, population in the i-th sub-group (n_i) is divided by total population (n) and then multiplied by the MPI of the i-th sub-group MPI_i. The total number of sub-groups is summed to give the MPI for the country. Next, the contribution of each subgroup to overall poverty can be calculated as $\frac{\frac{n_i}{n} \times MPI_i}{MPI_{COUNTRY}} \times 100$.

To derive the country's MPI, we compute the censored headcount ratio for each indicator by adding the vulnerable and deprived in that indicator and divide by the total population. To obtain the country's MPI, we compute the weighted sum of the censored headcount ratio. The formula given formally as follows:

$$MPI_{COUNTRY} = \sum_{i=1}^{k} w_i \times CH_i$$

where

i = the i-th indicator.

k = the total numbers of indicators.

w_i = weight of the i-th indicator.

CH_i = the censored headcount ratio of the i-th indicator

The contribution of the i-th indicator to the overall MPI = $\frac{w_i \times CH_i}{MPI_{COUNTRY}} \times 100$

2.3 Choice of Indicators

The choice of dimensions and indicators are guided by numerous factors: the global MPI, SAMPI, South Africa's country-specific context and issues that affect poverty, limitations imposed on the 2018 GHS data, as well as suitability and robustness of available data items (StatsSA, 2014: 5). In addition to the commonly used dimensions such as education and health, this study differentiates the standard of living dimension into three separate dimensions. Furthermore, the economic activity dimension is included, as well as the newly added isolation dimension. Below is a full description of the dimensions, indicators, and deprivation cut-offs. Table 1 shows the weighting of each indicator in detail.

Table 1 Dimensions, indicators, deprivation cut-offs and weights for the revised MPI

Dimension	Indicator	Deprivation cut-off	Weight
Education	#1: Years of schooling	No Household member aged 15 years or above has completed 7 years of schooling	1/14
	#2: School attendance	At least one child between the ages of 7 to 15 years is not attending an educational institution	1/14
Health	#3: Disability	At least one household member is disabled	1/28
	#4: Health worker	At least one household member was ill in the past three months but could not seek medical care due to inability to pay for health care services, distance to health care facilities and other socio-economic reasons	1/28
	#5: Adult food hunger	Often or always experienced it in the past 12 months	1/28
	#6: Child food hunger	Often or always experienced it in the past 12 months	1/28
Standard of living- conditions of dwelling	#7: Dwelling type	Living in an informal shack/ traditional dwelling/ caravan/ tent/ other	1/35
	#8: Roof material	Does not use standard materials such as corrugated iron, asbestos and tiles	1/35
	#9: Wall material	Does not use standard materials such as bricks, cement and tiles	1/35
	#10: Floor material	Does not have finished floor such as polished wood, vinyl strips, ceramic tiles, cement and carpet	1/35
	#11: Overcrowding	More than two persons per room	1/35
Standard of living- access to facilities and services	#12: Fuel for cooking	Using paraffin / wood/ coal/ dung/ other/ none	1/28
	#13: Water	There is no piped water in the dwelling or on stand	1/28
	#14: Sanitation type	No access to a flush toilet	1/28
	#15: Refuse removal frequency	Refuse is removed less than once a week or there is no concrete refuse removal system	1/28

Table 1 (continued)

Dimension	Indicator	Deprivation cut-off	Weight
Standard of living-asset ownership	#16: Operational assets	Does not own more than one of the following: radio, television, washing machine, fridge	1/28
	#17: Communication assets	Does not own at least one of the following: landline, telephone, cellular telephone, computer, internet connection in the household	1/28
	#18: Transport assets	Does not own at least one motor vehicle in working condition	1/28
	#19: Financial assets	Does not own at least one of the following: bank account, investment account, pension/provident fund, informal savings	1/28
Economic activity	#20: Unemployment	All household members aged 15 to 65 years are unemployed	1/14
	#21: Job search	At least one household member aged 15 to 65 years did not try to find work or start a business in the last four weeks due to illness, disability, lack of available transport or no money to pay for transport	1/14
Isolation	#22: Distance from the nearest water source	At least 200 m form the dwelling	1/35
	#23: Distance from the nearest sanitation facility	At least 200 m form the dwelling	1/35
	#24: Receipt of post/mail	Not delivered to the dwelling, post box or private bag	1/35
	#25: Time taken to the health institution normally visited	At least 30 min	1/35
	#26: Time taken to the workplace	At least employed household member takes 1 h or more to get to the workplace	1/35

Source: Adapted from Santos & Alkire (2011:6)

2.3.1 Education

The education dimension comprises of two indicators, namely years of schooling and school attendance, which are largely unchanged from Alkire and Foster's initial MPI method. This study employs the deprivation cut-offs from the Fransman & Yu, (2019) study for both indicators. The authors applied the years of schooling deprivation cut-off to family members aged 15 years and above who completed seven years of schooling rather than five. This threshold aligns with the viewpoint of Yu & Roos, (2018), who stated that illiteracy refers to people who have not completed primary education (or Grade 7). The school attendance indicator deprivation cut-off originally focused on any school-aged child that was not attending school in Grades 1 to 8 at the time of the survey. In this study, however, the cut-off point is altered to children aged 7–15 years who did not attend an educational institution up to Grade 9 because Grade 9 learners are supposed to be 15 years old.

