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A Decomposition Analysis of Health Poverty Trends in South Africa

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by

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Abstract

This study measures the incidence, depth and severity of health poverty in South Africa, using data from the National Income Dynamic Study (NIDS) 2008-2017. The resultant trend is decomposed using Shapley value-based decomposition method. The results show that 18% of the South African population were poor in 2008. The incidence decreased to 8% in 2017, with the depth and severity indices following this trend. The decomposition results indicate that the that health poverty is higher among males, the elderly, divorced or separated, unemployed individuals and those residing in farms. Notably, the health status of females, Africans, the low educated and those residing in urban areas show significant improvement during the 2008-2017 period.

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Table of Contents

Abstract i

List of Tables and Figures iv

1. Introduction 1

1.1 Aims and Objectives 3

2 Background: Health poverty measurement & determinants 4

2.1. Health poverty measurement 4

2.2. Determinants of health poverty 5

2.3. Background: A Review of South Africa's health policies 8

3. Methodology and Data 10

3.1. Methodology 10

3.2. Data 12

4. Results 14

4.1. Main results 15

A. Baseline Results – Health Poverty Trends 15

B. Baseline Decomposition Results 17

4.2. Robustness 20

Robustness check 1 – Sensitivity of Health Poverty Trends to choice of threshold 20

4.3 Discussion and policy implications 25

5. Conclusion 25

Appendix 27

References 33

List of Tables and Figures

Table 1: Summary of health poverty determinants

Table 2: Descriptive Statistics

Table 3: FGT Health Poverty Indices when k = 2

Table 4: Decomposition of health poverty headcount index when k = 2

Table 5: Sensitivity check – choice of threshold

Table 6: Descriptive Statistics of chronic health conditions

Table 7: Proportion of overall chronic health conditions by self-reported health measures

Table A1: Key variable description

Table A2: Decomposition of changes in the health poverty gap index when k = 2

Table A3: Decomposition of changes in the squared health poverty gap index when k = 2

Table A4: Decomposition of changes in the health poverty headcount index when k = 3

Figure 1: Health Poverty Trends when the health poverty threshold is set at k = 2 (Fair)

Figure 2: Decomposition net effects of the Health Poverty Headcount Index when k =2

Figure 3: Health Poverty Trends when the health poverty threshold is set at k = 3 (Good)

Figure 4: Decomposition net effects of the Health Poverty Headcount Index when k = 3

1. Introduction

The relationship between poverty and ill-health has long been recognised, both from a social justice perspective, as a way of pursuing an inclusive and equitable society, and from a functional economic perspective, as way of spurring productive development. A very important aspect of poverty is that it is multifaceted. Sen's (1990) Capability Approach (CA) acknowledges the plurality of human conditions by extending dimensions of wellbeing beyond the traditional dimensions of income and consumption. The CA framework encompasses health, education and longevity dimensions amongst other factors of human life. Good health confers benefits both at the individual and social level. At the individual level, having good health confers individuals the ability to live full and meaningful lives. Social benefits include less pressure on health care systems, better human capital, increased productivity and hence economic growth (World Health Organization, 2017). Accordingly, ensuring health and well-being is an overarching goal of many nations worldwide. This is reflected in Sustainable Development Goal - SDG 3: 'Ensure healthy lives and promote well-being for all at all ages' (United Nations, 2015:14).

Ensuring health and wellbeing for all is also one of South Africa's priorities within its transformation agenda. This follows from the country's quadruple burden of disease: non-communicable diseases (NCDs); communicable diseases (especially HIV and TB); maternal, neonatal and child morbidity and mortality; and deaths due to injury and violence (Department of Planning, Monitoring and Evaluation 2014; World Health Organization -WHO, 2017). The country's disease burden is on average four times larger than that of developed countries, and in most instances almost double that of developing countries' (Econex, 2009: pp.4). Evidence from a comparison of South Africa and other countries[1] classified in the same Global Burden of Disease region, shows that the Republic has the highest incidence of people per 100 000 with HIV/AIDS, Tuberculosis and Diarrheal disease (Institute for Health Metrics and Evaluation, 2017). For instance, in 2017 South Africa had 12,678 individuals per 100 000 with HIV/AIDs which is considerably higher than the group mean of 607 individuals per 100 000. This high level of disease burden imposes economic costs due to productivity losses arising from absenteeism and early retirement. Estimates indicate that in 2015 the economic costs

[1] Albania, Brazil, Cuba, Dominica, Jamaica, Moldova, Panama, Sri Lanka, Thailand and Tunisia

imposed by ill health in South Africa was 6.7% of total GDP (Rasmussen, et al., 2017). This position threatens the country's socio-economic progress. Consequently, understanding the distribution, drivers and trends of the health status in the country is essential for policy. Such knowledge is even more pertinent with the on-going discussion of introducing universal health care coverage (National Health Insurance) that is meant to benefit the poor.

Previous studies on health in South Africa (e.g. Bradshaw, 2008; Ataguba et al. 2015; Omotoso and Koch, 2018) have focused on health inequality and its social determinants. Omotoso and Koch, (2018) investigate changes in health inequality and how changes in the social determinants of health contribute to the observed health inequality patterns. In another study, Ataguba et al., (2015) investigate health inequality trends (self-reported illness and disability) and its determinants. The key findings of these studies show that the burden of ill health and disability are more prevalent among individuals in lower socioeconomic groups and that increasing prevalence of non-communicable diseases is being driven by individuals in lower socioeconomic groups. Further, findings indicate that the growing inequalities in ill-health in South Africa are explained by the differences in places of residence and socioeconomic statuses, (Ataguba et al. 2015; Omotoso and Koch, 2018). These studies are informative in terms of health inequality; however, they do not provide evidence on health poverty, which is defined as "the condition of being in poor health relative to what is considered to be minimally acceptable", Clarke and Erreygers (2020, p.2). While understanding both concepts of health – inequality and health poverty – is essential for crafting public health policy, these concepts capture distinct aspects. Health inequality measures consider the distribution of health outcomes in a population whereas health poverty measures capture the degree of deprivation in health. Acknowledging this important distinction, aforementioned studies leave a dearth of knowledge on health poverty in South Africa.

Much of the literature on health poverty is based on developed countries. Studies considering developing countries are very limited, perhaps due to data constraints and South Africa is no exception. While there is a large body of literature on poverty in South Africa, it is mainly concerned with income poverty (e.g., Posel et al., 2009; Rogan 2013; Seekings et al., 2015; Rogan et al, 2019). Studies that examine the issue of health in South Africa e.g. Williams et al., (2008) measure the association of perceived racial and non-racial discrimination with ill

health, while Charasse-Pouélé et al., (2006) investigate the sources of self-rated health inequalities that arise amongst South Africa's racial groups. Their findings reveal that Africans and Coloureds report higher levels of poor health than Whites. Chirinda, et al., (2018) find gender disparities in the healthy life expectancies of adults aged 50 years and older. The findings reveal that women had higher life expectancy even though they had poorer health outcomes throughout their lives. Though these studies collectively look into poor health outcomes that lead to decreased life expectancies, gender and racial disparities in health, they do not explore the deprivation and extent of health poverty amongst the sampled populations. Though previous studies are informative, there is a dearth of knowledge on the extent and drivers of health poverty in South Africa. This calls for more comprehensive assessments of health poverty.

1.1 Aims and Objectives

This study intends to fill the gap by measuring the magnitude of health poverty and assessing its trends and underlying factors. This study seeks to answer the following research questions:

i) *What is the extent of health poverty in South Africa and how has it evolved overtime?*

ii) *What are the socio-economic and demographic factors that underpin observed changes in health poverty in South Africa between 2008 and 2017?*

To answer these questions, data drawn from the 2008-2017 National Income Dynamics Surveys (NIDS) will be utilised. The study's methodology is twofold. First, Foster, Greer and Thorbecke - FGT (1984) type health poverty indices proposed by Bennet and Hatzimasoura (2011) for ordinal data are computed to evaluate the magnitude of health poverty in South Africa. Second, the study utilises the Shapley value-based decomposition technique suggested by Duclos and Araar (2006) to decompose changes in health poverty by demographic characteristics, education, labour market status, and location. This will shed light on the factors underpinning observed health poverty patterns in South Africa.

2 Background: Health poverty measurement & determinants

2.1. Health poverty measurement

Following Sen's capability approach (Sen, 1990; 2001) and the subsequent work by Nussbaum (2011), bodily health is one of the core functioning's which when satisfied allow an individual to live a full and meaningful life with the capability to flourish. According to Nussbaum's characterisation, bodily health is "*being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter*" (Nussbaum, 2011 p.33). This is one of the ten functioning's that all human beings intrinsically share and require to live a decent life. Notably, this capability is difficult to operationalise given its multifaceted nature. Nonetheless, previous studies have attempted to measure the degree of deprivation in health using techniques borrowed from the traditional measures of poverty.

The multifaceted nature of health poverty makes it difficult to identify the minimally acceptable level of health (i.e. threshold/poverty line) and hence measurements of the level of deprivation. The problem is exacerbated by a lack of cardinal and objective health indicators in the readily available household surveys. To circumvent this, the extant literature generally uses self-reported subjective measures of health (e.g. Brezezinski, 2015; Pascual-Sàez, et al., 2019; Clarke and Erreygers 2020). Though limited, subjective health measures are arguably strong predictors of objective health outcomes (Jylhä, 2009).

