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Socioeconomic inequality in malnutrition in developing countries

Ellen Van de Poel [a], Ahmad Reza Hosseinpoor [b], Niko Speybroeck [c], Tom Van Ourti [a], Jeanette Vega [b]

Introduction

Epidemiological evidence points to a small set of primary causes of child mortality that are the main killers of children aged less than 5 years: pneumonia, diarrhoea, low birth weight, asphyxia and, in some parts of the world, HIV and malaria. Malnutrition is the underlying cause of one out of every two such deaths.[1,2] The evidence also shows that child death and malnutrition are not equally distributed throughout the world. They cluster in sub-Saharan Africa and south Asia, and in poor communities within these regions.[3,4] Disparities in health outcomes between the poor and the rich are increasingly attracting attention from researchers and policy-makers, thereby fostering a substantial growth in the literature on health equity.[5–8] “Socioeconomic inequality” in malnutrition refers to the degree to which childhood malnutrition rates differ between more and less socially and economically advantaged groups. This is different from “pure inequality”, which takes into account all factors influencing childhood malnutrition. The available literature documenting socioeconomic inequality in malnutrition focuses mainly on individual countries or regions.[9–14] At a more global level, Wagstaff and Watanabe[15] provided evidence on socioeconomic inequality in malnutrition across 20 developing countries. Other relevant cross-country studies include those of Pradhan et al.,[16] who describe total inequality, and Smith et al.,[17] who describe inequalities between urban and rural populations. The latter two studies, however, provide no evidence on socioeconomic inequality within developing countries.

This paper contributes to the literature in several ways. First, it updates and enlarges the evidence base on average malnutrition and socioeconomic inequality in malnutrition using the most recent Demographic and Health Survey (DHS) data from 47 developing countries. The inclusion of such a large number of countries makes it possible to obtain insights into the regional clustering of poor–rich malnutrition disparities in the developing world and into the association between the average level of malnutrition and socioeconomic inequality. Given the focus on average rates of malnutrition in international development targets, it is of interest to establish how countries compare in terms of average rates of malnutrition and inequality in malnutrition. In addition to quantifying the degree of socioeconomic inequality using a single index, this paper also illustrates the different patterns found for the distribution of malnutrition across socioeconomic groups.

Second, in this paper, childhood malnutrition is measured using the new growth standards that have recently been released by WHO.[18] The new standards are based on children from Brazil, Ghana, India, Norway, Oman and the United States of America, and adopt a fundamentally prescriptive approach that is designed to describe how all children should grow, rather than merely how they actually grew in a single reference population at a specified time.[19] For example, the new reference population only includes children from study sites where at least 20% of women were willing to follow breastfeeding recommendations. To the best of our knowledge, this is the first study that presents estimates of malnutrition based on these new standards in a large set of countries. To check the sensitivity of the results to this change in reference group, the analysis was also carried out using the older United States National Center for Health Statistics (NCHS) reference population.[20]

Finally, in this paper, socioeconomic inequality in malnutrition is measured using the concentration index, which takes into account inequality across the entire socioeconomic distribution. Usually, when it is applied to binary indicators, such as mortality and stunting, the concentration index depends on the mean of the indicator. This would impede cross-country comparisons because there are substantial differences in means between locations. To avoid this problem, we use an alternative but related index recently introduced by Erreygers.[21]

Methods

Data

The data used came from all 47 DHSs that contained information on the nutritional status of children aged up to 5 years. The data represent countries from four regions: 26 in sub-Saharan Africa, seven in the eastern Mediterranean, five in south and south-east Asia, and nine in Latin America and the Caribbean. Table 1 shows the countries and the characteristics of the data sets used.