2.3.2 Health

The original MPI health indicator in the Alkire & Foster methodology consists of child mortality and nutrition. With regard to the nutrition indicator, an adult is considered undernourished if his/her Body Mass Index (BMI) is less than 18.5 and if a child is underweight. GHS does not ask questions on height and weight, while child mortality data was not released to the public (despite being captured by the survey). Hence, other health indicators (disability, health worker, adult food hunger and child food hunger) are included.

This study utilises the disability indicator adapted by Fransman & Yu, (2019) which stipulates a household being deprived if at least one member is disabled (i.e., having difficulty in seeing, hearing, walking, remembering and concentrating, self-care, or communicating). The health worker indicator is defined by the reasons why a person did not seek medical help when they were sick, such as the cost, distance and other socioeconomic factors (Fransman & Yu, 2019). The last two indicators, adult food hunger and child food hunger (The 2017 Omotoso & Koch study also included food hunger as an indicator in their study) focused on whether the adult and child members often or always experienced food hunger.

2.3.3 Standard of Living – Conditions of Dwelling

This study made a few alterations by dividing the original standard of living dimension into three different dimensions. The original MPI's standard of living dimension was based solely on the flooring material, while this analysis takes into account other factors such as dwelling type, roof material, wall material and overcrowding to establish the conditions of dwelling dimension. Recent local and even international studies also include these indicators: Omotoso & Koch, (2017) included these four indicators whereas Astuti, Firmansyah & Widodo, (2018) only considered roof and wall materials in their MPI. Dwelling type and overcrowding were incorporated in the Mushongera et al., 2017 (labelled as housing) as well as Fransman & Yu, 2019 studies. Lastly, dwelling type was included by Ebenezer & Abbyssinia, (2018) as well as Frame, De Lannoy & Leibbrandt, (2016).

2.3.4 Standard of Living – Access to Facilities and Services

Regarding the fuel for cooking indicator, when compared to the original methodology, the deprivation cut-off is expanded to include paraffin, none or other in addition to wood, coal and dung. The water indicator deprivation cut-off, on the other hand, has been narrowed such that only individuals without piped water in the dwelling or on stand are considered deprived in this indicator. The sanitation indicator takes into consideration households that do not have access to a flush toilet. Lastly, an additional indicator is added: refuse removal frequency, which was included by Omotoso & Koch, (2017) and Fransman & Yu, (2019). Thus, the household is deprived in this indicator if refuse is removed less than once a week or there is no concrete refuse collection scheme.

2.3.5 Standard of Living – Asset Ownership

Since the GHS asked abundant questions regarding a wide range of assets, four types of assets are included as indicators of the asset ownership dimension. First, the operational assets indicator deprivation cut-off accounts for households who do not have one of these assets: radio, television, washing machine or fridge. The second indicator comprises of numerous communication assets as shown in Table 1 (note that these communication assets were included in local studies such as Mushongera et al., (2017) and even international studies such as Arndt, Mahrt, Hussain & Tarp, (2018) as well as Ozughalu & Ogwumike, (2019)).

The third indicator considers whether the household has a vehicle in working condition (i.e., transport assets). Lastly, the financial indicator considers whether the household has a bank account, investment account, pension/provident fund, or informal savings either individually or jointly. Note that both the transport and financial assets indicators were included in recent international studies such as Iwasaki & Gi-Laitly, (2013) and Mahapatra, Bhattacharya, Atmavilas & Saggurti, (2018).

2.3.6 Economic Activity

The original global MPI approach does not take economic activity into account; however, unemployment remains one of the major socio-economic issues that South Africa faces reaching 34.5% in the first quarter of 2022 (Stats SA, 2022). Thus, it remains important to include the unemployment indicator. This study uses the narrow definition of unemployment; if all individuals of working age (15–65 years) are unemployed, the household would be deprived. The economic activity dimension and the unemployment indicator were included in many local studies, such as Mushongera et al., (2017), Omotoso & Koch, (2017), Ntsalaze & Ikhide, (2018), Frame et al., (2016) and Fransman & Yu, (2019). Lastly, the job search indicator considers reasons as to why a member of the household did not make an effort to find work, possibly due to being ill, being disabled, lack of available transport, or not by any means able to pay for the transport. This indicator was included in the Noble & Wright, (2012) study to derive the economic deprivation domain indicator; however, the authors used a statistical method than the MPI approach to derive the multidimensional poverty index.

2.3.7 Isolation

The newly introduced isolation dimension consists of five indicators: distance from the nearest water source, distance from the nearest sanitation facility, receipt of post/mail, time taken to the health institution normally visited and time taken to the workplace. The individual would be deprived if distance to the nearest water source and sanitation facility is at least 200 m from the dwelling, if mail is not delivered to the dwellings post box or private box, if it takes more than 30 min to get to a health institution and lastly if an employed person takes one hour and more to get to the workplace.

The inclusion of these five indicators under the isolation dimension aligns with the arguments of recent international studies as discussed earlier (Bird, Mckay & Shinyeka, 2010; Gallardo, 2020). In addition, these indicators corresponds with the earlier discussion on the characteristics of isolation as a poverty dimension, such as inadequate access to basic services (i.e. the nearest water source and nearest sanitation facility indicators), lack of ability to freely connect with others (i.e. the receipt of post/mail indicator), as well as time taken to important places (i.e. the time taken to health institution and workplace indicators).

2.4 Data

The GHS conducted annually by StatsSA was first introduced in 2002 to take over the collection of non-money-metric welfare information that was previously captured by the October Household Survey. In fact, such information is captured much more comprehensively with the introduction of the GHS. The GHS is aimed at all private homes in South Africa's nine provinces, as well as occupants of workers' hostels. In 2018, sample size was 21 225 at household level and 72 291 at person level.