Assuming an ordinal scale health variable with ratio scale properties, health poverty thresholds can be identified in two broad ways. The first adopts an arbitrary uniform threshold or one allowing for variation i.e. for women and men. The second, assumes a minimally acceptable health threshold that is contingent on the average health outcomes of individual's specific reference group. Those who fall below the thresholds are considered to be poor in health (Clarke and Erreygers, 2020). FGT poverty measures are widely used in empirical work that measure poverty. Such are favoured as they are easy to construct, pose stable axiomatic and decomposable properties, and they capture the depth and distribution of poverty from the threshold. However, standard FGT indices assume well-being indicators that are cardinal (e.g. income). This makes them inappropriate for use with ordinal data which is commonly used to

capture health status. To deal with this hurdle Bennett and Hatzimasoura (2011) introduce a general method of constructing ordinal FGT indices using self-reported health data. The present study adopts this approach to measure health poverty in South Africa.

2.2. Determinants of health poverty

While measurement of health poverty in a given population is important for policy, it is also pertinent to understand the factors underpinning observed health poverty patterns. In view of this, previous studies have been pre-occupied with trying to understand factors which drive health poverty levels and trends. Factors shaping health poverty are varied. These include age, race, gender, education, employment status, rural/urban location, province and religion.

Several international studies exist that assess the extent and nature of health poverty e.g., Bennett and Hatzimasoura (2011) for Canada and the US; Brzezinski (2015) for Britain; Simões et al., (2015) for Portugal; and Pascual-Sàez, et al., (2019) for Spain. Bennett and Hatzimasoura's (2011) empirical findings reveal that health disparities between the Canada and the US are greatest among low-income groups, while Brzezinski (2015) finds cohabiting and retirement to be significant determinants of health poverty. Similarly, Simões et al., (2015) and Pascual-Sàez, et al., (2019) find gender, age and education as significant contributors to increasing health poverty in Portugal and Spain.

Age is an important factor when evaluating individual's health outcomes. Contoyannis et al., (2004) finds that young people tend to report positive health outcomes than the elderly. The frequency and severity of health challenges faced by the old vary as compared to those faced by the young. Pascual-Sàez, et al., (2019) find that age has a positive marginal effect on the probability of reporting poor health. Additionally, Brzezinski's (2015) study shows that the increase in the population of retired individuals contributed to the increase in Britain's health poverty during the 1991-2008 period.

There is extensive literature focused on the health disparities between women and men. Most findings attribute the observed findings to existing differences in biology, psychology and the

roles and responsibilities that societies assign to the different genders (Ostlin et al., 2006, Crimmins et al., 2018). The literature shows, varying effects of gender on health. For instance, Lindeboom et al., (2004) show that gender has large and persistent effects on self-reported poverty health outcomes. Pascual-Sàez, et al., (2019)'s findings show that the negative impact of gender on heath poverty is at the detriment of women while Crimmins et al., (2018) show that male life expectancy is lower than female life expectancy. An analysis of the distribution of diseases shows that a higher proportion of males report more lethal conditions (cardiovascular diseases, stroke and diabetes) while females report more disabling chronic conditions such as arthritis and depression (Crimmins et al., 2018). Furthermore, Clarke and Erreygers', (2020) findings show a substantial but weakly persistent differential between men and women's life-expectancy.

As for education, the general finding in the literature is that it is positively correlated with positive health outcomes (DeWalt et al., 2004; Lindeboom et al., 2004; Grossman, 2006; Simões et al., 2015; Pascual-Sàez, et al., 2019). Grossman, (2006) shows the theoretical relationship between education and health through productive and allocative efficiency. Education may impart direct knowledge about health and health behaviors, thereby shifting the health production function, additionally, education improves individuals' health knowledge allowing them to choose an efficient input mix into their health production process. In other words, education has been found to reduce health poverty. Its influence on health outcomes runs through multiple channels. For instance, educated individuals have access to information that enables them to make informed health decisions. Also, education increases employment prospects, allowing individuals an opportunity to earn higher wages to afford healthier lifestyles, safer living environments and access to private health care (Cutler et al., 2010; Albert et al., 2011).

Regarding marital status, Lindström (2009) found significant varying health outcomes between married (or cohabiting) and single (or divorced) individuals. Married couples presented better health outcomes. However, the positive health effects may also be dependent on the marital quality, (Kiecolt-Glaser and Newton, 2001). Additionally, Brzezinski (2015) observes that cohabiting couples have the largest overall increasing effect on Britain's health poverty. Despite specific working conditions that characterise particular jobs, the surveyed literature

shows positive employment effects on good health outcomes, (Currie et al., 1999; Brzezinski, 2015; Pascual-Sàez, et al., 2019).

The relationship between religion and health is a multifaceted and complex in nature. There are contentious arguments on the exact empirical measurement of religiosity and its effects of health. As a result, much of the literature that studies this relationship is often descriptive and points towards correlations with suggestions on the mechanisms leading to the results (Mishra, et al., 2015; Zimmer, et al., 2016). Numerous studies propose that religiosity leads to favorable health outcomes by providing social support, reducing stress and the likelihood to engage in risky sexual behaviors (McCRee, et al., 2003; Koenig, 2012; Mishra, et al., 2015; Zimmer, et al., 2016). For instance, religious institutions tend to provide support during times of loss and mourning, and they integrate families by providing a social network. They also tend to ascribe to prayer and meditation which has been proved to reduce stress (Lim and Putnam, 2010). Contrasting arguments suggest that the observed positive health outcomes could be equivalent to a placebo effect (Kohls, et al., 2011).

The link between geographical location and health is indirect and direct in nature. Poor people tend to reside in rural or urban informal settlements. The direct effects that contribute to poor health stem from the limited access to water, poor sanitation, lack of infrastructure, as well as the limited access to public and private health care facilities in those areas, (Mathee, et al., 2006; Ward, et al., 2014). The indirect effects stem from the lengthy referral systems that individuals who access health care from rural hospitals and clinics have to go through in order to get specialized care. Lastly, the limited number of specialist doctors means that patients have to incur travel costs, time and resource usage to access specialist services that tend to be offered at tertiary hospitals (Gaede and Versteeg, 2011). Thus, the effect of location on health poverty depends largely on the infrastructure and living conditions in varying localities. In summary, the literature reviewed in this study suggests the following relationships framework:

Table 1: Summary of health poverty determinants

Variable	**Relationship with health (poverty)**
Age	+
Gender	+/-
Race	+
Education	-
Employment Status	-
Marital Status	+/-
Religion	-
Location	+/-

2.3. Background: A Review of South Africa's health policies

In 1994, the newly elected democratic government adopted a fragmented and highly inequitable health system. To reform the system, the African National Congress (ANC) created the Reconstruction Development Policy (RDP) to guide the country's post-Apartheid socio-economic reforms. The policy framework included strategies to improve access and quality of health care to all South Africans through the National Health System (ANC, 1994).

In 1996, the South African government introduced free health care for children under six years, pregnant woman and free primary health care for everyone. Other actions taken to improve maternal, child and women's health include, the introduction of the accelerated immunization program. This lead to an improvement in preventing child mortality that is attributable to diseases such as Hepatitis B, Measles and other communicable diseases, (Uzicanin, et al., 2002; Amponsah-Dacosta, et al., 2015). The hospital strategy project was also introduced in 1996. This lead to an improvement in the efficiency within government hospitals, by encouraging decentralized primary health care, with a core focus on local accountability through community empowerment. The Tobacco Products Control Act was also introduced in 1999 to restrict advertising and promotion of tobacco use, prohibit smoking in public and stipulate excise duty on tobacco products (World Health Organization). Tobacco Control programmes reduce the burden of tobacco related illness and death by reducing the prevalence of tobacco usage and limiting secondary smoke exposures, (World Health Organization - Regional Office for Africa,

2015). In support of this, Reddy, et al., (2013), found that tobacco control led to a gradual decline in smoking and cigarette usage amongst school learners in South Africa.

The 2009 Medical Schemes Act was introduced to regulate inequitable practices and reinforce governance in the private health sector. For instance, private hospitals are not allowed to dump patients into public facilities once they have exhausted their benefits. The Act also limits the waiting period which medical schemes are allowed to impose on beneficiaries before accessing their benefits (Department of Planning, Monitoring and Evaluation, 2014). Extensive strategies were also introduced to combat the HIV/AIDS pandemic. This includes the Comprehensive HIV and AIDS Care, Management and Treatment Plan as well as the HIV/AIDS and STI Strategic Plan. The strategies included programs which were used to educate people on preventative measures, increase access and usage of antiretroviral treatment, as well as early detection to prevent mother to child transmission (Department of Planning, Monitoring and Evaluation, 2014). More recently, the Department of Health released the National Health Insurance (NHI) white paper in 2017. The National Health Insurance is "a health care financing system that is designed to pool funds to actively purchase and provide access quality, affordable personal healthcare services for all South Africans based on their health needs, irrespective of their socioeconomic status" (Department of Health, 2017). Though the policy has been devised, the fund is still to be established.

