

# Measuring health gaps between the rich and the poor: a review of the literature and its implications for health research in Africa

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## Abstract

Measuring variations and gaps in health and wellbeing across individuals, social groups and societies is a critical issue confronting social scientists in their quest to explain why gaps in health between the rich and the poor persist within and across societies. This article provides a systematic review of the measurement of inequalities and their implications on rural and remote health. A comprehensive literature review was conducted using online databases and other collections of published research on measuring health gaps between the rich and the poor in order to trace the development of this field of inquiry. Despite the enormous information on the subject area, it is not always easy to disentangle the *independent* effects of social class or socio-economic status (SES) on health inequalities from genetic or biological differences when analyzing racial/ethnic, gender or age gaps in mortality and morbidity. The meaning of SES or social class also varies from one culture to the other. Despite decades of work in this field, it is not clear what it is about SES or social class that is associated with inequalities in health. Is it simply a question of access to resources? And on the issue of measurement, studies from various disciplines have shown that it is important to employ a raft of measures in order to measure and present the distributions fully from various angles and value judgments. In the rural African context, tackling vertical and horizontal inequalities in health requires tackling the root causes of poverty and promoting social policies that empower individuals and communities. Hence, the review discusses recent methodological developments that hold promise for addressing the knowledge gap that remain. We hope that researchers will reflect on the dynamics in measures of inequalities discussed in this paper as they continue to assess the status of health in Africa's contemporary and largely dominated rural population.

## Introduction

The desire to measure progress in reducing the burden of excess morbidity and mortality as well as the need to establish reasons for existing health gaps between the rich and the poor continues to persist within and across societies. This desire also continues to propel efforts aimed at examining vertical and horizontal inequalities in health by the international community as evidenced by the ongoing efforts to assess progress towards the achievement of the Millennium Development Goals (MDGs).<sup>1-7</sup> Although inequalities in health began to draw the attention of most public health experts in the 19<sup>th</sup> century, disparities in health and wellbeing across individuals, social groups and societies have always been part of human history.<sup>8,9</sup> Pioneering work on inequalities in health was conducted as early as the 19<sup>th</sup> century by prominent French, English, and German public health figures such as Villerme, Chadwick, and Virchow.<sup>9</sup>

Since the 1980s, a great deal of research by sociologists, demographers, economists and public health practitioners has focused on inequalities in morbidity and mortality. The stimulus for much of this research was moral outrage that followed the publication of *The Black Report* in 1980 in the United Kingdom. This report concluded that inequalities in health had widened even though Britain had introduced universal access to healthcare.<sup>10,11</sup> Although tremendous economic and medical progress had been made, western societies continued to struggle to understand why inequalities in health continue to exist. Currently, the debate on inequalities in health is also dominating the research and policy agenda in developing countries.<sup>12,13</sup> In fact, inequalities in health seem to be increasing between social groups within nations as well as across countries as evidenced by increasing socioeconomic disparities in mortality in western societies like the United States and Britain as well as the higher levels of infant and adult mortality and lower life expectancy among the poor in developing countries.<sup>8,14,15</sup> The etiological mechanisms that account for these health disparities also continue to be a mystery. These difficulties explain to some extent why there is no consensus on the most effective strategies for the reduction of health gaps within communities and across societies.

Since a comprehensive review of the literature on inequalities in health and the various approaches used to examine them is beyond the scope of any one paper, this review has a rather limited focus. For a comprehensive review, readers can refer to the growing multidisciplinary literature on the measurement of inequalities in health.<sup>5,9,16-21</sup> In this review, we

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Key words: Africa, health inequalities, life expectancy, socio-economic status, Millennium Development Goals, mortality.

Dedication: this work is dedicated to Dr. Amadou Noubissi who started the research but unfortunately passed away. Dr. Henry V. Doctor and Amson Sibanda concluded the project, which is published in his honor and memory.

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examine and discuss some common measures of inequalities in health that have been used in various multidisciplinary studies that we find to have been particularly useful in advancing the state of the art and that can also be used in the rural African context. Tools that allow researchers to better measure health inequalities are indispensable for monitoring pro-equity and pro-poor progress towards the MDGs. We further examine how the main findings of inequalities in health studies have informed science and policy.