Table 1. Characteristics of Demographic and Health Survey (DHS) data sets
html, 9kb

Analysis

Anthropometric data on the height-for-age and weight-for-height of children were used to quantify chronic and acute malnutrition, respectively. A small height-for-age reflects the slowing of skeletal growth, and is considered to be a reliable indicator of long-standing malnutrition in childhood. Low weight-for-height, on the other hand, indicates a deficit in tissue and fat mass, and this measure is more sensitive to temporary food shortages and episodes of illness. A low weight-for-age is also used in the literature to indicate malnutrition, but it is not used here as it does not discriminate well between temporary and more permanent malnutrition.[9, 20, 22]

A child was considered stunted or wasted if his or her height-for-age or weight-for-height, respectively, was two standard deviations or more below the median for the reference population.[9, 16] We used these crude binary indicators of stunting and wasting because their average values are much easier to interpret intuitively than continuous height-for-age and weight-for-age z-scores, and they, therefore, facilitate the comparison of stunting and wasting rates across socioeconomic groups and between countries.

This paper used the new WHO child growth standards that were released in April 2006.[18] The robustness of the paper's results against this change from the NCHS growth standards was also checked.[20]

An indicator of socioeconomic status was developed using principal component analysis.[23] This indicator combined information on a set of household assets and living conditions: the ownership of a car, phone, television, radio, refrigerator, bicycle and motorcycle; the availability of electricity, clean water and a toilet; and the material used to construct the wall, roof and floor of the household dwelling.

Socioeconomic inequality in stunting and wasting were calculated by means of a recently proposed generalization – introduced by Erreygers[21] (see also Van de Poel et al.[24] for an application) – of the traditional concentration index (C), which was proposed by Wagstaff et al.[25] This generalization overcomes several of the methodological shortcomings of the traditional concentration index while preserving its main characteristics: (i) negative values imply that malnutrition is more concentrated among poorer children, (ii) if all children, irrespective of their socioeconomic status, suffer equally from malnutrition, the concentration index would equal zero, and (iii) transferring malnutrition from a richer to a poorer individual reduces the concentration index. Of particular importance for this paper, it is worth mentioning that the generalization avoids dependence on the mean for the binary indicator (Wagstaff discussed a related issue for the bounds of the concentration index).[26] Not correcting for this dependence on the mean would impede cross-country comparisons because there are substantial differences in means between locations. In addition, it would result in a predetermined association between the average level of malnutrition and socioeconomic inequality.

Since the DHSs rely on multistage sampling procedures, all estimates take account of sampling weights, and statistical inference is adjusted for clustering at the level of the primary sampling unit. The statistical inference for the index recently proposed by Erreygers was based on an adapted version of the convenient regression approach.[27, 28]

Results

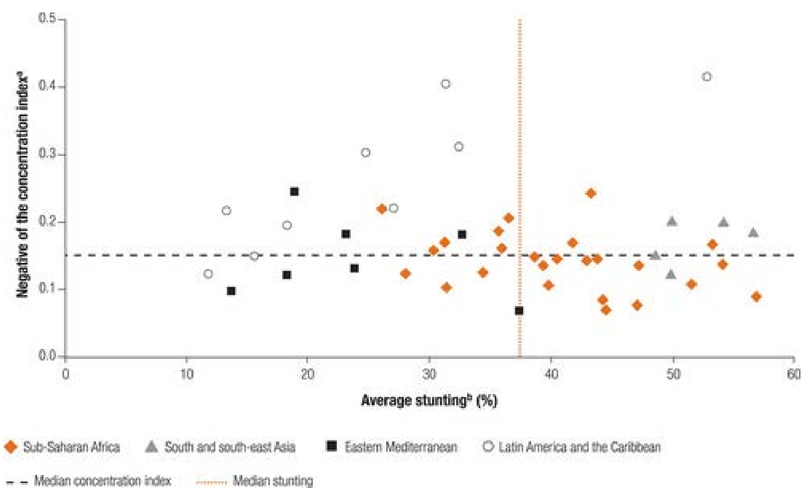
Table 2 shows socioeconomic inequality in stunting. In almost all countries, stunting disproportionately affected the poor. The concentration indices (based on WHO child growth standards and calculated as suggested by Erreygers)[21] were significant in all countries, except Madagascar, and ranged from –0.0005 in Madagascar to –0.42 in Guatemala. Socioeconomic inequality in stunting appeared largest in the Latin America and the Caribbean region, where the median concentration index equalled –0.22.