The GHS primarily includes non-income welfare data from six categories: education, health, and social progress, housing, household access to resources and facilities as well as agriculture. More specifically, the GHS asked comprehensive questions on non-money metric dimensions such as conditions of dwelling, access to facilities and services, asset ownership, as well as isolation and vulnerability. For the 26 indicators used in this study, they are primarily categorical data (respondents were asked to choose the relevant option in the question concerned).

2.5 Limitations

In this study, only the 2018 GHS data will be analysed to derive a snapshot of MPI because all 26 indicators were only asked in both 2017 and 2018 GHS. Thus, it is pointless to conduct a short one-year 'trend' analysis. In addition, since the majority of the indicators were captured at the household level rather than on an individual level, the study is limited to household units. However, estimates are derived for the population by using the household-level data using a weighted variable that takes the product of household weight and household size.

Furthermore, vulnerability would not be included as an additional standalone dimension because many indicators from the above-discussed seven dimensions already have relevance with vulnerability to some extent. For example, unemployment (i.e. the total number of adult unemployed household members indicator from the economic activity dimension) can be a stressful and unforeseen event that is difficult to deal with; experience of food hunger (i.e. the child hunger and adult hunger indicators from the health dimension) may cause the person to be physically weaker and even mentally damaged; absence of motor vehicle ownership in the household (i.e. the transport asset indicator from the asset ownership dimension) could lead to irreversible losses in terms of employment and income-earning opportunities.

Table 2 Factor loadings of each indicator using principal components analysis

Category	Indicator	Extracted components					
		First	Second	Third	Fourth	Fifth	Sixth
Education	#1: Schooling	0.110	0.070	−0.002	0.459	0.097	−0.012
	#2: Attendance	0.029	0.074	0.037	0.102	−0.018	0.531
Health	#3: Disability	0.032	−0.013	0.111	0.027	−0.085	0.627
	#4: Health worker	0.006	0.022	0.010	0.086	0.046	0.097
	#5: Adult hunger	0.073	0.449	0.502	−0.123	0.072	−0.079
	#6: Child hunger	0.067	0.439	0.497	−0.173	0.089	−0.076
Dwelling	#7: Dwelling	0.271	0.297	−0.391	−0.205	−0.062	−0.012
	#8: Roof	0.066	0.065	−0.140	−0.026	0.571	0.047
	#9: Wall	0.252	0.296	−0.382	−0.213	−0.059	−0.007
	#10: Floor	0.128	0.136	−0.187	0.026	0.441	0.106
	#11: Overcrowding	0.089	0.266	−0.171	−0.169	−0.310	0.229
Services / Facilities	#12: Fuel	0.253	−0.003	−0.006	0.088	0.136	−0.062
	#13: Water	0.349	−0.213	0.068	−0.093	0.044	−0.013
	#14: Sanitation	0.365	−0.234	0.125	−0.076	−0.063	−0.025
	#15: Refuse	0.345	−0.270	0.155	−0.059	−0.022	−0.027
Asset ownership	#16: Operational	0.255	0.150	−0.082	0.188	0.036	−0.097
	#17: Communication	0.068	0.130	−0.028	0.531	0.095	−0.044
	#18: Transport	0.222	0.079	0.009	0.125	−0.383	0.030
	#19: Financial	0.166	0.131	0.029	0.432	−0.063	0.033
Labour	#20: Unemployment	0.042	0.138	0.019	0.132	−0.237	−0.327
	#21: Job search	0.033	0.046	0.091	0.005	0.036	0.285
Isolation	#22: Distance water	0.270	−0.192	0.118	−0.091	0.156	0.020
	#23: Distance sanitation	0.005	0.016	−0.049	−0.063	0.105	−0.101
	#24: Post	0.333	−0.151	0.048	−0.039	−0.093	−0.069
	#25: Time health	0.164	−0.093	0.154	−0.044	0.087	0.125
	#26: Time work	−0.040	0.026	−0.038	−0.173	0.222	−0.005
Total % of explained variance of data		17.98	7.16	6.51	5.03	4.36	4.30
Eigenvalue		4.675	1.860	1.692	1.307	1.135	1.118

Source: Authors' calculations using the GHS 2018 data

3 Empirical Findings

3.1 Categorisation of Indicators

Table 2 shows the results of the first six extracted components with the aid of the PCA approach (detailed discussion of the PCA method falls beyond the scope of this study, but can be referred to Vyas & Kumaranayake, (2006) as well as Greyling & Tregenna, (2017)). The factor loadings of the indicators on these extracted components help reveal the indicators associated with the strongest associated with each component.

First, the factor loadings were the highest in the sanitation (0.365), water (0.349) and refuse (0.345) indicators in the first extracted component. The factor loading of the fuel indicator (0.253) was also quite high. Hence, it makes sense to group these four indicators into one category as 'Access to facilities and services'. Note that the factor loading were also quite high in the receipt of post/mail (0.333) and distance from the nearest water source (0.270) indicators; these two indicators were subsequently categorised under the 'isolation' dimension.

The factor loadings were the highest in the adult hunger and child hunger indicators in both the second and third extracted components. Therefore, it makes sense to group them together (along with the other two relatively 'weaker' indicators, namely disability and health workers – note that disability rather had a high factor loading in the sixth extracted component) into one category as 'health'.

