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Poor health reporting

Do poor South Africans underestimate their health needs?

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Abstract: Researchers often rely on household survey data to investigate health disparities and the incidence and prevalence of illness. These self-reported health measures are often biased due to information asymmetry or differences in reference groups. Using the World Health Organization study on global ageing and adult health, I find that the poor use a different reporting scale from the more affluent, leading to overestimation of their health status. This is tested by using the relatively novel anchoring vignettes approach and applying the hierarchical ordered probit model. Underestimation by the poor of their ill health could mean that South Africa's high levels of socioeconomic health inequalities are greater than realized.

Keywords: health inequality, health perceptions, self-reported health, vignettes
JEL classification: I12, I14

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1 Introduction

Studies focusing on socioeconomic health inequalities in South Africa have consistently found worse health outcomes amongst the poor relative to the wealthier population (Ataguba, Akazili and McIntyre 2011; Ataguba 2013; Ataguba and McIntyre 2013; Cockburn et al. 2012; Myer et al. 2008; Zere and McIntyre 2003). These inequalities are worsened by South Africa's comparatively high income inequalities and unequal access to basic social services (Ataguba, Azakili and McIntyre 2011). This research is aimed at showing that, as a vulnerable sub-group, the poor in South Africa are likely to underestimate their ill health. This is in line with various literature sources that have shown that since the poor are unable to afford being ill, they ignore and consequently under-report their ill health (Ataguba and McIntyre 2009; Harris et al. 2011; Havemann and Van der Berg 2003; Sauerborn et al. 1996a; Sauerborn, et al. 1996b). This leads to an underestimation of socioeconomic-related health inequalities and may have repercussions for the planning of a National Health Insurance (NHI) scheme.

2 Motivation

2.1 The unreliable nature of self-assessed health questions

Studies measuring health disparities using household survey data rely heavily on self-reported measures of health. Although self-reported health is more cost-effective and less invasive than relying on objective[1] measures of health, it is also likely to reflect differences in reporting behaviour across different socioeconomic groups. This reporting bias means that health disparities measured using self-reported health outcomes could possibly be biased.

Take, for instance, the overall self-assessed health (SAH) question. The most common method of capturing overall SAH is categorical and ordinal. An individual is asked to classify health as either 1 'Very poor', 2 'Poor', 3 'Fair', 4 'Good', or 5 'Excellent'. Persons from different sub-groups could have a different interpretation of what it means to have 'poor' or 'excellent' health. One reason for different interpretations is the use of different comparison groups. People usually compare their health to their peers and surrounding sub-groups (Boyce and Harris 2008; Harris et al. 2011). A person, who is surrounded by poor health, would consider him- or herself to be relatively well-off compared to their community or peers, even though their health compares poorly to the overall population (Bago d'Uva et al. 2008b; Etile and Milcent 2006).

Once these differences in reporting behaviour are systematic across a sub-group, it is referred to as 'reporting heterogeneity' (Etile and Milcent 2006; Hernandez-Quevedo, Jones and Rice 2005; Lindeboom and Van Doorslaer 2004). Reporting heterogeneity is present when, at a fixed level of health, a population sub-group is systematically more likely to under- or over-report their true, unobserved level of health. An often-cited example of reporting heterogeneity is the case of the Aboriginals in Australia. Although this sub-population of Australia fares poorly in terms of their objective health, their self-assessed reported health is on average better than the general Australian population (Mathers and Douglas 1998).

[1] Objective health here refers to health status as measured by a medical professional.

Even self-reported chronic conditions can be unreliable. If a certain sub-group, such as a group with a lower level of education or income, does not have to access to good, quality healthcare, chronic conditions may go undiagnosed and unreported.

Several authors have tested for reporting heterogeneity in self-reported health measures, but most of this work has been focused on developed country data (Etile and Milcent 2006; Hernandez-Quevedo et al. 2005; Humphries and van Doorslaer 2000; Lindeboom and Van Doorslaer 2004), while fewer studies have been done on developing country data (Bago d'Uva et al. 2008b). In most of these studies, vulnerable sub-groups systematically underestimate their ill health. Mu (2014) looks at health reporting differences between two provinces in China, one poor and one more affluent. She finds that persons from the poor province will systematically underestimate how poor their health is. In France, Etile and Milcent (2006) find that the poor are too optimistic about their health, as do Bago d'Uva et al. (2008b) for Indonesia, India and China. Some authors have also found that people with low levels of education are likely to report better health levels than they truly have (Bago d'Uva, O'Donnell and Van Doorslaer 2008a; Lunde and Løken 2011).

One reason why vulnerable sub-groups underestimate their ill health is because of their comparison groups as explained earlier. Another possible explanation pertaining specifically to the poor is that vulnerable sub-groups shift their perceptions of their own ill health due to their inability to cope with the economic costs involved with being ill. This includes not being able to afford quality healthcare, and also the economic costs of taking time off from income-generating activities when ill.