Although our focus is reviewing measures of health inequalities that could be utilized in the African context, which is largely rural, research limitations prevent a thorough review of these measures. Consequently, we extensively review measures of inequalities in health that have been used in developed societies since very little research has employed similar techniques in Africa. The major exceptions are studies that have documented socioeconomic inequalities in child and adult mortality, child malnutrition (stunting and underweight) as well as inequalities in knowledge of HIV/AIDS.<sup>22-28</sup> In this research, women with lower levels of schooling or social status have higher levels of child mortality. Work on HIV/AIDS is increasingly showing that individuals from lower socioeconomic backgrounds as well as women tend to be associated with higher risks for sexually transmitted infections, including HIV/AIDS. Research has also shown that the disadvantaged tend to have lower knowledge of how to prevent HIV/AIDS when

compared with individuals from higher socioeconomic groups. However, the differential vulnerability of the extremely poor such as urban slum dwellers has not been adequately examined. There is currently a growing need to examine inequalities in health among those with very limited access to safe water, adequate food, housing and medical care as evidenced by the establishment of the Navrongo Health Research Center in northern Ghana and the Nairobi Urban Health Equity Gauge (NUHEG) in Kenya. In addition, we know very little about inequalities in self-rated health in Africa such as functional disabilities that hamper one's ability to carry out everyday tasks and other indicators of psychological wellbeing.

## Methods of research

We reviewed the literature about measures of health inequalities, with a specific focus on measures that can be used within the largely rural African context. MEDLINE was the main database used for the search. We used two key terms: *measuring health inequalities* and *measuring health inequities*. Inclusion criteria included articles that discussed measures that can be utilized in the African context or those that discussed socio-inequalities in child and adult mortality, child malnutrition and inequalities in knowledge of HIV/AIDS. Articles were finally included that defined inequalities, discussed the various measures in terms of their advantages and disadvantages, as well as those that provided information on their applicability within the African context. The literature search also included a number of relevant published and unpublished reports, working papers and other discussion papers. These were obtained from economic and medical libraries and also the Internet. Some of the reports were also obtained using search engines such as Google Scholar.

## Results

The search identified over 1676 potential articles. Sixty-six articles and/or reports (representing 3.9% of the search results) met the inclusion criteria and were included in this review. The key issues from these articles are discussed below.

## Defining inequalities

In order to place health gaps between the rich and the poor at the center of policy debates, there is a need to critically think

about both conceptual and measurement issues related to inequalities in health. Progress towards reducing these inequalities rests on the ability of researchers to identify and measure the extent and magnitude of all facets of inequalities in morbidity, mortality, disability and self-reported wellbeing. This will provide the leverage to determine the true magnitude of the health gaps and also of monitoring progress towards their elimination. Thus, before discussing measures of health inequalities, we first consider the meaning of *health inequalities*, *inequalities in health*, or *inequities in health*. Do these concepts or indicators refer to the same thing? The following definitions show that various researchers understand these concepts differently.

Inequities in health/health inequities are often defined as:

... *avoidable inequalities that are unfair and unjust. In reality, however, the term is mainly applied to unfair and unjust differences in access to health services between regions and population subgroups within a country*<sup>29</sup> (p. 592).

This is different from the concept of inequalities in health, which is defined as:

... *systematic differences in morbidity and mortality rates between individual people of higher and lower socioeconomic status to the extent that these are perceived to be unfair*<sup>30</sup> (p. 4).

or

... *a broad range of differences in both health experience and health status between countries, regions, and socioeconomic groups. Most inequalities are not biologically inevitable but reflect population differences in circumstances and behavior that are in the broadest sense socially determined*<sup>29</sup> (p. 592).