Overall, the South African government has made great progress in developing statutory instruments that govern the health sector. It has also adopted policies aimed at enhancing the lives of those who cannot access quality health care due to their socio-economic status. Though there is still room for improvement with regards to the quality and perceptions of public healthcare, the adopted policies have made some positive impact in bettering the lives of many marginalised citizens (Harris, et al., 2011). Against this background, the study will examine the magnitude and changes in health poverty in South Africa and identify the factors underpinning observed trends between 2008 and 2017.

3. Methodology and Data

3.1. Methodology

This study measures health poverty in South Africa using the FGT type indices for ordinal self-reported health data closely following the approach proposed by Bennett and Hatzimasoura (2011). The indices are computed on a sample of N individuals whose self-reported health outcome is represented by a vector S, which contains the set of self-reported health categories, all ordered such that:

$$Y = (y_1, y_2, .., y_s)$$

where outcome $y_i > y_j$, if and only if health outcome i is preferred to j. Using a self-selecting health poverty threshold *k*, health poverty indices are then determined as the weighted sum of probabilities of individuals reporting health outcomes below the threshold *k*. The health poverty indices are given by:

$$\pi_\alpha(Y, k) = \sum_{i=1}^{k} p_j \left(\frac{k-j+1}{k}\right)^\alpha \; where \; 1 \leq j \leq k \; and \; \alpha \geq 0 \qquad (1)$$

Where p_j represents the probability that an individual selects a health self-assessment of j; α is a parameter that accounts for the index's sensitivity to the depth and distribution to health poverty. Higher values for α assign more weight to lower valuation categories (i.e., most deprived). Equation 1 reduces to the standard poverty headcount measure when $\propto = 0$. This study will compute health poverty indices for varying values of α and the health poverty thresholds k for robustness checks.

To understand the factors underpinning observed health poverty patterns, this study relies on the attractive feature of the FGT indices i.e. the additive property that enables decomposition. Assuming v^i and π_α represent the population and health poverty share of a sub-group $i \in (i, .., h)$, respectively, a population's health poverty is determined as the weighted sum of health poverty measures for varying subgroups. Consequently, the total change in health poverty between period t and $t+1$ is given by:

$$\Delta\pi_\alpha = \pi_\alpha(Y_{t+1}; k) - \pi_\alpha(Y_t; k) = \sum_{i=1}^{h} \left[v^i(t+1)\pi_\alpha^i(Y_{t+1}; k) - v^i(t)\pi_\alpha^i(Y_t; k) \right] \qquad (2)$$

Incorporating the shapley value decomposition concept[2], equation (2) can be decomposed as the weighted sum of the within-subgroup effects and the subgroups' population shares as follows:

$$\Delta\pi_\alpha = \sum_{i=1}^{h}\left(W^i + P_i\right)$$

$$= \sum_{i=1}^{h}\left[\frac{v^i(t_1)+v^i(t_2)}{2}\Delta\pi_\alpha^i + \frac{\pi_\alpha^i(Y_{t1};k)+\pi_\alpha^i(Y_{t2};k)}{2}\Delta v^i\right] \quad (3)$$

The variables W^i and p^i denote *within-subgroup* and *between-subgroup* population effects on the change in total health poverty, respectively. In equation (3) v^i captures individual's characteristics e.g. age, gender, race, education, marital status, labour market status and location. Notably, the effect of these individual characteristics on changes in health poverty can be easily identified since W^i is weighted by the sub-groups population shares averaged over time, whereas p^i is weighted by the subgroup levels of health poverty over time (Brzezinski, 2015).

Robustness checks

The subjective nature of self-reported health brings about contending views with regards to its validity. While other studies (e.g. Jylhä, 2009) find that it is a strong predictors of objective health outcomes, others (e.g. Schneider et al., 2011) reveal significant reporting heterogeneity associated with demographic and socioeconomic characteristics. This type of measurement error is known as "state dependent reporting bias" (Kerkhofs and Lindeboom, 1995). It occurs when different sub-groups of the population report systematically different cut-point levels, despite having the same levels of true health. Literature proposes methods that utilise more objective measures of "true" health to account for possible reporting bias e.g. hypothetical anchoring vignettes (Kerkhofs and Lindeboom, 1995; Lindeboom and van Doorslaer, 2004; Hernández-Quevedo et al., 2005; Vaillant and Wolff, 2012).

[2] Shapley value decomposition is a solution concept arising from cooperative game theory. In the context of health poverty indices, it allows us to compute the mean of the marginal effects of each subgroup. The mean yields the contribution of each factor (Duclos and Araar, 2005).

To assess the extent of reporting bias and the consistency of the self-reported health outcomes, this study measures the degree of overlap between individuals' self-reported health outcomes and subjective ill-health indicators represented by chronic conditions. The rationale of this is to assess the extent to which poor health is under-reported within the South African context. For instance, if an individual suffers from at least one chronic condition but reports excellent health this will give an indication of the extent to which health status is under-reported. This will inform the study if the subjective health measure at use is severely biased.

3.2. Data

This study uses data drawn from the 2008-2017 National Income Dynamic Study (NIDS). The sampling frame includes private households and residents in workers' hostels, convents and monasteries. The frame excludes other collective living quarters such as students' hostels, old age homes, hospitals, prisons and military barracks, (Woolard, et al., 2010). NIDS is a nationally representative survey contains detailed information on individual (e.g. age, race, gender, education, labour market status, health status and location) as well as household information (e.g. household composition and size).This study employed data from Wave 1 up to and including Wave 5.[3] Wave 1 initially had 28226 observations. Data points with missing observations and adults who refused to answer or were not available to answer the questionnaire were dropped from the data set. The remaining data set had 15115 observations. The same process was employed for Wave 2 up to Wave 5. Although the NIDS data follows a panel structure, this study ignores the panel dimension; it exploits only the cross-sectional dimension. The pooled dataset had 88547 observations. Design weights were incorporated to account for household non-response. To obtain appropriate estimates, standard errors and confidence intervals, the svyset command was employed with the use of post-stratification weights. Sample district council 2011 was chosen as the strata. The strata employed represents the primary sampling unit clusters. Table A.1 in the Appendix presents key variable definitions while Table 2 presents descriptive statistics for the pooled sample for each year.

[3] Wave 1 represents data from 2008, Wave 2 2010, Wave 3 2012, Wave 4 and 5 represent 2015 and 2017 respectively.

Table 2: Descriptive Statistics.[4]

Variable	Overall	2008	2010	2012	2015	2017
	Mean	**Mean**	**Mean**	**Mean**	**Mean**	**Mean**
SR Excellent	0,357	0,322	0,417	0,339	0,351	0,355
SR Very Good	0,297	0,271	0,297	0,290	0,304	0,319
SR Good	0,239	0,231	0,191	0,262	0,263	0,245
SR Fair	0,076	0,113	0,066	0,080	0,062	0,063
SR Poor	0,031	0,063	0,029	0,029	0,019	0,017
Age	36	37	37	37	35	36
Female	0,535	0,562	0,540	0,542	0,513	0,522
African	0,798	0,789	0,791	0,789	0,806	0,817
Coloured	0,085	0,080	0,087	0,091	0,083	0,084
Asian/Indian	0,025	0,025	0,023	0,025	0,027	0,023
White	0,092	0,106	0,100	0,095	0,085	0,076
Unemployed	0,151	0,190	0,142	0,164	0,133	0,126
Married	0,279	0,317	0,293	0,278	0,253	0,258
No Schooling	0,060	0,087	0,073	0,065	0,040	0,038
Primary Education	0,159	0,196	0,184	0,170	0,134	0,114
Incomplete Secondary	0,453	0,421	0,442	0,448	0,481	0,472
Matric	0,172	0,167	0,166	0,162	0,170	0,196
Tertiary Education	0,155	0,129	0,134	0,154	0,175	0,180
Christian	0,807	0,824	0,810	0,789	0,824	0,792
Other Religion	0,193	0,176	0,190	0,211	0,176	0,208
Urban	0,623	0,607	0,599	0,627	0,636	0,646
Western Cape	0,106	0,100	0,100	0,111	0,104	0,112
Eastern Cape	0,119	0,126	0,119	0,124	0,121	0,107
Northern Cape	0,023	0,023	0,023	0,022	0,020	0,027
Free State	0,054	0,057	0,056	0,056	0,047	0,052
KwaZulu-Natal	0,190	0,185	0,198	0,184	0,187	0,197
North West	0,066	0,073	0,069	0,067	0,064	0,055
Gauteng	0,262	0,249	0,253	0,265	0,278	0,262
Mpumalanga	0,079	0,078	0,079	0,072	0,078	0,090
Limpopo	0,079	0,078	0,079	0,072	0,078	0,090
N	**88547**	**15115**	**15961**	**18327**	**18785**	**20359**

[4] SR = Self -reported

The pooled sample has 88 547 observations for the period 2008-2017. Overall, 35% report that they their health outcome is excellent while 29% and 23% report very good and good health, respectively. A small share, 7% report fair health while 3% report poor health. Overtime those who report excellent health report better health outcomes from 32% in 2008 to 35% in 2017. This increase holds for those who report very good and good health. Contrarily, those who report fair and poor health experience deteriorating health outcomes over the 2008-2017 period. 11% of the population report fair health in 2008 which declines to 6% in 2017. Similarly, 6% report poor health in 2008 which declines to 1% in 2017.