Havemann and Van der Berg (2003) argue that one of the major reasons for the underestimation of ill health in South Africa is due to the lack of quality healthcare for the poor. In the general household survey (2002-07) medical scheme coverage is estimated to be approximately 14 per cent in South Africa, and this is heavily skewed towards the rich (Econex 2009b). The limited medical aid coverage means that poor South Africans either have to pay for good-quality private healthcare out-of-pocket (OOP), or they have to rely on the poor-quality public healthcare system (an inferior good in South Africa according to Havemann and Van der Berg 2003). Due to the poor quality and long waiting times, the less affluent often pay for private healthcare OOP, which poses a large financial strain.[2]

Therefore, not having access to good-quality healthcare means that vulnerable sub-groups, such as the poor, might underestimate their healthcare demand by just 'ignoring' certain illnesses. Research done on how health insurance affects healthcare utilization has shown that people with health insurance are more likely to visit a healthcare worker than those who have none (Vera-Hernandez 2003; Manning et al. 1987).[3] If access to better-quality healthcare through insurance leads to increased healthcare visits, one could regard the lack of quality healthcare as a significant barrier to health demand realization.

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[2] A fifth of health care utilization by persons in the lowest consumption quintile is from private providers (Burger et al. 2012).

[3] Healthcare worker visits by insurance status is not necessarily a good indicator of health need, since the decision to buy health insurance is partially determined by your current or previous health status, making the relationship endogenous. However, the studies cited here dealt with this endogeneity by analysing data from a randomized controlled trial, namely the 'Rand Health Insurance Experiment' which was implemented in the USA from 1971 to 1982.

Table 1, from Burger et al. (2012), illustrates how the levels of reported illness differ by quintile and across years in South Africa. Persons from the lowest expenditure quintiles are much less likely to report themselves as ill than persons from the upper quintiles. They are also less likely to consult a health worker once they do report themselves as ill.

Table 1: Reported illness and health worker consultation

	Prevalence of reported illness and injury over the last month (%)			Proportion of those ill/injured who reported consulting a health worker over the last month (%)		
Per capita household expenditure quintile	1993	1995	2003	1993	1995	2003
Poorest 20%	10.8	7.2	8.2	71.09	78.3	83.3
Quintile 2	13.5	8.5	9	77.8	804	83.3
Quintile 3	16.7	9.3	11.4	83.3	82.1	82.5
Quintile 4	18.9	11.4	13.5	85.6	86.5	82.7
Most affluent 20%	24.2	12.1	13.8	84	87.9	86.4
Total	16.8	9.7	11.2	80.5	83	83.6

Source: 1993 PSLSD, 1995 IES/OHS and 2003 GHS, from Burger et al. (2012).

The idea that people change their perceptions of illness based on their ability to cope with the economic costs, has been put forward in a few papers. Sauerborn et al. (1996a) create a model of household coping strategies in dealing with the economic burden of illness. Strategies can broadly be divided into two categories—(1) ones that prevent costs from occurring and (2) strategies that aim to manage the financial costs once they do occur. Amongst the strategies to prevent costs from occurring (1) is the strategy to modify your perception of your illness, or to ignore it.

In a different paper, Sauerborn et al. (1996b) found that the level of reported illness is lower during the rainy season in Burkina Faso. The severity of reported illness was also lower, and there was a shift towards home-based rather than hospital-based care. This lower rate of reported illness was present, despite the higher rates of fatalities for certain major objectively measured diseases (such as malaria) during the rainy season. Despite the fact that health needs are higher during the rainy season due to energy deficiencies and higher transmission of diseases, healthcare is utilized less during this period. The authors argue that the decreased household revenue and higher time costs during the rainy season, compared to the dry season, lead to cognitive (perceptional) and behavioural (decreased health-seeking behaviour) shifts in the demand for health. Litvack and Bodart (1993) found similar seasonal patterns in Cameroon.

2.2 The income-health gradient and the implications for health disparities

If vulnerable sub-groups systematically underestimate their ill health this will be picked up in the reporting of self-reported health questions. The vulnerable will report better health than they actually have, and this will mean that health inequalities based on self-reported measures will be an underestimate of the gap between the health of two sub-groups where one is vulnerable. Of particular interest in this paper is the health inequality by wealth categories (Burgard and Chen, 2014).

Some authors have explored the possibility that poor health reporting may lead to an underestimation of health disparities. Bago d'Uva et al. (2008b) test for systematic reporting differences across various socioeconomic groups in India, Indonesia and China. In all three countries, they find that there are systematic differences in the reporting behaviour of the poor and the non-poor, and that the impact of income on health is underestimated if self-reported data are used. However, the effects are small except for China. Nonetheless, they find that there is

reason for concern that reporting heterogeneity could lead to a small bias in measuring health disparities across income groups.

Bonfrer et al. (2013) look at health inequalities in 18 countries in Sub-Saharan Africa (SSA) (including South Africa). The authors are concerned with measuring the 'need for care' when using self-reported measures, and test for reporting heterogeneity by comparing inequalities (concentration indices) in objective health measures (stunting and underweight) to inequalities in self-reported health measures. They find health inequalities to be much more concentrated amongst the poor when using objective health measures, so using subjective health measures could lead to an underestimation of health disparities across income groups in SSA. Focusing more on racial-related health disparities, Dowd and Todd (2011) reveal that not accounting for different reporting behaviour will lead to an underestimation of the health disparities between African-American and white Americans.