In the fourth extracted component, communication assets (0.531) and transport assets (0.432) enjoyed one of the highest factor loadings, and thus they were classified under the 'asset ownership' category along with operational asset and transport asset. Note that schooling (0.459) was also associated with a high factor loading, but theoretically speaking it makes more sense to put it under the 'education' category (along with the attendance indicator which only had a very high factor loading in the sixth extracted component).

In the fifth extracted component, in absolute terms, roof (0.571), floor (0.441) and overcrowding (−0.310) were the three indicators with the highest factor loadings. They were subsequently categorised under the same 'conditions of dwelling' category, along with the dwelling type and wall indicators. Lastly, in the sixth extracted component, putting aside the earlier mentioned attendance and disability indicators, the factor loadings were very high in absolute terms in the unemployment (−0.327) and job search (0.285) indicators. Therefore, it makes sense to put these two indicators into one category, namely 'labour'.

3.2 Proportion of Population Deprived in each Indicator

Figure 1 depicts the percentage of population that was deprived within each indicator. The indicators with higher deprivation proportions mainly come from the three standard of living dimensions, namely conditions of dwelling, access to service and facilities, as well as asset ownership. A large proportion of the population was more deprived in the transport asset indicator (nearly 70%), followed by receipt of post or mail which comes from the newly added isolation dimension (41.06%), refuse removal frequency (38.54%), sanitation type (38.43%) and water (27.12%).

Table 3 displays the proportions of population deprived in each indicator by various demographic characteristics. Females were more deprived in all except three indicators (health worker, distance from the nearest sanitation facility and time taken to the

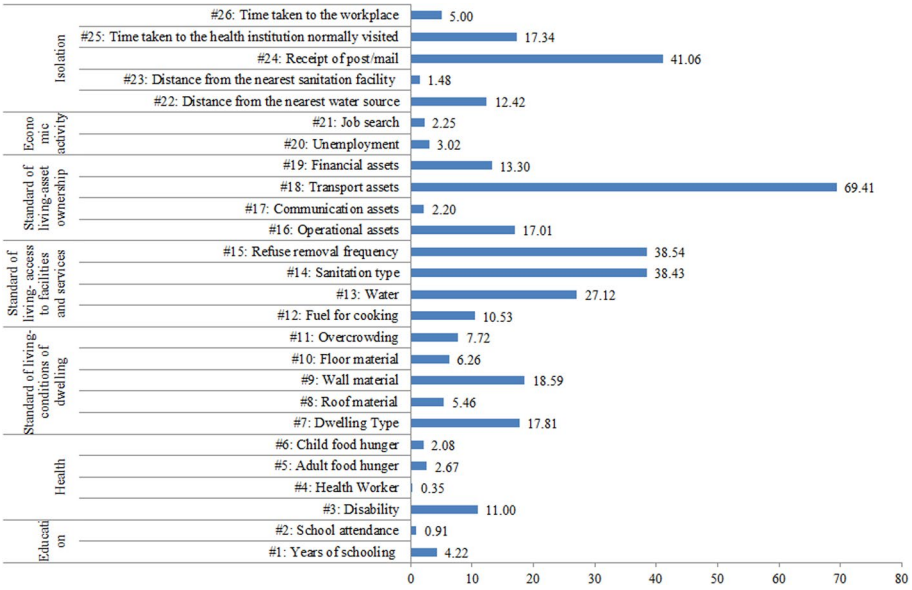

Fig. 1 Proportion (%) of population deprived in each indicator. Source: Authors' calculations using the GHS 2018 data.

workplace) with the highest proportion of deprivation at 83.2% in the transport asset indicator. On the contrary, the findings of Montoya & Teixeira, (2017) indicate that male-headed families were more vulnerable to poverty than single mothers and female-headed bi-parental families (deprivation was the highest in cooking fuel, overcrowding, and house-ownership indicators), contradicting the notion that women are more vulnerable than men. In addition, deprivation in indicators under the services and facilities as well as the newly introduced isolation dimension were more prominent in females than males.

Africans suffered a greater share of deprivation in almost all indicators in comparison to the other race groups. For example, five of the 26 indicators with high proportions stand out in the African group, namely transport assets (78.1%), receipt of post or mail (48.1%), sanitation type (46.7%), refuse removal frequency (45.8%) and water (32.3%). In contrast, the white race group had much lower deprivation proportions (5.2%, 6.9%, 0.6%, 7.4% and 6.0%, respectively). Furthermore, the newly added isolation dimension highlights three indicators with higher deprivations: distance from the nearest water source (15%), time taken to the health institution normally visited (19.5%) and as previously mentioned receipt of post or mail (48.1%).

Results concerning labour market status show that people coming from households headed by unemployed or inactive experienced a larger share of deprivation. This finding is expected since the lack of employment leads to low or no income and thus household members would be unable to afford basic necessities. The unemployed were mostly deprived in the transport asset indicator (89.8%), receipt of post/mail (45.1%), sanitation type (44.6%) and refuse removal frequency (41.1%). Interestingly, individuals coming from households headed by employed still suffered relatively high deprivations in some indicators, such as transport assets (nearly 60%) and receipt of post/mail (35.5%).