Now turning to other characteristics. The overall sample is composed of individuals aged between 35-37 years on average, mainly female (53%) and African (80%). This composition pattern is consistent across the different waves. 15% of the sample is unemployed individuals, 27% are married individuals. In terms of education, the sample is mainly composed of individuals that have incomplete secondary education (45%) and matric (17%). A very small share has no schooling (6%) while a modest share (15%) has tertiary education. There is moderate improvement in education attainment, with 19% having completed matric in 2017, from the 16% in 2008, and 18% having acquired a tertiary qualification in 2017 from the 12% in 2008. A large share (81%) of South Africans are Christians and this is consistent across all time periods. In terms of geographical location, 62% reside in urban areas while Gauteng (26%) and KwaZulu-Natal (19%) has a highest share of individuals across South Africa's provinces. Statistics indicate that Northern Cape has the smallest share (2%) of individuals in the sample. The share of urbanised individuals remained relatively stable over the 2008-2017 period.

4. Results

This section presents the results of the study in three broad sections. The first section begins with a discussion of the results on the health poverty trends (Figure 1 and Table 3). The baseline results are based on a health poverty threshold of $k = 2$ (Fair health). In this case, individuals who report their health as "Fair" = 4 and "Poor" =5 are regarded as health poor. The second section presents and discusses results of the decomposition of changes in health poverty (Table 4). All estimates are weighted by individual weights provided in the data and robust standard errors are computed to account for heteroscedasticity. Finally, the third section presents a series

of robustness checks related to choice of health poverty line and reporting bias in the self-reported health measure.

4.1. Main results

A. Baseline Results – Health Poverty Trends

Figure 1 plots the health poverty headcount measure (FGT0), health poverty gap (FGT1) and health poverty severity (FGT2) against time to reveal health poverty trends for the period 2008-2017, when $k = 2$ (Fair health). FGT0 measures the incidence of health poverty (i.e. share of individuals that are health poor). This captures the proportion of individuals who are poor in health. FGT1 measures how far on average are the poor are from the selected health threshold, this indicates the degree to which individuals fall below the health poverty threshold, while FGT2 captures the severity of health poverty faced by individuals below the health threshold $k = 2$ by putting more weight on those who have poor health. Table 3 presents the corresponding values for the different health poverty measures, standard errors and 95% confidence intervals.

Figure 1: Health Poverty Trends when the health poverty threshold is set at $k = 2$ (Fair)

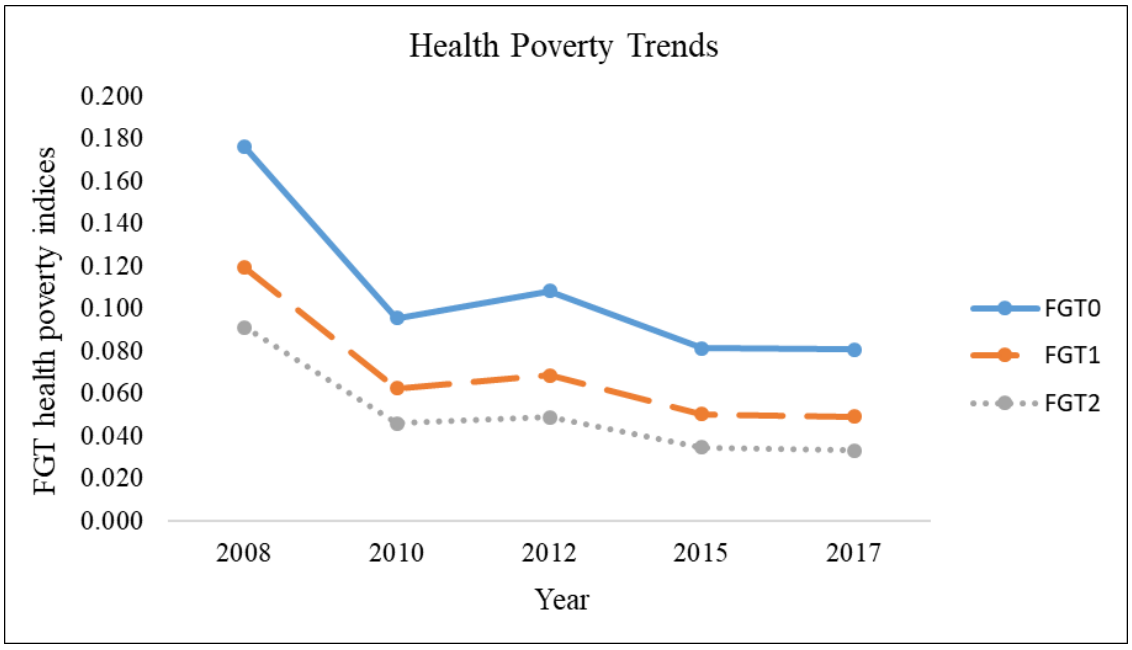


Figure 1 clearly shows a downward trend in health poverty during the 2008 to 2017 period. The share of health poor individuals (FGT0) was 17.6% in 2008 and this declined to 9.5% in 2010 and further declined to 8.1% in 2017. This decrease is also evident in the health poverty gap (FGT1) and health poverty severity (FGT2), which decreased by 7% points and 12.4% points, respectively, between 2008 and 2017. The decline in FGT1 indicates that the distance between those who report a self-rated health of Fair and Poor has declined with less people falling below the threshold. The decline in FGT2 also suggests that the extent of health poverty severity has also improved overtime.

Table 3: FGT Health Poverty Indices when k=2

	FGT0	**FGT1**	**FGT2**
2008	0,176	0,119	0,091
	(0,006)	(0,004)	(0,004)
	[0.165, 0.188]	[0.111, 0.128]	[0.084, 0.099]
2010	0,095	0,062	0,046
	(0,005)	(0,004)	(0,003)
	[0.086, 0.105]	[0.055, 0.069]	[0.040, 0.052]
2012	0,108	0,069	0,049
	(0,005)	(0,003)	(0,003)
	[0.098, 0.119]	[0.062, 0.075]	[0.0437, 0.054]
2015	0,081	0,050	0,035
	(0,004)	(0,003)	(0,002)
	[0.073, 0.090]	[0.045, 0.056]	[0.030, 0.039]
2017	0,081	0,049	0,033
	(0,004)	(0,002)	(0,002)
	[0.073, 0.088]	[0.044, 0.054]	[0.030, 0.037]

Notes: Robust standard errors in round brackets and 95% confidence intervals in square brackets.

The changes observed between 2008 and 2017 are statistically significant across all indices. This is evidenced by the non-overlap in the 95% confidence intervals for 2008 and 2017 health poverty measures (Table 3). Thus, the overall decline in health poverty across all health poverty measures suggest improvements in health status of the South African population or more precisely their perceived health status.

B. Baseline Decomposition Results

To obtain insights into the factors that underpin observed trends in health poverty, changes in health poverty headcount are computed between 2008 and 2017. This is then decomposed into the 'within' and 'between' group components by selected factors. The 'within group' component captures the effect of changes in health poverty that occur within a given group (e.g. females) while the 'between group' component captures the effect of changes in population share across groups (e.g. female and male). The baseline results of the decomposition are presented in Table 4, when the health poverty threshold is set at $k = 2$ (Fair health). The proportion columns in the Table capture the population shares of the different subgroups in each category while the FGT0 columns represent the headcount health poverty level in each subgroup. Figure 2 presents the net effects of each variable i.e. 'within effect' + 'between effect' to clearly show the factors that have had the greatest and least effect on the decline in health poverty between 2008 and 2017.