Looking at a developing country context, in this paper I will test for wealth-reporting heterogeneity in self-assessed health measures in South Africa and discuss the implication that this will have on measuring health inequalities. As previously stated, studies focusing on socioeconomic health inequalities in South Africa have consistently found worse health outcomes amongst the poor relative to the wealthier population. Most of these health inequalities are based on self-reported health measures. If reporting heterogeneity is present, and either the poor or the wealthy are underestimating their ill health, then these health disparities are biased.

Ataguba et al. (2011) show that South Africa is subject to the inverse care law, namely that there is a mismatch between who has the largest health needs, and who has access to health services in South Africa. Even though the poor have worse health outcomes than the wealthier population, they utilize health services less. Persons from the lower income quintiles in South Africa are not only less likely to seek care if they become sick, but are also less likely to consider themselves as ill in the first place (Burger et al., 2012; Havemann and Van der Berg, 2003). The demand for healthcare is dependent on the price of healthcare, but also on other restrictions such as limited access due to long travelling time to clinics and hospitals, and poor access to health knowledge. These barriers to entry affect how members of low-income groups evaluate their own health in order to decrease their reliability on their available healthcare options.

To test whether the poor as a vulnerable sub-group are under-reporting their ill health, two things have to be established. The first is whether wealth-reporting heterogeneity is present amongst South Africans. This has to be tested empirically. If wealth-related reporting heterogeneity is present, the second step is to measure the direction of the bias. This entails testing whether and to what extent the poor are over-reporting or under-reporting their ill health. The paper will start with a discussion of the data and estimator that will be used in this analysis. This will be followed by the analysis results, and will finish with a discussion of the policy implications for the results.

3 Methodology: Data

One often-used method to test for reporting heterogeneity is to proxy for true levels of health using objective measures of health (Etile and Milcent 2006; Hernandez-Quevedo et al. 2005; Lindeboom and Van Doorslaer 2004). Holding objective health fixed, it is possible to test for any variations in subjective health reporting. However, using objective health levels to compare differences in subjective health reporting proves problematic since the objective health measures in household surveys are often also self-reported. Given this, they are also likely to be under-reported by vulnerable sub-groups, since these groups have relatively poor access to healthcare in order to have certain illnesses diagnosed and treated.

An alternative to using objective health measures is the anchoring vignettes approach. An anchoring vignette is a hypothetical person with a fixed level of health. Heterogeneity can be estimated by analysing the way that sub-groups rate the health of anchoring vignettes. Previous papers that have used the vignettes approach to establish reporting heterogeneity in self-assessed health reporting include studies on Asia (Bago d'Uva et al. 2008b; Guindon and Boyle 2012), several countries in Europe (Bago d'Uva, O'Donnel and Van Doorslaer, 2008a; Peracchi and Rossetti 2008) and the USA (Dowd and Todd 2011).

The data used in this study are from a nationally representative South African dataset that contains vignette questions, namely the World Health Organization's study on global ageing and adult health (SAGE). The data only cover South African adults aged 50 years and above. They form part of a multi-country study that was recorded in 2008 and contains approximately 3,200 observations.

The SAGE data contain an overall self-assessed health question asking respondents to rate their health on a scale from one to five. Respondents are also asked to rate their health using a similar scale for a range of health domains. These include mobility, appearance, anxiety, pain/discomfort, cognitive abilities, interpersonal relationships, sleeping/resting ability and vision. Subsets of randomly chosen respondents are then provided with a set of hypothetical persons or vignettes, and are then asked to rate the health of these vignettes for the various health domains. Here follows an example of a vignette in the health domain of mobility:

> [Alan] is able to walk distances of up to 200 meters without any problems but feels tired after walking one kilometer or climbing up more than one flight of stairs. He has no problems with day-to-day physical activities, such as carrying food from the market.

Respondents are then asked to rate the hypothetical person's mobility on a scale from one to five. Since the vignette represents a fixed health state, any systematic variation in the way that respondents rate the vignettes is indicative of reporting heterogeneity.[4] For each health domain, there are five different vignettes. Each vignette within a health domain describes different levels of health and functionality.

In Table 2, I compare poor and non-poor vignette evaluations across the various health domains, where vignette 1 represents the healthiest vignette and vignette 5 represents the unhealthiest vignette. Therefore, each value in the table represents the percentage of poor (or non-poor) that valued the level of difficulty of vignette 1 (or 3 or 5) in health domain x as none (or mild, moderate severe or extreme).

A respondent is classified as poor if they fall within the bottom two wealth quintiles and non-poor if they fall in the top three wealth quintiles. This classification is based on a recent report by Statistics South Africa, which put the percentage of South Africans that fell below the upper-bound poverty line of R620 per capita per month (2011 prices) at 45.5 per cent in 2011 (Statistics South Africa 2014).

[4] The vignettes approach has also been used to calculate reporting differences in areas other than self-assessed health, namely economic status (Beegle, Himelein and Ravallion 2012), political efficacy (King and Wand 2007), clinical practices (Koedoot et al., 2002), health systems responsiveness (Rice, Robone and Smith 2011), and work disability (Kapteyn, Smith and Soest 2007).