The existence of these distinctions poses a number of issues. First, these contrasting perceptions have affected the way research questions in this field have been formulated. Researchers with an interest in the health of the poor have been concerned primarily with improving the health of that group alone, rather than with reducing differences between the rich and the poor.<sup>19</sup> In contrast, researchers interested in equality issues tend to focus their attention on reducing the health gradient between the rich and the poor while *righting the injustice represented by inequalities or poor health conditions among the disadvantaged* is the primary concern of those interested in health inequities. In addition, other scholars<sup>30</sup> contend that given the lack of universal access to health services, developing country researchers have approached inequalities in health as a problem that needs to be tackled by formulating policies that can guarantee a more equitable provision of health care services. In contrast, European researchers have been primarily concerned with the mech-

anisms that create socioeconomic disparities or gradients in morbidity and mortality while researchers in the United States have been interested in understanding the correlates of inequalities in incidence of disease. The second issue is whether these contrasting perceptions have affected the way inequities or inequalities in health have been measured resulting in the *mismeasure* of the true variance in health disparities between the rich and the poor. Berkman and Macintyre<sup>31</sup> sum up this problem by noting the following: *it is clear from the history of social inequalities in health that different investigators often conceptualize the same measures as being operationalizations of different underlying constructs* (p. 60). This has often led to different interpretations of the same phenomena.<sup>32</sup> Given these issues, the task of generating a comparative set of health equity or inequality indicators has been a difficult one. Our understanding of the nature and magnitude of health inequalities between social groups or across nations is further affected by the measure of inequality used. Some measures are continuous or ordinal while others capture absolute differences as opposed to relative differences.<sup>21,32</sup>

A complementary measurement issue we have is how to separate the rich from the poor and what empirical indicators of social class or socio-economic status (SES) one has to use to describe the distribution of health.<sup>20</sup> For instance educational attainment is the most common measure of SES in developing countries. The use of education as an SES indicator in developing countries has three distinct advantages. First, it is somewhat fixed early in adult life, so it is a relatively stable measure of SES.<sup>33</sup> Second, education has been shown to be a very strong and consistent indicator of morbidity and mortality in various parts of the world. Third, the existence of comparable educational systems in developing countries such as those developed by the British in Anglophone Africa as well as those developed by the French in Francophone Africa gives researchers the leverage to make valid cross country comparisons of inequalities in health using years of schooling completed as a consistent indicator of SES. The social hierarchy captured by different levels of schooling does not vary across most African societies and over time as compared to say occupational groupings.

In addition to education, household standard of living indices derived from consumer durable goods data and indicators of housing quality are also gaining in popularity in developing countries (Bawah AA, unpublished Ph.D. dissertation, 2002).<sup>34-37</sup> These indices have allowed researchers to circumvent the absence of income and wealth data in developing countries. In contrast, income, education and occupation are the most popular indicators of SES or social class in North America while occupa-

tion is commonly used in Europe.<sup>8,17,31</sup> These differences in the types of measurements used are largely the result of the types of SES data that are routinely collected in these countries as well as their perceived importance. Thus, because of the differences in types of SES data used, there is bound to be considerable variation in the accuracy and reliability of SES measures across communities and societies as well as the magnitude/gradient of the relationship between SES and health outcomes.<sup>38</sup> It also makes it difficult to compare inequalities in health measures between countries with different traditions of classifying social classes. When measuring inequalities in health, these different SES indicators pose additional problems since we do not know all the pathways linking them to various health outcomes. There have been no easy answers to the question: what is it about SES per se that accounts for health disparities between the rich and the poor? Some studies have shown that *education affects health both through and independent of its impact on income*<sup>8</sup> (p. 116), while other studies have shown that inequalities in health between racial groups still persist after controlling for SES.<sup>39,40</sup> In addition, research focusing on health disparities across racial groups in the United States has also tried to determine if there is a positive or negative link between health environments in childhood and death probabilities across the life cycle.<sup>41-45</sup> The main finding from these studies is that individuals from disadvantaged childhood backgrounds tend to have elevated risks of morbidity, disability and mortality in later life when compared with individuals who grew up in privileged circumstances.