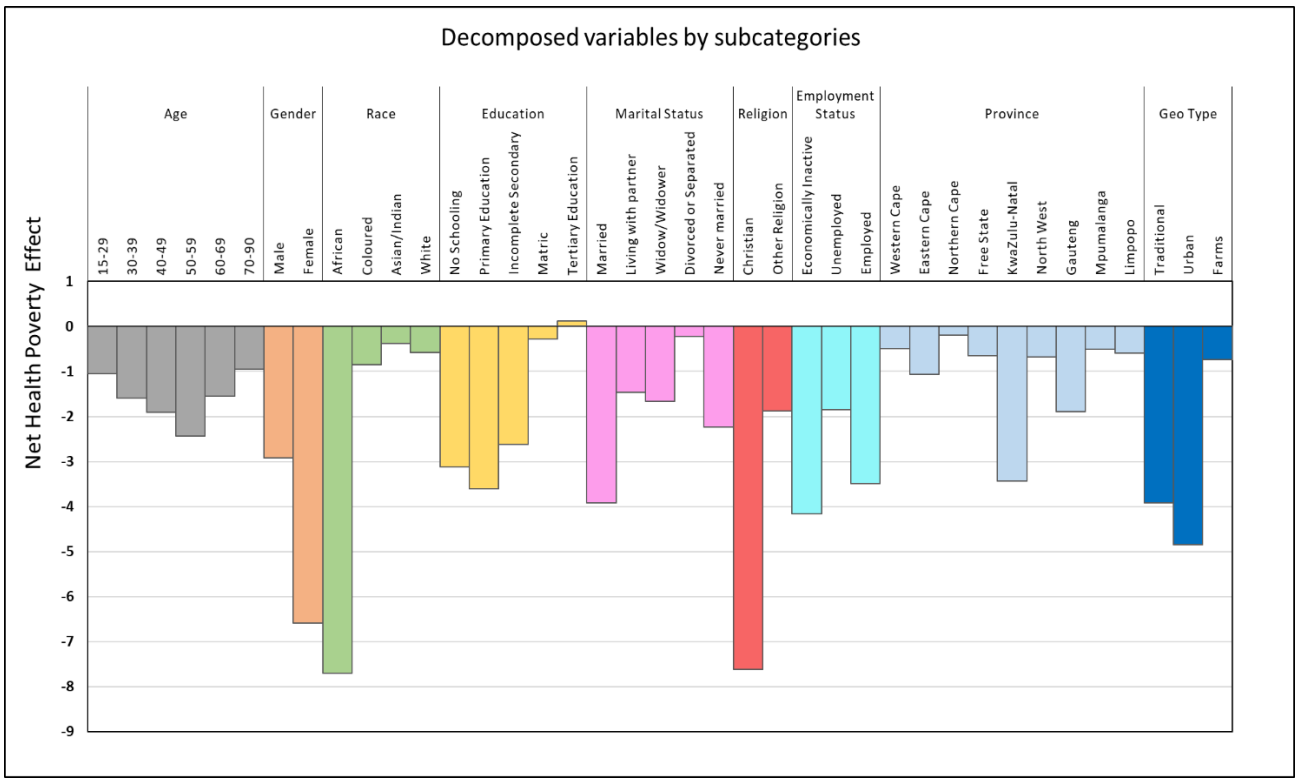
As discussed earlier, the health poverty headcount index decreases from 17.6% in 2008 to 8.1% in 2017. The 9.5%-point change is decomposed first by age group. Results in Table 4 indicate that 92% (i.e. 8.7% points) is attributed to the within age-group improvements in health poverty. A small contribution is observed from the than between age-groups shift in population shares. Improvements in health within the 50-59 and 30-39 age groups contributed the most to the decrease in health poverty. An assessment of the net effects i.e. 'within effect' + 'between effect' Figure 2 – of each age group shows that the 50-59 age group has the highest contribution towards health poverty reduction with the 70-79 age group making the least contribution.

With regards to gender, results indicate that the 'within group' changes in health poverty had a stronger effect than the 'between group' effect. Improvements in health poverty among females contributed considerably to the observed decline in health poverty. Thus, of the 9.5%-point total decline in health poverty 6% points are attributable to health improvements among women (within-effect). Turning to race, health improvements among Africans is the main driver of health poverty changes observed between 2008 and 2017. While increases in the share of Africans had a counteracting effect of increasing health poverty, the net effect of this group on health poverty still contributes towards health poverty reduction. The group with the least effect on health poverty reduction was Asian/Indians and Whites with a net effect of -0.35% and -0.26% points, respectively.

Table 4: Decomposition of health poverty headcount index when k = 2

Variable	Group	2008		2017		Decomposition	
		Proportion	FGT0	Proportion	FGT0	Within	Between
Age	15-29	41.6	0.059	42.0	0.033	-1.074	0.019
	30-39	20.6	0.143	24.8	0.054	-1.995	0.409
	40-49	15.7	0.208	14.5	0.092	-1.739	-0.171
	50-59	11.1	0.362	9.6	0.163	-2.043	-0.399
	60-69	7.0	0.417	5.7	0.237	-1.140	-0.409
	70-90	4.0	0.514	3.4	0.322	-0.703	-0.247
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-8.702*	*-0.798*
Gender	Male	43.8	0.138	47.8	0.065	-3.325	0.409
	Female	56.2	0.206	52.2	0.095	-5.976	-0.608
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-9.301*	*-0.200*
Race	African	78.9	0.181	81.7	0.080	-8.066	0.371
	Coloured	8.0	0.200	8.4	0.088	-0.912	0.057
	Asian/Indian	2.5	0.210	2.3	0.062	-0.352	-0.029
	White	10.6	0.120	7.6	0.092	-0.257	-0.323
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-9.576*	*0.076*
Education	No Schooling	8.7	0.468	3.8	0.246	-1.378	-1.739
	Primary educ.	19.6	0.291	11.4	0.181	-1.691	-1.910
	Incomplete sec.	42.1	0.136	47.2	0.065	-3.135	0.513
	Matric	16.7	0.077	19.6	0.052	-0.456	0.181
	Tertiary educ.	12.9	0.067	18.0	0.055	-0.190	0.304
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-6.850*	*-2.651*
Marital	Married	31.7	0.202	25.8	0.096	-3.04	-0.874
	Cohabiting	8.9	0.223	5.7	0.087	-0.979	-0.485
	Widow/widower	6.8	0.460	5.8	0.247	-1.340	-0.323
	Divorced/separated	3.2	0.236	3.3	0.162	-0.238	0.019
	Never married	49.4	0.109	59.3	0.053	-3.031	0.798
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-8.626*	*-0.874*
Religion	Christian	82.4	0.174	79.2	0.084	-7.211	-0.399
	Other Religion	17.6	0.190	20.8	0.070	-2.290	0.409
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-9.510*	*0.010*
Employment	Econ. inactive	37.9	0.233	40.1	0.116	-4.541	0.380
	Unemployed	19.0	0.136	12.6	0.057	-1.245	-0.608
	Employed	43.1	0.144	47.3	0.057	-3.905	0.418
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-9.690*	*0.190*
Province	Western Cape	10.0	0.151	11.2	0.091	-0.627	0.133
	Eastern Cape	12.6	0.164	10.7	0.092	-0.827	-0.238
	Northern Cape	2.3	0.225	2.7	0.124	-0.257	0.057
	Free State	5.7	0.198	5.2	0.094	-0.570	-0.086
	KwaZulu-Natal	18.5	0.257	19.7	0.065	-3.639	0.200
	North West	7.3	0.189	5.5	0.128	-0.390	-0.285
	Gauteng	24.9	0.148	26.2	0.068	-2.033	0.143
	Mpumalanga	7.8	0.167	9.0	0.090	-0.646	0.143
	Limpopo	10.8	0.119	9.8	0.069	-0.504	-0.095
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-9.491*	*-0.010*
Geo Type	Traditional	33.7	0.195	31.1	0.084	-3.563	-0.352
	Urban	60.7	0.165	64.6	0.079	-5.320	0.475
	Farms	5.6	0.189	4.3	0.076	-0.561	-0.181
	Total Population	*100.0*	*0.176*	*100.0*	*0.081*	*-9.443*	*-0.057*

Figure 2: Decomposition net effects of the Health Poverty Headcount Index when k =2



Pertaining to human capital, individuals with no schooling, primary and incomplete secondary education had the highest contribution towards the decrease in health poverty. This occurred mainly through the 'within group' improvements in health. The net effect of these groups are all negative with the strongest effect observed among individuals with primary education. Those with tertiary education had a net effect (0.11%) of increasing health poverty. Married and never married individuals contributed the most to the decrease in health poverty. This was mainly through the 'within group' changes. Of the total health poverty decline, -3.91% points and -2.23% points of the total decline in health poverty attributable to married and never married groups, respectively. Figure 2 on net effects shows that individuals who are divorced or separated (-0.22%) had the least contribution to the reduction in health poverty over the 2008-2017 period.

Results for religion shows that improvements in health among Christians contributed the most to the decline in the health poverty. Although the 'between group' effect is weak accounting for -0.4% points, it also serves to reduce health poverty. Economically inactive individuals and those in employment had the largest contribution towards the reduction in health poverty while the unemployed had the least contribution. This is clearly depicted in Figure 2.

Relating to spatial factors, results show that changes within province account for almost all the decrease in the provincial category's contribution to health poverty between 2008 and 2017. Figure 2 shows that Kwa-Zulu Natal had the highest health poverty reducing contribution followed by Gauteng, the Northern Cape had the lowest contribution to health poverty reduction. Urban areas contributed the most to reducing the incidence in health poverty through the 'within effect' followed by traditional areas and lastly farms. The decomposition results of health poverty gap (FGT1) and severity (FGT2) are presented in Table A. 2 and A. 3 in the Appendix. The findings for these measures are generally similar to those uncovered when using the health poverty incidence (FGT0). Similarly, figure 4 in the appendix depicts the net effects for the heath poverty headcount index when k =3.

4.2. Robustness

Robustness checks are necessary to ensure the accuracy of the main results. The first robustness check conducted relates to the sensitivity of results to the choice of health poverty threshold. The second robustness check pertains to assessing the extent of reporting bias in the health measure utilised.

Robustness check 1 – Sensitivity of Health Poverty Trends to choice of threshold

Baseline results use $k = 2$ (Fair health), it is well known that health poverty measures are sensitive to the choice of health poverty threshold. To examine the sensitivity of results, the threshold is shifted to $k = 3$ (Good health) which implies that individuals with 'Good' =3, 'Fair' =2 and 'Poor' =1 are considered to be health poor. Results of the sensitivity threshold check are presented in Table 5.