Table 2: Summary of vignettes

	Vign. 1		Vign. 3		Vign. 5	
	Non-poor	Poor	Non-poor	Poor	Non-poor	Poor
Mobility						
None	37.88	39.30	5.29	5.36	2.78	4.93
Mild	24.68	23.52	10.88	14.96	0.98	2.32
Moderate	27.59	26.34	32.31	38.16	3.11	4.27
Severe	9.59	9.44	34.84	35.17	20.98	20.34
Extreme	0.26	1.39	16.68	6.35	72.15	68.13
Vigorous activity						
None	21.08	25.69	3.57	2.84	2.30	4.01
Mild	29.90	29.89	8.67	9.43	0.15	0.00
Moderate	32.09	24.31	23.31	30.78	2.43	3.29
Severe	14.16	17.98	40.09	38.69	20.39	20.03
Extreme	2.76	2.12	24.36	18.26	74.72	72.67
Depressed						
None	2.55	0.32	3.79	3.00	4.10	8.08
Mild	10.63	14.64	2.62	8.86	1.02	0.62
Moderate	38.08	39.74	6.81	13.80	4.00	10.25
Severe	43.24	41.81	57.96	57.55	37.60	39.03
Extreme	5.50	3.49	28.82	16.79	53.28	42.03
Relationships						
None	31.23	31.91	7.23	9.70	88.44	92.17
Mild	11.67	11.38	6.47	2.44	5.88	4.74
Moderate	30.32	35.30	16.71	29.58	3.65	1.51
Severe	22.93	19.80	52.45	46.67	1.47	0.96
Extreme	3.85	1.61	17.13	11.61	0.56	0.62
Body pain						
None	2.35	0.78	1.26	0.46	1.45	1.91
Mild	3.49	5.45	22.90	19.18	6.21	0.31
Moderate	29.46	33.28	49.40	56.57	4.90	4.76
Severe	53.93	55.02	24.97	22.40	41.46	52.42
Extreme	10.77	5.47	1.46	1.39	45.97	40.60
	Vign. 1		Vign. 3		Vign. 5	
	Non-poor	Poor	Non-poor	Poor	Non-poor	Poor
Body discomfort						
None	2.68	0.70	1.09	0.36	1.11	1.55
Mild	3.17	5.18	24.34	29.55	7.30	0.29
Moderate	26.03	33.94	50.97	47.63	4.62	7.62
Severe	59.26	54.59	22.03	21.65	41.41	43.82
Extreme	8.87	5.58	1.57	0.81	45.56	46.73

Sleep						
None	5.00	2.42	10.63	9.33	84.70	86.85
Mild	18.39	18.58	13.73	9.91	7.12	6.68
Moderate	28.44	23.85	27.25	28.77	3.24	1.23
Severe	43.28	46.28	43.34	46.85	2.58	3.65
Extreme	4.89	8.87	5.06	5.14	2.35	1.59
Energy						
None	4.02	4.33	4.04	2.35	85.65	87.00
Mild	9.74	8.44	8.96	7.86	7.40	4.12
Moderate	33.30	31.44	27.56	29.38	2.50	3.49
Severe	44.44	45.29	49.55	52.57	2.52	3.32
Extreme	8.50	10.50	9.89	7.84	1.93	2.07
See people						
None	31.71	37.54	2.99	2.25	3.29	5.67
Mild	34.21	27.48	7.80	7.14	1.62	0.26
Moderate	22.71	27.59	24.67	33.65	4.60	5.35
Severe	9.42	5.84	50.72	43.57	32.25	26.02
Extreme	1.95	1.55	13.82	13.38	58.24	62.70
See objects						
None	25.96	29.68	2.94	3.43	3.66	5.24
Mild	32.46	31.49	6.25	13.41	1.56	0.48
Moderate	27.36	26.52	27.83	32.52	4.33	4.35
Severe	11.49	7.75	46.94	36.43	28.39	25.41
Extreme	2.73	4.57	16.05	14.22	62.06	64.52

	Vign. 1		Vign. 3		Vign. 5	
	Non-poor	Poor	Non-poor	Poor	Non-poor	Poor
Grooming						
None	19.87	23.77	28.78	29.04	1.34	2.49
Mild	26.11	34.16	28.76	31.02	2.71	1.36
Moderate	41.72	28.50	29.23	20.24	5.08	0.85
Severe	10.94	12.53	12.82	16.27	15.88	22.33
Extreme	1.35	1.04	0.40	3.43	75.00	72.96
Appearance						
None	21.10	20.21	29.83	31.54	0.83	1.61
Mild	25.62	30.92	30.58	22.37	5.89	1.26
Moderate	41.85	38.22	26.69	22.49	3.68	3.74
Severe	10.55	8.73	11.90	17.90	12.55	12.17
Extreme	0.88	1.92	1.00	5.70	77.06	81.22
Learning						
None	4.44	2.89	40.78	36.93	4.20	2.57

Mild	17.77	17.47	30.95	31.39	6.81	1.20
Moderate	50.12	35.47	20.95	19.36	7.01	6.01
Severe	26.15	40.71	6.60	8.95	36.06	42.01
Extreme	1.52	3.45	0.73	3.38	45.91	48.21

Source: Author's calculations based on the WHO SAGE (2008) data.

From this naïve depiction of vignette ratings prevalence it appears that in most health domains, the non-poor are more likely to opt for the worst difficulty levels, namely 'severe' and 'extreme' than the poor. The poor, in comparison, are more likely to choose the middle category, namely 'moderate'. This is especially true if you look at the first five health domains, namely mobility, vigorous activity, depression, ability to create relationships and dealing with body pain. If the non-poor use the same scale they use to judge themselves as they do the vignettes (which we assume they do), this suggests that the non-poor are much more pessimistic in their health ratings than the poor.