Examining these issues in developing country settings has been hampered by the lack of appropriate data. This situation might change given the establishment of Health and Demographic Surveillance Systems (HDSS) in largely rural areas of African and Asian countries. Given their strategy of collecting detailed demographic, socioeconomic and health information from all persons and households on a regular basis, HDSS systems have immense potential to collect reliable information on childhood socioeconomic circumstances and disease environments which can then be linked to health disparities across the life cycle. These data will undoubtedly give researchers the leverage to better understand the direction of causation between childhood socioeconomic circumstances and adverse health outcomes in later life. It will also be possible to examine if childhood conditions are related to disparities in adult morbidity and mortality both through and independent of socioeconomic conditions in later life. Thus, it is important to pay close attention to the numerous ways in which very diverse societies and population groups can influence the way

inequalities in health between the rich and the poor are measured. The magnitude of inequities in health can be determined by individual and community-level data since the social determinants of health are a product of both individual behavior as well as the distribution of resources within society.<sup>46</sup>

## Measuring inequalities in health

Although the emphasis of research in the area of inequalities in health is on measuring and documenting health gradients between individuals and socioeconomic groups as well as on explanation, considerable attention has also been placed on cross-country differences as well as on small-area analysis. If we assume that individuals cluster in areas with individuals of similar risks, and if the geographical areas across countries are of similar size, then the results of small area analysis might be comparable and meaningful.<sup>20</sup> The variety of summary measures for capturing the magnitude of inequalities in health at these various levels generally fall into two families: individual-mean differences and inter-individual differences.<sup>21,47</sup> The first group of measures captures inter-individual differences in health and this includes relative mean deprivation, the Atkinson index and the Gini coefficient. These measures are popular in the economic literature. The second group includes measures that highlight inter-group differences in health such as the concentration index, the slope index of inequality, the index of dissimilarity, rate ratios, low to high ratio, and rate difference. These measures have largely been drawn from demography, sociology, and epidemiology. The use of any one of these measures in a particular society is heavily influenced by data availability as well as its intended use. Table 1 summarizes these principal measures.<sup>48-58</sup> No effort is made to neither summarize the principal findings of each methodology nor discuss the contents of Table 1 further. However, we synthesize the discussion based on the review of the merits and demerits of the measures presented in Table 1. Readers can refer to the specified references for detailed descriptions and other attributes.

## Discussion

This review demonstrates that a number of issues have to be taken into consideration in the study of measures of inequalities or inequities in health. The review showed that it is not always easy to disentangle the *independ-*

*ent* effects of social class or SES on health inequalities from genetic or biological differences when analyzing racial/ethnic, gender or age gaps in mortality and morbidity. In addition, the meaning of SES or social class also varies from one culture to another. Given the different types of SES data collected in various parts of the world as well as their perceived relevance to health inequalities, efforts to make meaningful cross or within country comparisons of health inequalities might be undermined.

Despite decades of work in this field, the jury is still out when it comes to determining what it is about SES or social class that is associated with inequalities in health. Is it simply a question of access to resources? If it is a question of access, some researchers have questioned why the gradient in health inequalities is monotonic and not linear.<sup>7,59</sup> It has also been noted that *poor health could lead to low income just as low income could lead to poor health*<sup>21</sup> (p. 52). Research has also shown that some measures of health inequality such as national averages often conceal the true magnitude of inequality. For instance, regional infant mortality rates have often been found to differ markedly from national averages.<sup>60</sup> Another puzzling finding has to do with inequalities in self-reported health. Several studies have shown that the poor in both developed and developing societies are more prone to report less illness as compared to the well-to-do despite the fact that they have more disadvantaged backgrounds.<sup>20,61</sup> Thus, the magnitude of health inequalities within social groups or across nations can vary substantially depending on what measure one chooses to use to measure health inequalities.<sup>18,38</sup> And on the issue of measurement, studies from various disciplines have shown that it is important to employ a raft of measures *in order to measure and present the distributions fully from various angles and value judgements*<sup>62</sup> (p. 7).

## Implications on science and policy

The implications of studies on measuring inequalities in health on science have been substantial. First, a large body of recent research on inequalities in health has tried to show that individual attributes (*e.g.*, income, education, and occupation) and the socioeconomic characteristics of the communities they live in are related to the incidence of certain diseases, average levels of mortality and life expectancy. This body of work has shown that wider disparities in income within a society are associated with higher levels of mortality and lower probabilities of surviving to adult-