Using $k = 3$ increases health poverty incidence, gap and severity levels; this is expected. Over-time, all health poverty indices decline. FGT0, FGT1 and FGT2 decrease to 40.8%, 21.6% and 13.9% in 2008 and 32.6%, 14.1% and 7.3% in 2017. The corresponding changes in health poverty are: FGT0 (-8.2%), FGT1(-7.5%) and FGT2(-6.6%). Though there is a slight increase in percentage point, the direction of the results is congruent with those obtained when $k=2$. Figure 3 highlights the trend described above when the health poverty threshold is set at $k=3$.

Table 5: Sensitivity check – choice of threshold

	FGT0	FGT1	FGT2
2008	0,406	0,215	0,139
	(0,010)	(0,005)	(0,004)
	[0.388, 0.428]	[0.205, 0.226]	[0.131, 0.147]
2010	0,286	0,137	0,080
	(0,010)	(0,005)	(0,004)
	[0.266, 0.306]	[0.127, 0.147]	[0.073, 0.087]
2012	0,371	0,169	0,093
	(0,011)	(0,005)	(0,003)
	[0.350, 0.391]	[0.160, 0.179]	[0.087, 0.010]
2015	0,345	0,148	0,076
	(0,009)	(0,004)	(0,003)
	[0.327, 0.363]	[0.140, 0.157]	[0.071, 0.081]
2017	0,326	0,141	0,073
	(0,009)	(0,004)	(0,003)
	[0.308, 0.344]	[0.133, 0.150]	[0.068, 0.078]

Notes: Robust standard errors in round brackets and 95% confidence intervals in square brackets.

Figure 3: Health Poverty Trends when the health poverty threshold is set at k = 3 (Good)

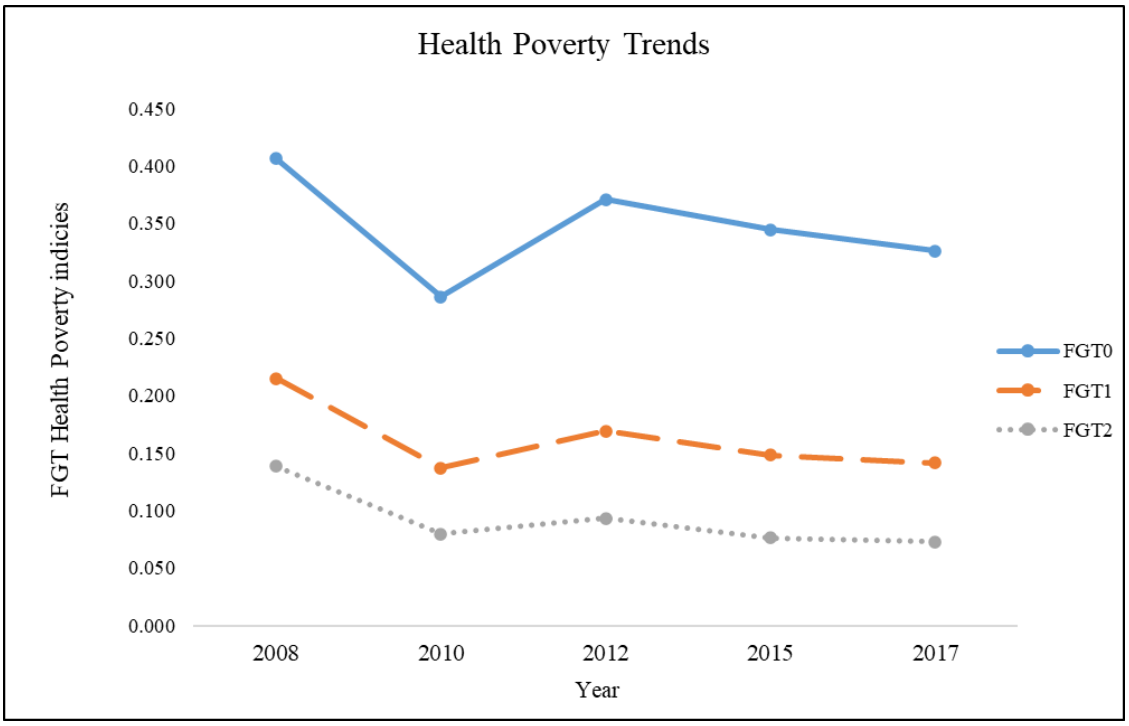


Table A.4 in the Appendix, present the decomposition results for health poverty incidence when *k=3* (Good). Results show that the 15-29 and 30-39 age groups, females contributed considerably to the decrease in health poverty over the 2008 and 2017 time periods. African and those with education below matric had the highest contribution to the reduction in health

poverty. As established when *k=2*, individuals with tertiary education contributed to increasing health poverty through the between group effect. Married individuals and Christians contributed considerably to the reduction in health poverty. In terms of employment status and geographical type, almost all the effect on health poverty is accounted for by the 'within group' rather than 'between group' effect. The spatial outcomes indicate that individuals who stay in the Eastern Cape, Free State and the North West all contributed towards decreasing health poverty through within and between group effects. These results are consistent with those obtained when the threshold is set at *k = 2* (Fair health).

Robustness check 2: Under reporting Bias

The self-reported health measure used in this study might suffer from reporting bias in which individuals favour reporting of better health. This limitation has been highlighted by previous studies using NIDS (e.g. Ardington et al., 2013; McLaren et al., 2014; Lau et al., 2015).

Table 6: Descriptive Statistics of chronic health conditions

Variable	Overall		2008		2010		2012		2015		2017	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
TB	0,036	0,187	0,035	0,183	0,030	0,170	0,047	0,211	0,034	0,182	0,035	0,183
HB	0,125	0,330	0,135	0,341	0,113	0,316	0,161	0,367	0,104	0,305	0,110	0,313
Diabetes	0,035	0,184	0,035	0,183	0,034	0,182	0,046	0,209	0,034	0,180	0,026	0,159
Stroke	0,007	0,084	0,008	0,091	0,007	0,084	0,008	0,089	0,007	0,083	0,005	0,073
Asthma	0,032	0,175	0,034	0,181	0,035	0,184	0,040	0,196	0,026	0,159	0,024	0,153
Heart Condition	0,020	0,141	0,030	0,171	0,017	0,128	0,025	0,157	0,015	0,123	0,014	0,118
Cancer	0,009	0,092	0,007	0,084	0,006	0,079	0,006	0,079	0,012	0,107	0,011	0,106
All Chronic Conditions	0,203	0,402	0,219	0,414	0,182	0,386	0,248	0,432	0,181	0,385	0,180	0,384

Table 7: Proportion of overall chronic health conditions by self-reported health measures

Self-rated health	Proportion with chronic conditions
Excellent	0,111
Very Good	0,158
Good	0,258
Fair	0,287
Poor	0,187

Acknowledging this limitation, this robustness check investigates the extent of reporting bias by comparing the subjective self-reported health status measure with more objective measures i.e. chronic conditions. NIDS data has information on chronic conditions such as Tuberculosis, High blood pressure, Diabetes, Stroke, Cancer and Heart conditions. Using chronic conditions, the robustness check examines if the trend in health poverty obtained when using the subjective measure is the same as that observed when using the prevalence of chronic conditions. Another check involves checking the degree of overlap between the subjective measure and chronic conditions. For instance, if a large share of individuals suffer from chronic conditions report excellent or good health it will be indicative of reporting bias in favour of better health status. Table 6 represents the proportion of individuals that suffer from chronic health conditions while Table 7 presents the degree of overlap.

Overall statistics (Table 6) shows that 20% suffered chronic conditions. In 2008, 22% report having a chronic condition which declined to 18% in 2018. Considering specific conditions, high blood pressure is the highest experienced chronic condition in the sample and in 2008. Over time, the share of individuals with high blood pressure decreased from 13.5% in 2008 to 11% in 2017. Based on both the subjective measure of health and prevalence of chronic conditions, results point to the same pattern; an improvement in health status in South Africa.

Table 7 presents results of the overlap between reported health status and chronic conditions. Results on the overlap provides some evidence of systematic differences in reporting behaviour, revealing discrepancies between subjective health measures and chronic conditions. Of those who have at least one chronic conditions, 11% report “excellent”, 15.8% “Very good” and 25.8% report “Good” health. This implies that there is under-reporting of poor health outcomes under the subjective health measure. The implication of this on this study’s analysis is that the level of health poverty reported in this study is potentially understated and can be viewed as a lower bound.

4.3 Discussion and policy implications

The empirical results show that health poverty incidence decreased in South Africa; 17.6% in 2008 to 8.1% in 2017. The decline also extends to health poverty gap and severity. Robustness checks suggests that the level of health poverty could be understated due to reporting bias. The decomposition results show that individuals aged 50-59 years, females, Africans, those with education below matric, Christians, employed and economically inactive people and those residing in urban areas and KwaZulu Natal had the highest net contributions to reductions in health poverty. Results show that individuals aged 70-90 years, males, Asian/Indians and whites, divorces/separated, unemployed and individuals with tertiary education and those residing in farms had the least contribution to the reduction in health poverty. There is also considerable variation in the contributions to health poverty reduction across provinces with Northern Cape contributing the least to the observed trend.