Rural residents were more deprived in 21 indicators in comparison to those in the urban areas. It was estimated that 90.4% of those residing in rural areas were highly

Table 3 The proportion (%) of population deprived in each indicator by personal characteristics

Dimension		Education		Health				Conditions of dwelling					Services and facilities			
Indicator		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15
Gender	Male	4.1	0.8	9.3	0.4	2.1	1.5	17.6	5.1	18.2	5.8	7.6	8.5	22.5	31.5	32.7
	Female	4.4	1.1	13.0	0.3	3.3	2.7	18.0	5.9	19.1	6.8	7.8	12.9	32.6	46.7	45.5
Race	African	4.8	0.9	11.3	0.3	2.9	2.3	20.8	5.6	21.5	6.2	8.7	12.7	32.3	46.7	45.8
	Coloured	2.2	1.8	11.7	0.8	3.1	2.0	9.6	3.0	10.7	6.6	7.2	1.8	3.8	4.1	7.0
	Indian	2.8	0.0	7.6	0.1	0.9	0.1	2.9	9.5	3.5	3.0	0.6	0.5	1.7	2.1	4.7
	White	1.0	0.2	8.5	0.4	0.4	0.5	0.3	5.4	1.3	7.6	0.1	0.1	6.0	0.6	7.4
Labour market status	Employed	3.0	0.8	7.0	0.3	1.6	1.4	17.3	5.0	18.1	5.4	8.0	6.8	20.1	28.0	29.2
	Unemployed	3.2	1.5	10.2	0.4	7.7	4.7	26.9	4.5	27.1	7.4	9.1	14.4	31.2	44.6	41.1
	Inactive	6.4	0.9	17.5	0.4	3.3	2.6	16.5	6.3	17.5	7.4	7.0	15.6	37.2	53.5	52.6
Area type	Urban	2.7	0.8	9.3	0.4	2.3	1.8	15.2	4.7	16.0	4.9	8.6	4.1	9.6	11.9	11.5
	Rural	7.2	1.2	14.2	0.3	3.3	2.6	22.7	6.9	23.6	9.0	6.0	22.9	60.8	89.4	90.4
Province	Western Cape	1.8	1.3	10.3	0.5	4.0	2.2	17.6	3.3	18.8	7.8	9.3	1.4	9.0	5.4	9.1
	Eastern Cape	6.9	2.0	12.5	0.1	0.8	0.5	30.5	7.8	33.0	13.8	6.1	11.3	55.0	56.6	59.1
	Northern Cape	5.4	1.8	19.9	0.2	4.4	2.0	13.2	0.8	15.5	6.7	8.0	3.7	17.4	25.0	32.7
	Free State	4.7	0.7	10.0	0.8	4.7	3.4	17.1	2.0	17.7	4.3	8.7	6.3	11.4	26.2	22.8
	KwaZulu-Natal	4.3	0.9	12.0	0.2	4.1	3.4	22.0	8.0	22.9	8.7	7.2	14.4	36.7	57.7	54.9
	North West	6.2	1.5	16.2	0.7	3.1	2.5	16.9	1.7	18.1	4.5	10.0	8.9	38.4	51.6	42.6
	Gauteng	2.6	0.3	8.1	0.4	1.9	1.8	16.4	7.0	16.3	4.5	9.8	5.5	7.2	9.9	9.3
	Mpumalanga	5.1	1.1	11.8	0.3	3.0	2.5	11.8	2.5	12.3	2.5	3.8	14.7	27.6	61.1	64.7
	Limpopo	5.8	0.1	10.6	0.1	0.5	0.6	6.7	4.0	7.2	1.8	4.0	27.4	54.7	77.8	82.3

Dimension		Asset ownership				Economic activity		Isolation				
Indicator		#16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26
Gender	Male	15.2	2.0	57.9	11.0	2.3	1.7	9.8	1.6	36.7	15.7	6.6
	Female	19.2	2.4	83.2	16.1	3.9	2.9	15.5	1.3	46.2	19.4	3.1

Table 3 (continued)

Dimension		Asset ownership				Economic activity		Isolation				
Race	African	19.9	2.1	78.1	15.2	3.6	2.4	15.0	1.5	48.1	19.5	4.9
	Coloured	7.2	5.4	58.3	9.7	1.3	2.2	1.0	1.2	13.0	8.1	5.0
	Indian	2.7	0.8	18.8	2.9	0.3	1.1	0.9	1.6	9.9	7.2	4.3
	White	1.2	0.1	5.2	0.5	0.2	0.7	1.4	2.1	6.9	7.4	6.3
Labour market status	Employed	13.9	1.3	59.4	7.1	0.0	1.2	7.9	1.5	35.5	13.9	8.9
	Unemployed	25.0	2.7	89.8	22.3	36.4	1.9	13.7	2.0	45.1	18.1	0.0
	Inactive	20.0	3.5	80.4	21.0	0.0	3.9	19.3	1.4	48.9	22.6	0.0
Area type	Urban	11.7	2.0	61.6	9.7	3.1	1.9	3.2	1.7	21.9	9.7	6.1
	Rural	27.1	2.6	84.4	20.3	2.8	2.9	30.2	1.1	77.9	32.1	2.8
Province	Western Cape	8.3	3.4	53.7	6.2	2.0	2.5	2.7	1.3	16.8	6.4	7.0
	Eastern Cape	27.8	4.5	82.6	21.5	1.5	1.5	20.7	1.4	59.6	21.4	0.6
	Northern Cape	14.2	7.7	70.1	15.9	3.2	2.7	4.8	0.8	22.9	14.7	0.9
	Free State	12.9	3.3	75.4	12.4	4.6	1.5	3.2	1.3	16.8	17.5	2.6
	KwaZulu-Natal	19.8	1.8	77.2	14.6	3.3	4.2	24.5	0.8	57.9	24.3	3.1
	North West	17.4	3.1	74.7	22.2	4.0	2.0	13.6	0.8	40.2	24.6	2.9
	Gauteng	11.9	0.8	58.0	9.3	3.2	1.7	2.2	2.6	20.2	9.2	9.4
	Mpumalanga	18.9	0.7	71.4	13.5	5.0	1.9	11.0	1.7	56.9	24.9	5.1
	Limpopo	24.5	1.8	79.9	14.4	1.7	1.2	25.2	0.6	76.4	23.1	2.8