**Table 1. Summary measures of inequalities in health and selected attributes.**

Measure	Selected characteristics
The Gini Coefficient (G) and Lorenz curve	Based on the Lorenz curve, an accumulated frequency that measures health inequalities among a specific population Most popular <sup>32</sup> and successful measure in economics and extensively applied in many studies on inequalities <sup>48,49</sup>
Pseudo Lorenz curves	Based on grouped data. Population is distributed into social classes, which are ranked by health Because the classes are ranked by their health, the Pseudo Lorenz curve, just as the Lorenz curve fails to establish the association between the inequalities in health and SES Both Lorenz and Pseudo Lorenz curve are unable to verify if persons with the poorest health (the sickest) belong to the lower socioeconomic class or not <sup>18</sup>
PCA	A statistical technique for data reduction; reduces the number of variables in an analysis by describing linear combinations of the variables that contain most of the information in the original variables (Stata Statistical Software: Release 7.0.; 2001. StataCorp., College Station, TX, USA) <sup>50</sup> PCA reduces $n$ dimensional system into fewer dimensions. For <i>e.g.</i> , a set of $n$ SES indicators $x_1, x_2, \dots, x_n$ , representing ownership of $n$ assets in each household, PCA can transform this $n$ dimensional random vector $(x_1, x_2, \dots, x_n)$ into fewer dimensional SES variable $y_j$ . That is, $y_j = a_1x_1 + a_2x_2 + \dots + a_nx_n$ The variable $y_j$ is divided into quintiles of the asset index and the value of each indicator (health, nutrition, etc.) (Bawah AA, unpublished Ph.D. dissertation, 2002) <sup>36</sup>
Poor-rich ratio indicator	Can be considered a by-product of PCA or any measure that produces ratios by socioeconomic group <sup>32</sup> If ratio >1 it means that the poor are at a disadvantage. If <1 it means that the poor are at an advantage
Concentration index (CI)	CI relates SES to health. Individuals in a population are ranked in ascending order of income or some other indicator of SES (beginning with the poorest and ending with the richest) and not by a health variable <sup>48</sup> Uses a concentration curve to express the cumulative proportion of ill health experienced by each cumulative proportion of the population ranked by SES <sup>21</sup>
Health concentration index (C)	C is equal to twice the area between the concentration curve and the diagonal and provides a measure of the extent of inequalities in health that are systematically associated with SES <sup>18,32</sup> Lowest value, -1, occurs when all the population's health is concentrated in the hands of the most disadvantaged person. Maximum value, 1, occurs when all the population's health is concentrated in the hands of the least disadvantaged person Advantages: reflects the experiences of the entire population; sensitive to the distribution of the population across socio economic groups; also ensures that the socio-economic dimension to inequalities in health is taken into account because it ranks individuals by SES rather than by health
Range measures	Measures such as rate differences and rate ratios are the most common. Generally used to compare the range in rates of morbidity or mortality between the top and the bottom socio-economic groups <sup>21</sup> For <i>e.g.</i> , the <i>Black Report</i> showed that in 1970-71 men and women in occupational class V had a 2.5 times greater chance of dying than their professional counterparts in class I <sup>10</sup> Disadvantages: overlooks the dynamics of the intermediate groups. The gap between the top and the bottom groups might, for <i>e.g.</i> , remain unchanged, but the extent of inequality between the intermediate groups might be diminishing (or increasing). The range takes no account of the sizes of the groups being compared, which can lead to misleading results when comparisons are performed over time and across countries
Index of dissimilarity (ID)	ID identifies the amount of ill health or deaths that would have to be redistributed across socioeconomic groups in order for all groups to have the same mortality or morbidity rate <sup>21</sup> ID assumes that socioeconomic inequalities in health arise as a result of the inequitable distribution of resources. To solve the distribution problem, societies can reduce the level of mortality or morbidity among the poor by taking away some of the mortality or morbidity gains enjoyed by higher socioeconomic groups <sup>9</sup> Disadvantages: ID is insensitive to the socio-economic dimension to inequalities in health; does not pay particular attention to where high morbidity or mortality rates are located in any one particular socioeconomic group
Slope and relative indices of inequality (SII and RII)	Presented as a histogram, with the height of each bar indicating the level of ill health of the class in question and the width representing the relative size of the population in each class <sup>18</sup> The Slope Index then relates the rate of health problems to a measure of SES by means of regression analysis. The estimated slope is interpreted as the absolute difference in morbidity or mortality between successive socioeconomic groups
Other measures of inequalities	Other measures have been used to determine the nature and magnitude of health inequalities and these include life expectancy, health expectancy, disability-free life expectancy, disability-adjusted life years, QALYs, SMR proportional mortality rates, rate ratios and odds ratios <sup>33,51-54</sup> With a few exceptions, these measures have not been used to monitor the patterns and sizes of health inequalities in Africa. Others <sup>55</sup> examined gender and provincial disparities in disability-free life expectancy in South Africa Other measures include a combination of individual- and family-level characteristics with the socioeconomic characteristics of communities. These studies have shown that the effects of place of residence or community on morbidity and mortality persist over and above the effects of individual-level attributes and household-level SES <sup>39,56-58</sup>