The findings that highlight provincial differences suggest that South Africa should relook at how health policies are implemented at a provincial level, with an aim to redress provincial health inequities. Similarly, the findings that show the increase in the poor health outcomes of individuals who have acquired a tertiary education suggests that there is a need to investigate the possible mechanisms that correlate higher education with poorer health outcomes. Additionally, the poor health outcomes of the elderly, male and unemployed individuals suggest that health policies targeted at those individuals can be improved. Lastly, the results indicate that health policies that benefit those residing in farms and divorced/separated individuals can have significant impact in enhancing health improvements in the country.

5. Conclusion

This study measures the magnitude of health poverty in South Africa by computing FGT poverty indices for ordinal self-reported health data. Using the NIDS data, the computed indices are further decomposed using Shapley decomposition to determine the factors underpinning the observed trends. The computed indices show that health poverty has decreased over the 2008-2017 period. The decomposition results highlight the population sub-groups that contributed to the reduction in health poverty as well as those that had the least

contribution. Based on the study's results, health policies that benefit the elderly, males, divorced/separated, unemployed individuals and those residing in farms can contribute to further improvements in health. Notably, the health status of female, Africans, low educated individuals and those residing in urban areas has improved significantly. This is commendable, thanks to the various health interventions by government. This achievement should be strengthened in future policies so as to maintain the positive momentum.

This study has some limitations. The study has established the possibility of reporting bias in the self-reported health measure which is likely to downwardly bias the estimates of health poverty in South Africa. Future studies and data collection can complement subjective heath measures with a comprehensive collection and analysis of objective health measures. The study attempts to do this but in a limited manner. In addition, the decomposition analysis sheds light into factors underpinning the observed trends, however, one cannot make clear judgements on the mechanisms contributing to the results. This can be explored in future research.

Appendix

Table A1: Key variable description

Variable	Survey Question	Possible outcomes
Health	How would you describe your health at present?	Excellent (1)
		Very good (2)
		Good (3)
		Fair (4)
		Poor (5)
Chronic health conditions	Have you ever been told by a doctor, nurse or healthcare professional that you have?	
	-Tuberculosis	Yes/No
	-High blood pressure	Yes/No
	-Diabetes	Yes/No
	-Stroke	Yes/No
	-Asthma	Yes/No
	-Heart problems	Yes/No
	Cancer	Yes/No
Age	What is your date of birth?	Respondents date of birth
Gender	What is your gender?	Male
		Female
Race	What population group would you describe yourself belonging to?	African
		Coloured
		Asian/Indian
		White
		Other
Marital status	What is your current marital status?	Married
		Living with partner
		Widow/widowed
		Divorce/Separated
		Never married
Labour market status	Employment status?	Regular employment
		Self-employed
		Casual worker
		Subsistence work
		Not employed
Education	What is the highest level of education you have successfully completed?	No schooling
		Primary Education
		Secondary Education without matric
		Matric/Senior Certificate
		NTC (Level 1,2 & 3)
		Certificate with less than Grade 12
		Diploma with less than Grade 12

		Bachelors degree
		Bachelors degree and diploma
		Honours degree
		Higher degree (Masters/ Doctorate)
		Other
Province & Geographical Type	Derived variables.	Urban
		Traditional
		Farms
		Western Cape
		Eastern Cape
		Northern Cape
		Free State
		KwaZulu-Natal
		North West
		Gauteng
		Mpumalanga
		Limpopo

Table A2: Decomposition of changes in the health poverty gap index when k = 2

Variable	Group	2008		2017		Decomposition results	
		Proportion	FGT1	Proportion	FGT1	Within	Between
Age	15-29	41.6	0.039	42.0	0.020	-0.774	0.014
	30-39	20.6	0.094	24.8	0.033	-1.399	0.263
	40-49	15.7	0.141	14.5	0.056	-1.285	-0.114
	50-59	11.1	0.250	9.6	0.101	-1.548	-0.270
	60-69	7.0	0.289	5.7	0.143	-0.930	-0.277
	70-90	4.0	0.356	3.4	0.190	-0.618	-0.163
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-6.560*	*-0.540*
Gender	Male	43.8	0.094	47.8	0.039	-2.499	0.270
	Female	56.2	0.140	52.2	0.058	-4.466	-0.405
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-6.965*	*-0.135*
Race	African	78.9	0.124	81.7	0.048	-6.071	0.249
	Coloured	8.0	0.132	8.4	0.055	-0.639	0.043
	Asian/Indian	2.5	0.124	2.3	0.037	-0.213	-0.021
	White	10.6	0.080	7.6	0.054	-0.241	-0.206
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-7.164*	*0.064*
Education	No Schooling	8.7	0.331	3.8	0.152	-1.129	-1.193
	Primary Education	19.6	0.200	11.4	0.115	-1.335	-1.292
	Incomplete Secondary	42.1	0.092	47.2	0.040	-2.329	0.341
	Matric	16.7	0.047	19.6	0.030	-0.312	0.114
	Tertiary Education	12.9	0.040	18.0	0.030	-0.142	0.178
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-5.254*	*-1.846*
Marital Status	Married	31.7	0.135	25.8	0.056	-2.279	-0.568
	Living with partner	8.9	0.151	5.7	0.050	-0.738	-0.320
	Widow/Widower	6.8	0.321	5.8	0.156	-1.044	-0.220
	Divorced or separated	3.2	0.161	3.3	0.099	-0.199	0.014
	Never married	49.4	0.074	59.3	0.033	-2.265	0.533
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-6.532*	*-0.568*
Religion	Christian	82.4	0.118	79.2	0.051	-5.481	-0.270
	Other Religion	17.6	0.128	20.8	0.043	-1.626	0.270
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-7.10*	*0*
Employment Status	Economically Inactive	37.9	0.162	40.1	0.071	-3.571	0.256
	Unemployed	19.0	0.088	12.6	0.037	-0.809	-0.398
	Employed	43.1	0.097	47.3	0.034	-2.854	0.270
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-7.235*	*0.135*
Province	Western Cape	10.0	0.102	11.2	0.056	-0.497	0.092
	Eastern Cape	12.6	0.102	10.7	0.057	-0.525	-0.149
	Northern Cape	2.3	0.152	2.7	0.081	-0.178	0.043
	Free State	5.7	0.136	5.2	0.058	-0.426	-0.057
	KwaZulu-Natal	18.5	0.184	19.7	0.038	-2.805	0.142
	North West	7.3	0.126	5.5	0.076	-0.327	-0.185
	Gauteng	24.9	0.099	26.2	0.040	-1.498	0.092
	Mpumalanga	7.8	0.119	9.0	0.058	-0.511	0.099
	Limpopo	10.8	0.075	9.8	0.042	-0.341	-0.057
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-7.121*	*0.021*
Geo Type	Traditional	33.7	0.134	31.1	0.051	-2.677	-0.234
	Urban	60.7	0.111	64.6	0.048	-3.962	0.312
	Farms	5.6	0.130	4.3	0.047	-0.412	-0.121
	Total Population	*100.0*	*0.120*	*100.0*	*0.049*	*-7.057*	*-0.043*

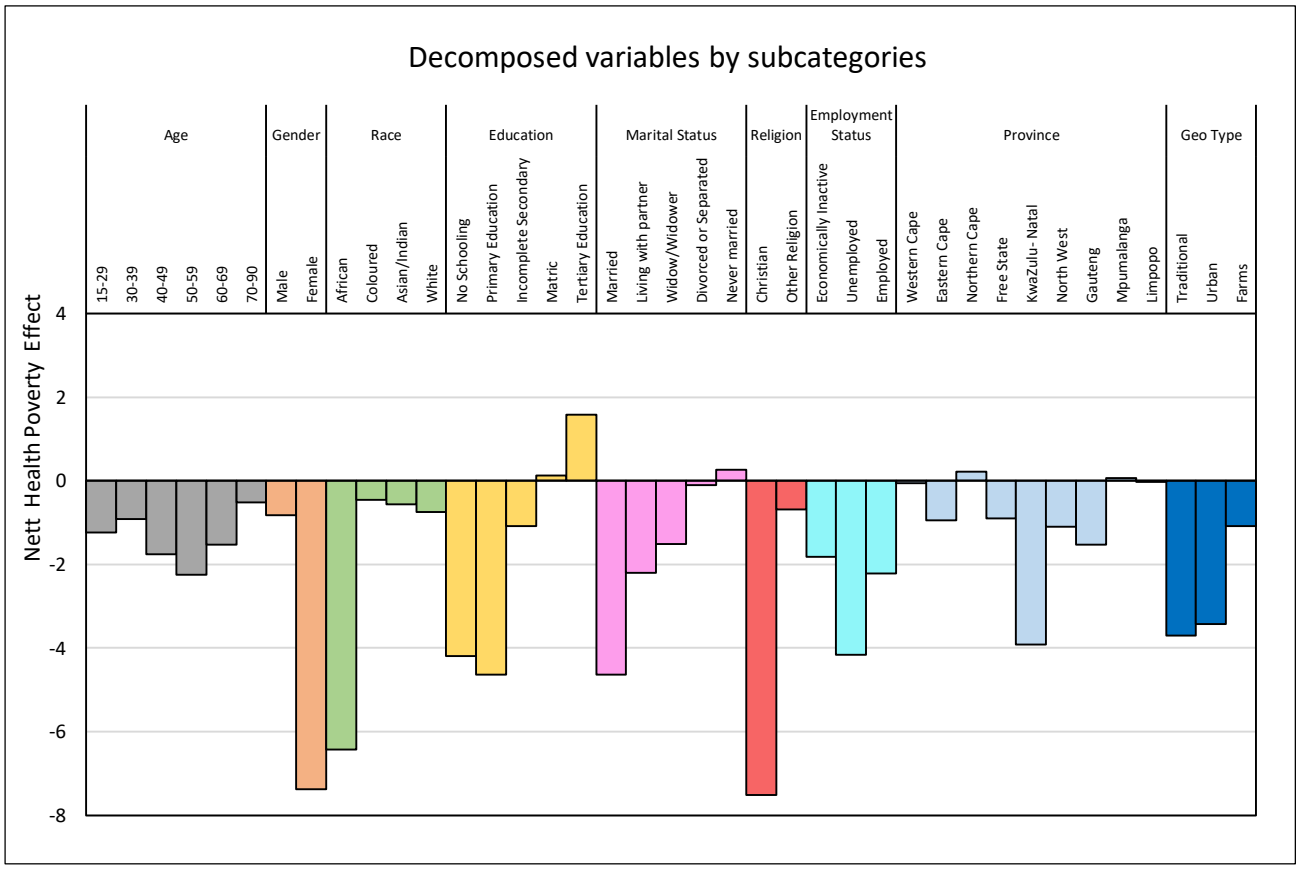
Table A3: Decomposition of changes in the squared health poverty gap index when k=2