The results on wasting are presented in Table 3. Wasting was generally more concentrated among the poor, but socioeconomic inequality was much smaller than for stunting. For about one third of countries, socioeconomic inequality was not significant. The median concentration index was largest in south and south-east Asia (–0.05 based on WHO child growth standards).

Table 2 and Table 3 also show average stunting and wasting rates, respectively, based on the new WHO child growth standards and the NCHS growth standards. For both indicators of malnutrition, the average rate was higher when the new WHO reference standards were used. However, socioeconomic inequality was fairly similar with the two different growth standards. Consequently, the following discussion relates mainly to the WHO child growth standards.

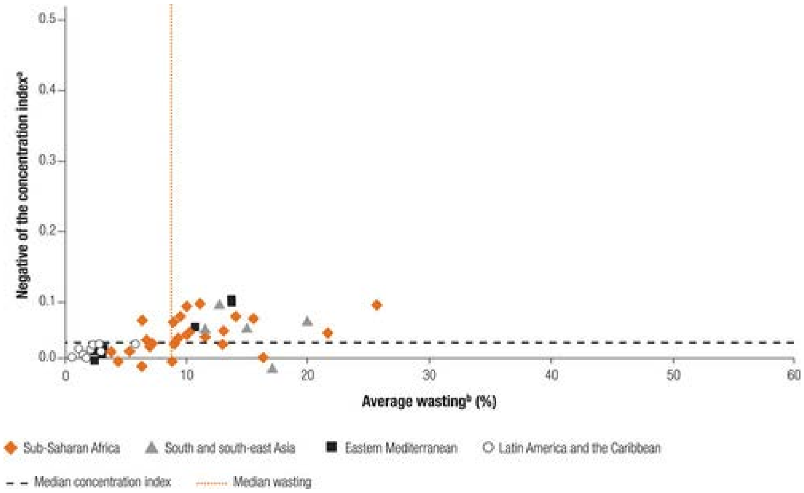
Fig. 1 plots the average level of stunting against the concentration index for socioeconomic inequality in stunting. For illustrative purposes, the negative of the concentration index is shown in this figure and Fig. 2, such that a high value on the y-axis indicates high socioeconomic inequality in favour of the rich. There was no clear association between average stunting and socioeconomic inequality in stunting (Spearman coefficient = 0.20, P = 0.17). If only socioeconomic inequality in the Latin America and Caribbean region was considered, there was an association between a high average level of stunting and high socioeconomic inequality in stunting.

Fig. 1. Average stunting versus the negative of the concentration index



a Calculated as suggested by Erreygers.[21] b Derived using WHO child growth standards.

Fig. 2. Average wasting versus the negative of the concentration index



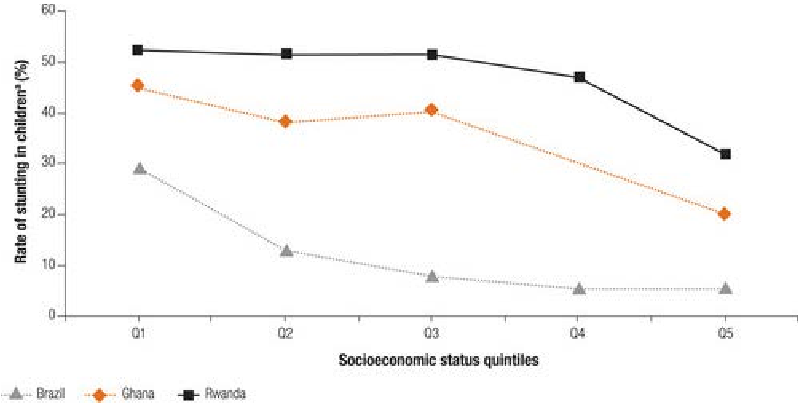
[a] Calculated as suggested by Erreygers.[21] [b] Derived using WHO child growth standards.