SES, socio-economical status; PCA, principal components analysis; QALYs, quality-adjusted life years; SMR, standardized mortality rates.

hood.<sup>63,64</sup> By implication, this research suggests that to reduce inequalities in health, societies should reduce income inequalities or reduce poverty. Second, the World Health Organization (WHO) believes in sustained investment in the health of the poor. For instance, others<sup>29</sup> contend *under the leadership of Gro Harlem Brundtland, the WHO argued forcibly that health is key to reducing poverty and to development* (p. 591). These competing views simply show that there are contrasting positions on the most effective strategy to reduce inequalities in health. Should the creation of wealth through economic development be the main route to tackle health disparities as opposed to a strategy of making intelligent and equitable investments in social policies that have the greatest potential to improve the health and wellbeing of society? There is no doubt that in the rural African context, tackling inequalities in health requires tackling poverty. And lastly, adopting a life-course perspective to measuring inequalities in health is also good for policy since it is much easier to target age-specific or life-course specific interventions. For instance, governments can target the health needs of preschool children or adolescent mothers.

## Conclusions

While the aforementioned implications pertain to science and policy in general, there are measurement issues that are critical to rural and remote health. As people living in Africa's rural and remote areas progress towards the deadline (year 2015) for attaining the MDGs, it is not only access to health and other social services that must be improved. They also need to experience improved living conditions such as those available to their counterparts in the major cities. The degree to which people living in rural and remote areas are disadvantaged or have their health needs hardly addressed can be addressed using measures discussed here such as standardized mortality rates (SMRs) and quality-adjusted life years (QALYs).

The SMR, also defined as a weighted average of the age-specific rate ratios, compares the observed number of deaths in a cohort with an expected number obtained by applying the standard rates to the cohort age structure. One advantage of the SMR is that age-specific numbers of deaths are not required in its computation. It suffices to know only the total number of deaths, which are readily available in many African countries. However, because details on numbers of deaths by cause, subgroup and age are often not available from official publications for reasons related to economy (*e.g.*, space constraints and additional computational time), caution is required in inter-

preting the SMR since there is no way of evaluating the hypothesis of constant rate ratios that is needed to justify fully the use of the SMR. The SMR is also the preferred measure when analyzing cross-sectional data according to birth cohort rather than the calendar period since the age intervals for which data are available differ for different generations.<sup>65</sup>

The QALY has become a widely used measure of health benefits for evaluating health care programs particularly in sub-Saharan Africa where a number of interventions are being deployed as we count down to the MDGs deadline of 2015. Traditional outcome measures such as mortality are inadequate to compare healthcare interventions, which produce different outcomes across various disorders, and across various sub groups of people. The advantage of the QALY is its ability to simultaneously capture gains (or losses) from reduced (or increased) morbidity and extended survival, and combines these into a single measure. Nevertheless, the QALY has some limitations such as its inability to collect health related quality of life information from certain patients such as children and those with mental health problems.<sup>66</sup> Despite these shortfalls, the SMR, QALY, and other measures will provide, *inter alia*, the number of excess deaths and *poor* quality life years among people of rural and remote areas compared with their counterparts in major cities. This is very critical since majority of African countries, overwhelmed by critical national priorities, are struggling to provide the most basic health services to their rural communities. We hope that researchers will reflect on the dynamics in measures of inequalities discussed in this paper as they continue to assess the status of health in Africa's contemporary and largely dominated rural and remote population.

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