For five of the health domains, namely dealing with relationships, body discomfort, sleep, energy and learning, there appears to be a possible coding error. In these domains the ratings of vignette five, which is the vignette with the worst health state, is rated as the vignette with the best health state.[5] Since the trend appears for both the poor and the non-poor, this discrepancy cannot be attributed to a violation of the vignette equivalence assumption.[6] These health domains are left out of the remainder of the analysis, as the reason for this irregularity is unclear.

4 Methodology: Estimator

The hierarchical ordered probit model (HOPIT)[7] as proposed by King et al. (2004) is used to establish reporting heterogeneity using the vignettes approach. The model is an extension of the ordered probit model (Tandon et al. 2003). The HOPIT model consists of two components, the *reporting behaviour equation* and the *health equation*, which is calculated jointly for efficiency (Bago d'Uva et al. 2008b).

In the *reporting behaviour component* the vignettes are used to establish the cut-points of the ordinal self-assessed health variable as a function of individual characteristics. Only the data from the subset of individuals who answer the vignettes questions in a specific domain are used in this component. The component is essentially a generalized ordered probit model, where the cut-points of an ordinal variable are allowed to shift with individual characteristics. The wealth variable that was previously described is included as a possible individual characteristic, to test for different reporting scales across the two wealth groups (Rice, Robone and Smith 2012; Tandon et al. 2003).

[5] The exception is the 'learning' health domain, where vignette three is rated to have overwhelmingly good health.

[6] See footnote 7.

[7] The two major assumptions for the HOPIT model are response consistency and vignette equivalence. Response consistency means that individuals use the same reporting scale to judge vignettes as they do to judge their own health. Vignette equivalence entails that individuals use the same health ranking of a vignette within a specific health domain. Previous studies have tested the validity of these assumptions (Bago d'Uva et al. 2011; Hirve et al. 2013; Salomon, Tandon and Murray 2004).

Suppose that $H_{T_{ij}}^{v}$ represents the true fixed level of health for hypothetical **v**ignette[8] number **j** for respondent **i.**[9] Then the observed health of vignette **j** by respondent **i** is defined as AH_{ij}^{v}. In a survey questionnaire where the vignette and self-assessed health questions have five possible categories, the observed cut-points and the actual cut-points relate to one another in the following way:

$$H_{T_{ij}}^{v} = \alpha_j + \varepsilon_{ij}$$

$$AH_{ij}^{v} = m \; if \; s_i^{m-1} \leq H_{T_{ij}}^{v} \leq s_i^{m}$$

$$for \; s_i^0 = -\infty, s_i^5 = \infty \; \& \; m = 1, \ldots, 5$$

And $s_i^1 < s_i^2 < s_i^3 < s_i^4 < s_i^5$ (1)

(Tandon et al. 2003)

Additionally, the cut-points s_i^m can be expressed as a function of a series of covariates (including one for wealth). Equation (1) can be rewritten as:

$$AH_{ij}^{v} = m \; if \; X_i'\beta^{m-1}{}_j \leq H_{T_{ij}}^{v} \leq m \; if \; X_i'\beta^{m}{}_j \quad (2)$$

(Tandon et al. 2003)

The second component of the HOPIT model is the *health equation*. In this component, the cut-points that are calculated in the *reporting behaviour* component are used and fixed to the self-assessed health question on the same health domain. The self-assessed health equation is the ordinal self-assessed health indicator in a specific health domain, regressed onto a set of individual characteristics. The variance is set equal to 1 for identification. Since the cut-points are fixed, this component is similar to an interval regression model.

The fixed cut-points are dependent on a set of individual characteristics, so that self-assessed health can be purged of any reporting heterogeneity, and the resulting health figures are considered unbiased. By comparing the purged health figures to the original health figures, it is possible to establish if the difference is significant and whether reporting heterogeneity was present (King et al. 2004; Rice, Robone and Smith 2012; Tandon et al. 2003).

$$H_{T_i}^{S} = \beta_i X_i + \varepsilon_2$$

$$SAH_i^S = m \; if \; s_i^{m-1} \leq H_{T_i}^{S} \leq s_i^{m}$$

$$for \; s_i^0 = -\infty, s_i^5 = \infty \; \& \; m = 1, \ldots, 5$$

And $s_i^1 < s_i^2 < s_i^3 < s_i^4 < s_i^5$ (3)

(Tandon et al. 2003)

8 The v superscript indicates that the equation refers to a vignette.

9 Under the vignette equivalence assumption, $H_{T_{ij}}^{v}$ can be specified as an intercept and a random error term.

5 Results

5.1 Descriptive statistics

In Table 3, a summary of the covariates (X_i) that will be included in the analysis, aggregated by wealth status is displayed. This includes a dummy variable that is equal to one if the respondent is female, an age variable, level of education, marital status and race. Also included in the analysis will be the wealth status variable, 'poor'.