Fig. 2 shows the same association for wasting and clearly illustrates that the socioeconomic inequality in wasting is much smaller than that in stunting. There was a negative association between average wasting and the concentration index for wasting (Spearman coefficient = –0.60, $P < 0.001$), which implies that countries with higher average wasting tend to have higher socioeconomic inequality. However, Fig. 2 also shows that the magnitude of the association was low, at best. The low values of the concentration index for socioeconomic inequality, combined with the finding that the relative variability in the average wasting level across countries (coefficient of variation = 0.68) was higher than that in the average stunting level (coefficient of variation = 0.35), suggest that one should not focus too much on the significance of the association between average wasting and socioeconomic inequality in wasting.

When the traditional concentration index (or the one suggested by Wagstaff)[26] was used, different results were obtained for these associations. That is, there was a strong positive association between average stunting and socioeconomic inequality in stunting (Spearman coefficient = 0.78, $P < 0.001$), whereas the association between average wasting and socioeconomic inequality in wasting was not significant (Spearman coefficient = 0.14, $P = 0.35$). This confirms the importance of correcting for dependence on the mean.

Table 2 and Table 3 also show the distributions of stunting and wasting for different socioeconomic status quintiles. The pattern of the distribution can vary, and this is illustrated for three selected countries in Fig. 3.[29] In Rwanda, socioeconomic inequality in stunting could be characterized as “mass deprivation” – stunting is highly prevalent within the majority of the population while a small privileged class is much better off. A second pattern, as seen in Ghana, could be described as “queuing” – average stunting is lower than in the previous pattern, but richer population groups are better off while the poor have to wait for a “trickle-down” effect. Third, socioeconomic inequality in stunting in Brazil took the form of “exclusion” where the prevalence of stunting is relatively low in the majority of the population but was much higher in a poor deprived minority.

Fig. 3. Distribution of stunting across socioeconomic status quintiles for three countries



[a] Derived using WHO child growth standards.

Table 2. Estimated stunting rates in children aged less than 5 years according to socioeconomic status
html, 30kb

Table 3. Estimated wasting rates in children aged less than 5 years according to socioeconomic status
html, 30kb

Discussion

This study illustrates that socioeconomic inequality in malnutrition is present throughout the developing world. The study findings show that the better-off suffer less from malnutrition and that the resultant inequality is much more pronounced for stunting than for wasting. This finding could have been expected as previous evidence has suggested that socioeconomic status has a smaller effect on the stochastic conditions that precipitate wasting (e.g. unforeseen environmental factors and disease) than on long-term malnourishment.[9, 15] Socioeconomic inequality in stunting was largest in the Latin America and Caribbean region, with Guatemala being an outlier, which is also in line with previous findings.[11, 15, 30]

Average wasting and stunting rates derived using the WHO child growth standards were larger than those derived using the NCHS reference population. This was also found by de Onis et al. for Bangladesh, the Dominican Republic and a pooled sample of North American and European children.[31] However, estimates of socioeconomic inequality in both stunting and wasting were similar with the different growth standards, as were the associations between socioeconomic inequality and average stunting or wasting.

When studying the association between average malnutrition and socioeconomic inequality in malnutrition, the choice of the inequality index used does matter. With Erreygers' index,[21] there was no clear association between average stunting and socioeconomic inequality in stunting (though some evidence for a limited association with wasting was found), while use of the traditional concentration index (or the one suggested by Wagstaff)[26] produced, instead, the opposite findings. It is worth noting that Wagstaff and Watanabe[15] found evidence for an inverse relationship between being underweight and socioeconomic inequality on using the traditional concentration index. Applying Erreygers' index to the data in their paper reverses this finding, which illustrates Erreygers' point about the need to be careful when comparing concentration indices across countries with very different stunting levels.