Source: Authors' calculations using the GHS 2018 data

deprived in the refuse removal indicator, followed by sanitation type (89.4%), transport assets (84.4%), receipt of post/mail (77.9%), and water (60.8%). On the other hand, it is interesting that 61.6% of the population residing in the urban areas were still deprived of transport assets despite being considered to be of crucial importance to urban residents (Iwasaki & El-Laithy, 2013).

Looking at the results by province, deprivations were most profound in the Eastern Cape and Limpopo provinces but least in the Western Cape and Gauteng provinces. Firstly, Eastern Cape was highly deprived in the following indicators: transport assets (82.6%), receipt of post or mail (59.6%), refuse removal frequency (54.9%), sanitation type (56.6%) and water (55.0%). Secondly, indicators with the high deprivation proportions in the Limpopo provinces were refuse removal frequency (82.3%), transport assets (79.9%), sanitation type (77.8%), receipt of post/mail (76.4%) and water (54.7%).

In conclusion, results from Table 3 suggests that individuals who were African female residents living in rural areas of Eastern Cape and Limpopo, and resided in households headed by unemployed or inactive were associated with greater deprivations. In addition, the proportion of population deprived in the transport assets, receipt of post or mail, sanitation type, refuse removal frequency and water indicators were relatively higher.

Table 4 MPI by gender, race, labour, area type and province

		H	A	MPI
All	All	0.0582	0.3941	0.0230
Gender	Male	0.0465	0.3931	0.0183
	Female	0.0723	0.3949	0.0285
Race	African	0.0702	0.3938	0.0277
	Coloured	0.0106	0.4175	0.0044
	Indian	0.0019	0.3965	0.0008
	White	0.0016	0.3883	0.0006
Labour market status	Employed	0.0279	0.3894	0.0109
	Unemployed	0.1290	0.3967	0.0512
	Inactive	0.0896	0.3956	0.0355
Area type	Urban	0.0205	0.3907	0.0080
	Rural	0.1307	0.3952	0.0517
Province	Western Cape	0.0129	0.3882	0.0050
	Eastern Cape	0.1391	0.3983	0.0554
	Northern Cape	0.0224	0.4071	0.0091
	Free State	0.0311	0.3906	0.0122
	KwaZulu-Natal	0.1043	0.3936	0.0410
	North West	0.0650	0.4111	0.0267
	Gauteng	0.0229	0.3837	0.0088
	Mpumalanga	0.0503	0.4030	0.0203
	Limpopo	0.0518	0.3771	0.0195

Source: Authors' calculations using the GHS 2018 data

3.3 MPI Estimates

Table 4 shows the MPI estimates by gender, race, labour status, area type and province. The table also presents information on the incidence (H) and intensity of poverty (A). Overall, 5.8% of the population were defined as multidimensionally poor whereas the MPI was 0.0230. In addition, both H and MPI were relatively higher for females, Africans, unemployed, rural residents as well as Eastern Cape and KwaZulu-Natal. These findings in general align with what was found in the recent South African empirical studies reviewed earlier.

3.4 MPI Decomposition

Table 5 presents estimates of the extent to which each sub-group contributed to overall poverty. In 2018, more than half of the population consisted of males (55%); however, female contribution to multidimensional poverty was greater (56.70%). Furthermore, the African race group's contribution to multidimensional poverty was extremely high at 98.05%. This finding is expected as the African race group accounted for over 80% of the population. As for the labour status, the inactive contributed most to MPI poverty.

With regards to the area type, 65% of the population resided in the urban area; however, rural residents accounted for more than three quarters of MPI poverty. Lastly, provinces with

Table 5 MPI decomposition by gender, race, labour, area type and province

		MPI	Population (%)	Contribution (%)
All	All	0.0230	100.00	100.00
Gender	Male	0.0183	54.40	43.30
	Female	0.0285	45.60	56.70
Race	African	0.0277	81.38	98.05
	Coloured	0.0044	8.59	1.66
	Indian	0.0008	2.31	0.08
	White	0.0006	7.72	0.21
Labour market status	Employed	0.0109	56.13	26.57
	Unemployed	0.0512	8.29	18.49
	Inactive	0.0355	35.57	54.95
Area type	Urban	0.0080	65.76	22.93
	Rural	0.0517	34.24	77.07
Province	Western Cape	0.0050	11.10	2.41
	Eastern Cape	0.0554	10.69	25.79
	Northern Cape	0.0091	2.20	0.88
	Free State	0.0122	5.24	2.77
	KwaZulu-Natal	0.0410	19.31	34.52
	North West	0.0267	6.75	7.86
	Gauteng	0.0088	26.82	10.28
	Mpumalanga	0.0203	7.95	7.02
	Limpopo	0.0195	9.94	8.46

Source: Authors' calculations using the GHS 2018 data

Table 6 MPI decomposition by dimension

Dimension	Weight (%)	Contribution (%)
Education	14.3	6.0
Health	14.3	4.3
Dwelling	14.3	17.0
Services/Facilities	14.3	31.4
Asset ownership	14.3	22.1
Economic activity	14.3	4.0
Isolation	14.3	15.1
	100.0	100.0

Source: Authors' calculations using the GHS 2018 data

the highest contributions to MPI poverty were KwaZulu-Natal, Eastern Cape and Gauteng. These results are consistent with the findings of Omotoso & Koch, (2017) and Fransman & Yu, (2019).