The descriptive statistics show that the sample is approximately 55 per cent female and 62 years of age on average. The non-poor population is significantly more likely to be married and have higher levels of education. The poor consist largely (80 per cent) of people from the African black population group, while only half (50 per cent) of the non-poor are African black. Persons from the Asian, Indian and white population groups fall almost completely into the non-poor category. Approximately 20 per cent of the people in the represented population have health insurance. This is slightly higher than the 14 per cent estimated by Econex (Econex 2009b), but is expected given that the sample only covers persons aged 50 years and above. Health insurance membership is concentrated amongst the top three wealth quintiles.[10]

Table 3: Summary of covariates

		Non poor	Poor	Diff.
Female		0.55	0.55	0
Age		62.61	62.3	.33
Never married		.11	.18	.04***
Married		.54	.36	.18***
Widowed		.27	.28	-.01
Years of education		8.53	6.2	2.32***
Race	Black	.50	.81	-.31***
	Coloured	.23	.17	.06***
	Asian/Indian	.14	.01	.13***
	White	0.13	0.01	.12***

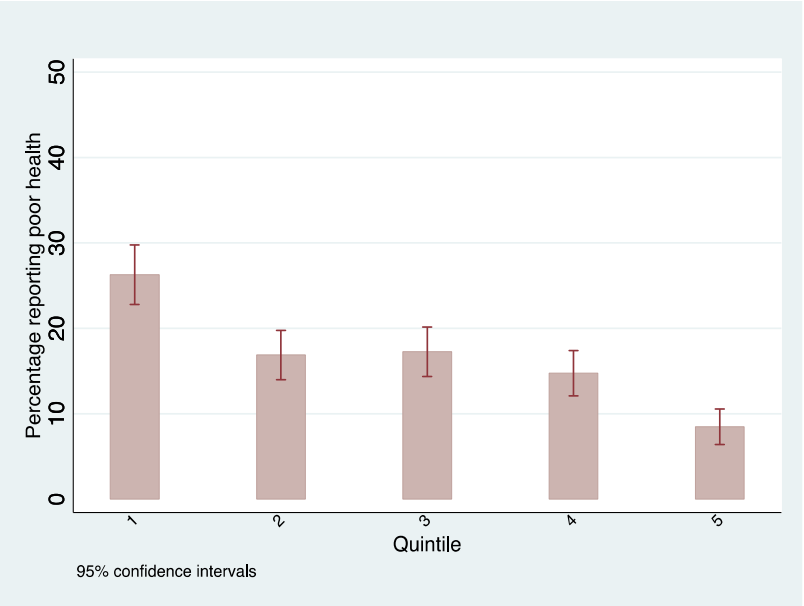
Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations based on the WHO SAGE (2008) data.

Figure 1 displays the differences in overall self-reported health across wealth quintiles for the SAGE data. Persons from the lower income quintiles are significantly more likely to report poor health than persons from quintile five (the richest quintile). However, according to the proposed coping strategy, these health gaps are underestimated, and the health inequalities are much larger.

[10] Private health insurance membership is not included in the final model.

Figure 1: Percentage reporting poor health by wealth quintile



Source: Author's calculations based on the WHO SAGE (2008) data.

5.2 Testing for reporting heterogeneity

The output from the HOPIT models makes it possible to test whether the poor and the non-poor use different reporting scales (reporting heterogeneity). Reporting heterogeneity can be established by testing for the joint significance of the poor/non-poor variable across the cut-points of the *reporting behaviour* component of the HOPIT model (Jones et al. 2007). Once reporting heterogeneity has been established, one can also test whether the shift in reporting scales is parallel or whether reporting heterogeneity differs at various levels of health. That is, whether the effect of the wealth variable on self-reported health is equal across all thresholds (cut-points).

The *p*-values of these two tests in each of the eight health domains are presented in Table 4.[11] At a 10 per cent significance level, the null hypothesis of wealth-reporting homogeneity can be rejected in all eight remaining health domains.

In the health domains where reporting homogeneity was rejected, the poor and the non-poor systematically used different reporting scales when analysing their health. The results from the second column reveal that the null hypothesis of a parallel cut-point shift cannot be rejected for five of the eight health domains.[12] The reporting differences by wealth group in these health

[11] In this analysis, I will only present the results for the wealth variable covariate.

[12] The coefficient estimates of the wealth variable in the cut-points are shown in Appendix Table A1. The table reveals that in the three health domains where a parallel cut-point shift was rejected (nearsightedness, self-care and appearance), the poor have higher thresholds at better levels of health. A poor respondent is more likely to rate the vignette's difficulty with self-care and appearance as 'none' (as opposed to 'mild') and would rather opt for the 'mild' category than the 'moderate' category. In contrast, the significant and negative coefficient for cut-point 4 for the appearance health domain reveals that the poor also systematically opt for the most extreme categories of the health scale when they rate the health of a poor health state vignette (they would choose 'extreme' rather than 'severe'). For the appearance health domain, the poor have stricter health standards at poor levels of health, and very lenient health standards at good levels of health. This is only true for the 'Difficulty maintaining appearance' health domain.

domains are characterized by a uniform shift of the thresholds, even if the direction of the shifts is not yet clear from these tests.