Socioeconomic inequality in stunting occurred in different patterns, which could be described as mass deprivation, queuing and exclusion. The manner in which systems based on primary health care will develop will be different in these different contexts. In the case of exclusion, programmes targeted at specific population groups, namely the poorest, are urgently needed to achieve pro-equity outcomes while in other instances, such as mass deprivation, a broad strengthening of the whole system, either alone or combined with targeting, is required.[29]

In this respect, the distribution of malnutrition across socioeconomic groups, as shown in Table 2 and Table 3, can provide a useful tool for health policy-makers as it can easily be used to classify countries according to the above-mentioned patterns.

There are several limitations to this study. First, it has to be noted that data were only available for children aged 0–3 years instead of 0–5 years for six of the 47 countries (i.e. the Central African Republic, the Comoros, India, Kyrgyzstan, the Niger and Togo). Since anthropometric deficits accumulate over time, average malnutrition rates for these countries were underestimated compared with rates for other countries. However, as already discussed by Wagstaff and Watanabe, changes in the age limit do not systematically produce an upward or downward bias in socioeconomic inequality.[15] Furthermore, the results were found to be robust when these countries were excluded.

Second, the use of an asset index to capture socioeconomic status has its shortcomings. Houweling et al. have shown that the choice of asset can influence the observed magnitude of the health inequality, but also conclude that, in the absence of reliable information on income or expenditure, the use of such an asset index is generally a good way of distinguishing between socioeconomic layers within a population (see also Wagstaff and Watanabe).[32,33] With respect to the present study, it is important to note that a separate asset index was constructed for each country. It was, therefore, possible for the correlation between assets and socioeconomic status to vary between countries.

Third, the present study investigated only socioeconomic inequality in childhood malnutrition in the developing world and the extent to which inequality was related to the average malnutrition rate. Clearly, this is only a first step in a broader research agenda whose aim is to analyse the determinants of socioeconomic inequality in childhood malnutrition within and across developing countries. The next step should consist of combining literature findings on both socioeconomic and proximate determinants of malnutrition, such as feeding practices, health-care seeking behaviour and the mother's nutritional status (e.g. Smith et al., Mosley and Chen, and Ruel et al.),[17,34,35] with a decomposition approach, such as the one proposed by Wagstaff et al.[10]

Conclusion

The findings of this study have both methodological and policy implications. With regard to methodology, this paper is the first to study socioeconomic inequality in childhood malnutrition in the developing world using recently introduced WHO child growth standards. It was found that, although average malnutrition is higher when using this reference population, estimates of socioeconomic inequality are fairly similar to those derived using the NCHS reference population. In addition, the analysis demonstrated that, when studying the association between average malnutrition and the concentration index, it is important to take into account the dependence of this index on the mean value of the binary malnutrition indicator. When this was done, there was no clear relationship between average malnutrition and socioeconomic inequality.

The absence of a relationship between average malnutrition and socioeconomic inequality also has important implications for health policy. It suggests that there was no fundamental difference in socioeconomic inequality between countries with a low average level of malnutrition and those with a much higher average level. While it is not clear from this study whether this is the consequence of a deliberate policy focus on average malnutrition levels, it does indicate that policy-makers should be aware that a focus on reducing the average malnutrition level does not seem to lead to obvious generalized benefits. Nevertheless, the main goals and targets of large-scale development programmes such as the Millennium Development Goals continue to be couched in terms of improving population averages.[36]

The results of this study indicate that not only the degree of socioeconomic inequality in malnutrition but also its pattern should be of concern in setting health policies. To reduce malnutrition in, for example, a range of Latin American countries, policies should be targeted at the poor. In contrast, in many sub-Saharan African countries, there is substantial scope for progress by focusing simply on the general population, in addition to targeting the poor. ■

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Competing interests

None declared.

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Affiliations

a. Erasmus University Rotterdam, Rotterdam, the Netherlands.
b. World Health Organization, Geneva, Switzerland.
c. Institute for Tropical Medicine Antwerp, Antwerp, Belgium.