The MPI may also be decomposed by dimensions and indicators to examine the extent of each dimension and indicator contribution to multidimensional poverty, as discussed before. As outlined in Table 6, dimensions contributing most to overall poverty were services and facilities (31.4%), followed by asset ownership (22.1%), conditions of the dwelling (17.0%) as well as the newly included isolation dimension (15.1%). On the other hand, the economic activity variable contributed the least to overall poverty (4%). This is in contrast with studies that omitted important dimensions such as Stats SA, (2014) which found that the economic activity dimension contributed 32.9% in 2001 and 39.8% in 2011, Omotoso & Koch, (2017) (50% in 2002 and 59.7% in 2014), as well as Frame, De Lannoy & Leibbrandt, (2016) (30.9% contribution). Nonetheless, our findings concur with the argument of Salecker, Ahmadov & Karimli, (2020) that while employment can help reduce monetary poverty, it may have minimal impact on multidimensional poverty.

Table 7 shows the contributions of each indicator to multidimensional poverty. The transport assets indicator contributed most to MPI poverty (9%), followed by sanitation, refuse removal, water, operational assets and receipt of mail/post (8.8%, 8.6%, 8.3%, 7.0% and 6.8%, respectively). The findings resonate with that of Finn, Leibbrandt & Woolard, (2013) and even other sub-Saharan African studies such as Stoeffler, Alwang, Mills & Taruvinga, (2016) and Batana, (2013) that the asset indicators contributed a lot to multidimensional poverty. Focusing on the newly added indicators under the isolation and vulnerability dimension, the receipt of mail/post indicator contributed most to MPI poverty (6.8%) as mentioned above. On the other hand, the distance to the nearest sanitation facility and the time taken to the place indicators had the least contributions to MPI poverty (both 0.2%).

Lastly, despite the results not shown, robustness tests by changing the cut-off points to 0.2, 0.4 and 0.5 (instead of 1/3) indicated that the empirical findings remained similar, as the characteristics of the poor, as well as the extent of MPI contributions by indicators and dimensions, remained mostly unchanged.

Table 7 MPI decomposition by indictor

	Indicator	Weight (%)	Contribution (%)
Education	#1: Years of schooling	7.1	5.1
	#2: School attendance	7.1	0.9
Health	#3: Disability	3.6	2.0
	#4: Health Worker	3.6	0.1
	#5: Adult food hunger	3.6	1.3
	#6: Child food hunger	3.6	1.0
Dwelling	#7: Dwelling Type	2.9	5.5
	#8: Roof material	2.9	1.7
	#9: Wall material	2.9	5.7
	#10: Floor material	2.9	2.7
	#11: Overcrowding	2.9	1.3
Services / Facilities	#12: Fuel for cooking	3.6	5.7
	#13: Water	3.6	8.3
	#14: Sanitation type	3.6	8.8
	#15: Refuse removal frequency	3.6	8.6
Asset ownership	#16: Operational assets	3.6	7.0
	#17: Communication assets	3.6	1.2
	#18: Transport assets	3.6	9.0
	#19: Financial assets	3.6	5.1
Economic activity	#20: Unemployment	7.1	2.2
	#21: Job search	7.1	1.8
Isolation	#22: Distance from the nearest water source	2.9	4.3
	#23: Distance from the nearest sanitation facility	2.9	0.2
	#24: Receipt of post/mail	2.9	6.8
	#25: Time taken to the health institution	2.9	3.6
	#26: Time taken to the workplace	2.9	0.2
		100.0	100.0

Source: Authors' calculations using GHS 2018 data

4 Conclusion

This study modified the MPI approach further to re-examine the MPI method by including new indicators that were hardly considered in the recent South African studies to re-examine multidimensional poverty in the country, with the aid of the GHS 2018 data. Unfortunately, because the child mortality data has not been disclosed (despite asked in GHS), it is not possible to run the SAMPI approach on the GHS data and investigate the changes (if any) of multidimensional poverty between the original SAMPI approach and our approach. However, this study remains significant since the empirical findings highlight crucial indicators and dimensions that are frequently overlooked in existing studies.

The empirical findings suggested that whilst female Africans living in rural areas of the Eastern Cape and Limpopo remained most prone to MPI poverty, the top few dimensions contributing most to poverty were access to services and facilities, asset ownership and dwelling, with isolation following closely behind in fourth. In addition, the indicators which contributed most to MPI poverty were transport assets, sanitation type, refuse

removal frequency, water source, operational assets and receipt of post/mail. Thus, further reforms still need to occur regarding these dominant poverty indicators. Furthermore, the contribution of economic activity indicators to multidimensional poverty was lower than in earlier studies.