Table 4: Test for reporting heterogeneity and parallel cut-point shift in vignettes severity ratings– p-values

Health domain	Reporting homogeneity	Status	Parallel cut-point shift	Status
Moving around	0.0101	Reject	0.5260	
Vigorous activity	0.0249	Reject	0.1560	
Depressed	0.0274	Reject	0.7789	
Body pains	0.0372	Reject	0.4045	
Farsighted	0.0601	Reject	0.7558	
Nearsighted	0.0084	Reject	0.0861	Reject
Grooming	0.0029	Reject	0.0083	Reject
Appearance	0.0001	Reject	0.0000	Reject

Source: Author's calculations based on the WHO SAGE (2008) data.

Given that these tests show that self-reported data are likely to be biased in the tested health domains, they can be used to gain valuable insight into the poor population's actual levels of health versus their perceived levels of health.

Although reporting heterogeneity can be established in Table 4, it remains unclear in which direction this bias is going. By comparing the results from the second component of the HOPIT model (the unbiased estimates of SAH) to the results from a self-assessed health equation ordinal probit estimator (where reporting heterogeneity has not been taken into account), it is possible to see whether the coefficient estimate will increase or decrease once reporting heterogeneity is taken into account.

In Table 5, the coefficient estimates of the wealth variable for the specific health domains are reported for both the ordered probit and the HOPIT models. Since the SAH variable measures the difficulty that the respondent experiences in health domain x (where '1' indicates no difficulty and '5' indicates extreme difficulty), a positive coefficient indicates a worse state of health.

In almost all of the eight health domains, the coefficient estimate changed signs from negative to positive after taking reporting differences into account. Prior to taking reporting heterogeneity into account, the poor were more likely to report a better level of health in a specific health domain than the rich. However, after controlling for reporting differences and the various other individual characteristics (X_i), the poor are more likely to have worse levels of health in these domains. In the one health domain (vigorous activity), where the coefficient estimate does not switch signs, the coefficient estimate still increases and becomes close to zero.

Therefore, in all eight health domains where the poor were likely to use a different reporting scale than the non-poor, the poor were likely to be under-reporting their ill health. The results show that the poor are worse off than they perceive themselves to be in terms of their health. Even though it is not possible to say so with statistical precision, the results indicate that relying on self-reported health measures to measure disparities by income groups could lead to an underestimation of the disparities.

Table 5: Coefficients of poor variable from ordered probit and HOPIT

	Ordered probit	HOPIT	Difference
Moving around	-0.0324	0.0924	0.1248
	(0.0542)	(0.0822)	
Vigorous activity	-0.112**	-0.0366	0.0754
	(0.0492)	(0.0886)	
Depressed	-0.127***	0.00213	0.12913
	(0.0492)	(0.0762)	
Body pains	-0.0428	0.0505	0.0933
	(0.0467)	(0.0761)	
Farsighted	-0.0273	0.0907	0.118
	(0.0481)	(0.0631)	
Nearsighted	-0.0500	0.0920	0.142
	(0.0485)	(0.0649)	
Grooming	0.0284	0.235**	0.2016
	(0.0664)	(0.110)	
Appearance	0.0634	0.262**	0.1986
	(0.0668)	(0.113)	

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations based on the WHO SAGE (2008) data.

5.3 Robustness check

To test for the robustness of the results, I change the specification of the wealth variable. In the new classification, persons in the bottom three wealth quintiles are classified as poor and the top two quintiles are classified as non-poor. The results are presented in Appendix Tables A2 and A3. The test for reporting heterogeneity (Table A2) reveals that reporting heterogeneity can only be rejected in five out of the eight health domains now. In the three domains where reporting heterogeneity is not rejected at a 10 per cent level, namely *moving around, vigorous activity* and *body pains*, reporting differences are driven by the poorest quintiles (quintiles one and/or two), and persons from quintile three have a similar reporting behaviour to persons from the top quintiles. When it comes to assessing difficulty with bodily pain and mobility, the very poor are optimistic about their ability despite their disadvantage.

Appendix Table A3 compares the results of the ordered probit to the HOPIT model with the new wealth classification. The results can be interpreted in the same way as the results from Table 5, namely a positive coefficient indicates a higher level of difficulty in a specific domain. In all the health domains, once reporting heterogeneity is controlled for, the level of difficulty a poor person experiences in a specific domain becomes worse. The results are therefore also indicative of the poor underestimating their health needs.

6 Discussion: Health perceptions, health demand and the National Health Insurance

These results are indicative that all health inequalities measured on self-reported data are likely to be under-capturing the gap between poor and non-poor health outcomes. This not only includes the ordinal SAH question, but also self-reported acute and chronic conditions, or components of the 'activities of daily life'. If the poor are less likely to perceive themselves as ill, they are less likely to report their illness.

Policy initiatives that aim to remove barriers to access on the supply side will help to realize unmet health needs. This includes a move towards more quality home-based community care visits (Sauerborn et al. 1996a), subsidized patient transport systems for referrals (Ataguba and McIntyre 2012), or high-quality public mobile health vans. The first phase of implementation of the NHI aims to improve supply side constraints, especially in primary healthcare (Marten et al. 2014).

The feasibility of NHI in South Africa is a topic that is currently being discussed extensively since the South African government announced its goal to achieve universal coverage (Econex 2009a). Implementing the NHI in South Africa would mean greater access to better-quality healthcare for those who need it but are unable to afford it. If the preliminary evidence is true, if the poor are more likely to ignore their illnesses due to their inability to cope with the economic costs, then the NHI will help them to realize certain health needs. However, based on the design of the proposed NHI, realization of health needs will also hold certain implications for its sustainability.