Variable	Group	2008		2017		Decomposition results	
		Proportion	FGT2	Proportion	FGT2	Within	Between
Age	15-29	41.6	0.029	42.0	0.014	-0.61	0.01
	30-39	20.6	0.070	24.8	0.022	-1.08	0.19
	40-49	15.7	0.107	14.5	0.038	-1.04	-0.08
	50-59	11.1	0.194	9.6	0.070	-1.28	-0.20
	60-69	7.0	0.224	5.7	0.096	-0.81	-0.20
	70-90	4.0	0.278	3.4	0.124	-0.56	-0.12
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-5.39*	*-0.41*
Gender	Male	43.8	0.071	47.8	0.026	-2.05	0.20
	Female	56.2	0.107	52.2	0.039	-3.65	-0.30
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-5.70*	*-0.10*
Race	African	78.9	0.095	81.7	0.033	-4.99	0.18
	Coloured	8.0	0.098	8.4	0.038	-0.49	0.03
	Asian/Indian	2.5	0.082	2.3	0.024	-0.14	-0.01
	White	10.6	0.060	7.6	0.035	-0.23	-0.15
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-5.85*	*0.05*
Education	No Schooling	8.7	0.262	3.8	0.104	-0.99	-0.90
	Primary Education	19.6	0.155	11.4	0.081	-1.14	-0.96
	Incomplete Secondary	42.1	0.070	47.2	0.027	-1.89	0.25
	Matric	16.7	0.032	19.6	0.019	-0.24	0.08
	Tertiary Education	12.9	0.026	18.0	0.018	-0.12	0.11
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-4.38*	*-1.42*
Marital Status	Married	31.7	0.102	25.8	0.037	-1.87	-0.41
	Living with partner	8.9	0.115	5.7	0.031	-0.61	-0.23
	Widow/Widower	6.8	0.251	5.8	0.110	-0.89	-0.17
	Divorced or Separated	3.2	0.123	3.3	0.068	-0.18	0.01
	Never Married	49.4	0.056	59.3	0.022	-1.85	0.39
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-5.39*	*-0.41*
Religion	Christian	82.4	0.090	79.2	0.034	-4.54	-0.20
	Other Religion	17.6	0.096	20.8	0.030	-1.27	0.20
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-5.80*	*0.00*
Employment Status	Economically Inactive	37.9	0.126	40.1	0.048	-3.03	0.19
	Unemployed	19.0	0.064	12.6	0.027	-0.58	-0.28
	Employed	43.1	0.073	47.3	0.022	-2.29	0.20
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-5.90*	*0.10*
Province	Western Cape	10.0	0.078	11.2	0.038	-0.43	0.06
	Eastern Cape	12.6	0.071	10.7	0.040	-0.37	-0.10
	Northern Cape	2.3	0.115	2.7	0.060	-0.14	0.03
	Free State	5.7	0.105	5.2	0.040	-0.35	-0.04
	KwaZulu-Natal	18.5	0.147	19.7	0.024	-2.35	0.11
	North West	7.3	0.094	5.5	0.049	-0.29	-0.13
	Gauteng	24.9	0.074	26.2	0.027	-1.21	0.07
	Mpumalanga	7.8	0.095	9.0	0.043	-0.44	0.08
	Limpopo	10.8	0.054	9.8	0.029	-0.26	-0.04
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-5.83*	*0.03*
Geo Type	Traditional	33.7	0.103	31.1	0.035	-2.20	-0.17
	Urban	60.7	0.084	64.6	0.033	-3.22	0.23
	Farms	5.6	0.101	4.3	0.032	-0.34	-0.09
	Total Population	*100.0*	*0.091*	*100.0*	*0.033*	*-5.77*	*-0.03*

Table A4: Decomposition of changes in the health poverty headcount index when k = 3

Group	2008		2017		Decomposition results	
	Proportion	**FGT0**	**Proportion**	**FGT0**	**Within**	**Between**
15-29	41.6	0.262	42.0	0.231	-1.320	0.090
30-39	20.6	0.371	24.8	0.273	-2.255	1.345
40-49	15.7	0.464	14.5	0.379	-1.279	-0.484
50-59	11.1	0.628	9.6	0.493	-1.402	-0.853
60-69	7.0	0.706	5.7	0.596	-0.705	-0.828
70-90	4.0	0.757	3.4	0.740	-0.066	-0.451
Total Population	*100.0*	*0.408*	*100.0*	*0.326*	*-7.019*	*-1.181*
Male	43.8	0.347	47.8	0.300	-2.148	1.320
Female	56.2	0.455	52.2	0.350	-5.724	-1.648
Total Population	*100.0*	*0.408*	*100.0*	*0.326*	*-7.872*	*-0.328*
African	78.9	0.415	81.7	0.322	-7.478	1.050
Coloured	8.0	0.408	8.4	0.333	-0.615	0.164
Asian/Indian	2.5	0.462	2.3	0.260	-0.484	-0.082
White	10.6	0.344	7.6	0.383	0.361	-1.115
Total Population	*100.0*	*0.408*	*100.0*	*0.326*	*-8.216*	*0.016*
No Schooling	8.7	0.750	3.8	0.620	-0.820	-3.370
Primary Education	19.6	0.527	11.4	0.499	-0.443	-4.198
Incomplete Secondary	42.1	0.368	47.2	0.305	-2.829	1.747
Matric	16.7	0.293	19.6	0.257	-0.656	0.787
Tertiary Education	12.9	0.273	18.0	0.284	0.172	1.410
Total Population	*100.0*	*0.408*	*100.0*	*0.326*	*-4.567*	*-3.633*
Married	31.7	0.447	25.8	0.370	-2.206	-2.427
Living with partner	8.9	0.491	5.7	0.376	-0.845	-1.361
Widow/Widower	6.8	0.733	5.8	0.592	-0.894	-0.623
Divorced or Separated	3.2	0.492	3.3	0.448	-0.139	0.041
Never married	49.4	0.317	59.3	0.269	-2.649	2.911
Total Population	*100.0*	*0.408*	*100.0*	*0.326*	*-6.740*	*-1.460*
Christian	82.4	0.407	79.2	0.329	-6.355	-1.164
Other Religion	17.6	0.409	20.8	0.314	-1.820	1.140
Total Population	100.0	0.408	100.0	0.326	-8.175	-0.025
Economically Inactive	37.9	0.451	40.1	0.381	-2.739	0.918
Unemployed	19.0	0.400	12.6	0.274	-2.009	-2.148
Employed	43.1	0.372	47.3	0.293	-3.608	1.386
Total Population	100.0	0.408	100.0	0.326	-8.356	0.156
Western Cape	10.0	0.356	11.2	0.314	-0.451	0.385
Eastern Cape	12.6	0.356	10.7	0.331	-0.295	-0.648
Northern Cape	2.3	0.421	2.7	0.449	0.074	0.148
Free State	5.7	0.468	5.2	0.349	-0.656	-0.238
KwaZulu- Natal	18.5	0.495	19.7	0.265	-4.403	0.484
North West	7.3	0.447	5.5	0.393	-0.353	-0.754
Gauteng	24.9	0.384	26.2	0.306	-1.993	0.459
Mpumalanga	7.8	0.454	9.0	0.403	-0.426	0.492
Limpopo	10.8	0.327	9.8	0.356	0.303	-0.336
Total Population	*100.0*	*0.408*	*100.0*	*0.326*	*-8.192*	*-0.008*
Traditional	33.7	0.419	31.1	0.335	-2.731	-0.968
Urban	60.7	0.398	64.6	0.321	-4.830	1.410
Farms	5.6	0.440	4.3	0.326	-0.566	-0.517
Total Population	*100.0*	*0.408*	*100.0*	*0.326*	*-8.126*	*-0.074*

Figure 4: Decomposition net effects of the Health Poverty Headcount Index when k = 3



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