With regard to standard of living of people, policies and programs implemented aim to address the issue of access to services and facilities, such as inadequate access to clean water and sanitation. For instance, both the Sustainable Development Goal number 6 and Millennium Development Gal number 7 focus on sustainable access to clean water and sanitation for all (Morton, Pencheon & Squires, 2017; Onda, Labuglio & Bartram, 2012). However, communities in South Africa still use the bucket system for sanitation (Nhamo, Nnemachena & Nhamo, 2019). Therefore, assessing water supply, sanitation and hygiene (WASH) is vital in leaving no one behind and more tools are needed to diagnose WASH access of vulnerable groups (Ezbakhe, Gine-Garriga & Perez-Foguet, 2019). In addition, policies should not only be targeted at delivering services but also at improving the quality of services to the poor.

Fourie, (2006) suggests policies should not only focus on increasing quantity but rather quality of infrastructure in South Africa. The funds budgeted for infrastructure investment should be used for improving existing stock instead of creating new infrastructure that will only require maintenance in the future. However, improvements and upgrades of infrastructure should primarily focus on rural areas. The importance of maintenance and expansion of infrastructure is vital to economic activity (Perkins, Fedderke & Luiz 2005).

As for asset ownership, the lack of vehicle ownership can be a barrier to finding and maintaining employment for low-income households, since public transport is rare, if any, in rural areas (Goldberg, 2001). Few people own cars in rural areas but utilise other means of transport modes such as trucks, taxis and even animal-drawn carts (Starkey & Hine, 2014). According to Johnson, Currie & Stanley (2010), car ownership is expensive for low-income households and causes significant financial stress on the poor. The rural transport strategy merely concentrates on improving rural transport infrastructure, public transport and non-motorised transport (Department of Transport, 2007). Therefore, policies should also support car ownership for the poor by providing funds or grants to purchase a 'starter car' which temporarily helps individuals get to work until they can save and purchase a more reliable vehicle (Goldberg, 2001).

After examining the isolation dimension, it is clear this dimension had an impact on MPI poverty, and the receipt of post or mail indicator contributed most to MPI poverty under this dimension. Previously, mail was sent to rural areas through PO boxes; nowadays, people no longer choose to go to a post office or postal point to collect mail, but instead they prefer to have it sent directly to their residence like any other street delivery. Also, shortage of postal facilities to households was attributed to the lack of housings with formal addresses, mainly in rural areas and informal settlements. Hence, the government mandated address extension initiative sought to provide structured addresses for all households around the country, which included the Post Office expanding delivery service to rural areas. While the address expansion project was a success, certain areas remain unfinished and thus require further development (Rossouw & Kgope, 2007).

Technology has changed the way people communicate and interact. As more people become comfortable with online shopping, parcel and business-to-consumer mail/packages have increased accordingly (Department of Communications, 2013). Thus, possible plans from the post offices include launching an online e-commerce platform that focuses on small and medium enterprises in rural areas (Dumasi, 2020). Also, information and communication technologies (ICTs) policy facilitate inclusive socio-economic transformation

in South Africa. It includes a wide range of technologies such as computing and information technologies, telecommunications technology, the internet, and traditional means of communication such as postal deliveries (Department of Telecommunications and Postal Services, 2016). In addition, Mamba & Isabirye, (2015) created a structure to help direct ICTs' commitment to rural development. The authors suggest that user engagement and sustainability will enhance ICTs, and private sector involvement is often needed to maintain facilities and equipment. ICTs adoption and usage that is effective will help underserved rural communities grow.

The findings in this study indicated economic activity and education contributed least to MPI poverty; however, these two dimensions remain important in reducing poverty. With regard to education, while mean years of schooling increased, there has been little success in the quality of education (Van der Berg, 2007). Despite the post-apartheid government increasing expenditure on education, it did not lead to drastic improvement in learners' educational performances (Van der Berg et al., 2011). The high unequal learning of children with poor socio-economic backgrounds gives rise to poor performance early in their learning and they fall behind in their initial years in the education system (Spaull & Kotzé, 2015). Spaull (2013) suggests that there is still much more improvement needed in teaching and learning in classrooms, and improving Black education is crucial in reducing racial earnings (Van der Berg, 2007). With regard to economic activity, StatsSA (2021) states that unemployment is still concentrated amongst the young black Africans. Employment policies should target young African women in rural areas. Bhorat (2012) suggested a transport subsidy that allows job seekers to afford the traffic cost to find employment. This proposed subsidy program aligns with the key empirical finding that a high proportion of population were deprived in the transport assets indicator.

Government should promote social cohesion as it helps reduce inequalities and socio-economic disparities in society. Chipkin & Ngqulunga, (2008) as well as Easterly, Ritzen & Woolcock, (2006) consider social cohesion as an effective bond between citizens, as it is needed to build trust, confidence and patience between government and citizens to implement reforms. Thus, to build a cohesive society in South Africa, reducing poverty, inequalities, social divisions, and exclusions should be given more prominence (David, Guilbert, Hino, Leibbrandt, Potgieter & Shifa, 2018).

Lastly, a more universal MPI should be developed to make comparisons amongst countries and on a national level, in particular sub-Saharan African and developing countries. It is because there are certain poverty characteristics that are bound to exist often in these countries, and hence the statistical bureaus of the respective countries should modify the household survey questions to ensure information on these crucial indicators is captured.

Authors½′ contributions Ms Jackson is the main author as the manuscript was created from her Masters full thesis. Prof Yu is the secondary author as he was the thesis supervisor.

Declarations

Competing interest Not applicable.

Ethics approval Not applicable, as the study used the publicly available data (General Household Survey 2018) released by Statistics South Africa.

Consent to participate Not applicable.

Consent for publication Pending (we must first wait for reviewers' feedback on the revised manuscript).

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