Several authors have argued that the benefits of health services should be distributed within a country by healthcare need, as opposed to their ability to pay (Wagstaff and Van Doorslaer 1993; McIntyre and Ataguba 2011). This concept is referred to as social solidarity, and is one of the core building blocks of universal health coverage (Econex 2009a; Mills et al. 2012). The second underlying concept of a feasible universal coverage system is that those with greater health needs should benefit most from the healthcare system.

Ataguba and McIntyre (2012) show that even though healthcare financing is broadly progressive in South Africa, the benefits received from the system are largely attributed to the rich who have relatively better health than the poor. Even though public health spending has become significantly more pro-poor since 1994 (Burger et al. 2012), the distribution of benefits remains inequitable (Ataguba and McIntyre 2012) and the quality of public healthcare to which the poor have access remain inadequate (Burger et al. 2012).

If the poor are under-reporting their ill health, their health needs will go unrealized and unmet. Since financing of the NHI is based on a model of cross-subsidization from those who can afford to pay for healthcare to those who cannot afford to pay for healthcare, then an underestimation of the health needs of those who cannot afford to pay ('non-contributing individuals') will decrease the sustainability of NHI financially (Econex 2009a). Establishing the true health needs of vulnerable sub-groups is becoming increasingly important with the planning of the NHI.

7 Conclusion

The analysis provides evidence that when self-reported health measures are used to calculate health inequalities across income groups, the results are likely to be biased and underestimated. From an operational perspective, this could undermine the sustainability of the planned National Health Insurance.

One possible reason for why the poor in South Africa underestimate their health needs is the self-censoring of their reported health needs (if health needs are measured using prevalence of poor health and illness). If this is the transmission mechanism that causes a systematic underestimation of ill health by the poor, then providing access to higher quality services at lower cost will work to decrease the reporting bias.

In conclusion, policies aimed at decreasing health inequalities amongst South Africans should not only be aimed at improving the quality of public healthcare, but should also address the differences in health perceptions between the poor and the non-poor (Harris et al. 2011). Although private

health insurance providers often focus on the demand side of health and devise ways to promote prudent health behaviour, the public healthcare sector predominantly still focuses on improving the supply side. However, supply side interventions will prove fruitless if the demand side attitude is lacking.

Appendix

Appendix Table A1: Coefficients of wealth variable in the cut-points

	Cut-point 1	Cut-point 2	Cut-point 3	Cut-point 4
Moving around	0.135**	0.103*	0.137**	0.216***
	(0.0609)	(0.0588)	(0.0584)	(0.0706)
Vigorous activity	0.153**	0.116**	0.0389	0.143**
	(0.0633)	(0.0591)	(0.0567)	(0.0618)
Depressed	0.149**	0.121**	0.115**	0.174***
	(0.0639)	(0.0589)	(0.0552)	(0.0662)
Body pains	0.115*	0.0625	0.143**	0.157**
	(0.0621)	(0.0551)	(0.0556)	(0.0775)
Farsighted	0.115**	0.0883*	0.124**	0.135**
	(0.0539)	(0.0522)	(0.0519)	(0.0621)
Nearsighted	0.168***	0.0815	0.102**	0.0959
	(0.0550)	(0.0527)	(0.0516)	(0.0600)
Grooming	0.207***	0.205***	0.0692	-0.0706
	(0.0637)	(0.0606)	(0.0634)	(0.0717)
Appearance	0.175***	0.230***	-0.0161	-0.142**
	(0.0642)	(0.0607)	(0.0637)	(0.0704)

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations based on the WHO SAGE (2008) data.

Appendix Table A2: Test for reporting heterogeneity and parallel cut-point shift in vignettes severity ratings with new wealth variable - p-values

Health domain	Reporting homogeneity	Status	Parallel cut-point shift	Status
Moving around	0.2799		0.9510	
Vigorous activity	0.5383		0.6910	
Depressed	0.0028	Reject	0.9595	
Body pains	0.7161		0.8708	
Farsighted	0.0000	Reject	0.0691	Reject
Nearsighted	0.0003	Reject	0.0709	Reject
Grooming	0.0072	Reject	0.0037	Reject
Appearance	0.0481	Reject	0.0239	Reject

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations based on the WHO SAGE (2008) data.

Appendix Table A3: Coefficients of new poor variable from ordered probit and HOPIT

	Ordered probit	HOPIT	Difference
Moving around	-0.00541	0.0989	0.10431
	(0.0554)	(0.0829)	
Vigorous activity	-0.135***	-0.123	0.012
	(0.0501)	(0.0892)	
Depressed	-0.162***	0.00196	0.16396
	(0.0504)	(0.0764)	
Body pains	-0.0498	-0.00915	0.04065
	(0.0480)	(0.0780)	
Farsighted	0.0476	0.285***	0.2374
	(0.0497)	(0.0658)	
Nearsighted	0.0362	0.231***	0.1948
	(0.0499)	(0.0674)	
Grooming	0.0202	0.176	0.1558
	(0.0677)	(0.113)	
Appearance	0.0529	0.152	0.0991
	(0.0687)	(0.117)	

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations based on the WHO SAGE (2008) data.

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