Socioeconomic Inequalities in Children Health in MENA Countries

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Abstract

It is always concerned that there are large inequalities in the child health sector between rich and poor, especially in the developing countries. The purpose of this paper is to examine child health inequality and the child health achievement in six Middle East and North Africa countries, with particular attention being paid to the relative contribution of each category of health attributes to total socioeconomic health inequality and to the deviation from perfect health within each country. We address this question with the use of Makdissi, Sylla and Yazbeck (2012)’s counting approach and decomposition approach to capture the socioeconomic inequalities in children health. Data comes from the Demographic and Health Surveys (DHS) and the United Nations Children's Fund (UNICEF).

1. Introduction

Health inequality describes the health which is not equally distributed between different population groups. There are several approaches to measure the health inequalities. First, the range is a widely used index for measuring the health inequalities before the 1990s. The range can be used directly as a health inequalities measurement by comparing the top and bottom socioeconomic group. Also, it can be used in the ratio forms. The disadvantage of range as a measurement tool is easily exposed. If we divide the total population into various socioeconomic classes, each socioeconomic class may or may not have same population shares. Also, the range usually fails to notice the changes of the intermediate groups. In a word, the range has many drawbacks.

Afterwards, the Lorenz curve and the associated Gini coefficient are also popular methods that apply to measure health inequalities. The Lorenz curve shows the cumulative proportions of the population, ranked by their health status, against the cumulative proportions of total health. The Gini index can be obtained by twice the area between the Lorenz curve and the 45 degree line. Pure health inequalities can be captured by this way of measurement, but the socioeconomic inequalities in health is not taken into consideration. Nonetheless, a big progress of measuring health inequalities has been made.

Then, the health concentration curve is introduced in the health literatures measuring socioeconomic health inequalities. The idea of the health concentration curve is the similar as the Lorenz curve. Instead of using health status as the rank unit of the population in the Lorenz curve, socioeconomic status is used for rank in the health concentration curve. The health concentration curve shows the cumulative proportions of

the population, ranked by their socioeconomic status, against the cumulative proportion of total health. The health concentration index is also similar to the Gini index. It is obtain by twice the area between the concentration curve and the 45 degree line. Since the health concentration index incorporates socioeconomic inequalities into the health study, it is most frequently used index in recent health economics literature.

However the health concentration index may lead to several measurement problems. Wagstaff (2002) points out that concentration index ignores the average level of population health. When the relative distribution of health stays the same, an improvement of average level of population health is considered neutral. In order to account for the average level of population health, the health achievement index is proposed to capture both average level of population health status and socioeconomic health inequality. Furthermore, the measurement problem of arbitrariness of the concentration index is raised by Erreygers (2006) and Zheng (2008). Since most health information is presented in forms of categorical variables, they argue that when the inequality index is applied to non-ratio-scaled variables, inequality ranking becomes arbitrary. Therefore, measuring income inequality is not the same as measuring health inequality. Makdissi and Yazbeck (2012) solve this measurement problem by using counting approach through which a new ratio-scaled health status variable is defined.

The purpose of this paper is to examine the child health achievement and socioeconomic health inequality in Middle East and North Africa countries. We will adopt the concentration index and the achievement index as measurement of health inequality and health achievement in this paper. In order to avoid the arbitrariness of the concentration index, we will use Makdissi and Yazbeck (2012)'s counting approach and

Makdissi, Sylla and Yazbeck (2012)'s decomposition approach in the measurement of child health achievement and socioeconomic health inequality.

This paper is an attempt to make contribution to the previous academic literature in three aspects. First, even though a number of papers have examined child health achievement and health inequality, little work has been done using counting approach. Second, more than one health indicator has been employed in this paper to paint a more accurate picture of the child health condition. Finally, in recent years, an increasing number of researchers and policy makers have recognized that studying health inequality provide significant guidelines for policies. From the perspective of policy makers, this paper is developed to shed light on the relative importance among the child health problems. The results are useful for child health policy planning and implementation in these developing countries. In addition, different levels of health inequality aversion are allowed to choose according to the preference of the policy makers.

This paper is organized as follows. The next section briefly reviews health economics literature. Section 3 presents the theoretical model used to address the measurement of children's health achievement and socioeconomic health inequality. Then the data and health variables used in the empirical illustration are described in Section 4. Section 5 provides the discussion of the results for each country, while section 6 concludes the results.

2. Literature Review

Yukiko argues that "Health inequality has long attracted keen attention in research and policy arenas"(2007). Furthermore, many research papers have shown that the survival rate of child is positively correlated with household income, which means that

children who come from households owning lowest level of assets have the highest possibility of experiencing health problems. Some researchers use one country's data while some others use data of either several developing countries or both developing and developed countries.

2.1 Child health inequality with one country case study

In year 2001, Wagstaff, Doorslaer and Watanabe (2011) used the data of Vietnam Living Standards Surveys (VLSS) of two years, year 1993 and year 1998. They chose height-for-age as an important variable and found that two factors lead to inequalities in it in year 1993 and 1998, which are household consumption and some other influences that difficult to observe at the commune level. They also observed that changes of these two factors can also lead to increasing inequalities.

Hailat and Peracchi (2011) accessed repeated cross sectional data from Demographic and Health Surveys (DHS) from year 1992 to year 2008 for Egypt only. The purpose of this paper is to determine the relationship between household circumstances and child health status in Egypt, while child survival rate and average height are selected as the two main indicators of child health. Three main conclusions have been drawn from their research. First, there is a significant positive association between child survival rate and average height of children. Second, some factors are only positively related to child survival rate not to the average height of children, including mother's age at child birth and father's education background. Thirdly, some factors are not related to child survival rate and average height of children, such as television and car ownership.

2.2 Child health inequality with a sample of many countries

Wagstaff and Watanabe (2000) used data from surveys of 20 developing countries, including Bangladesh, Brazil, China, Guatemala, Indonesia, and so on. Among these 20 surveys, 11 of them are Living Standards Measurement Study (LSMS) surveys, while the other 9 of them are similar surveys, which have multi-topics. They divided the children from these 20 developing countries into two groups, poor children and non-poor children, and then they explored inequalities in malnutrition between these two groups. Several conclusions have been drawn. They found that in most of the countries, the poorer the child is, the higher the rate of malnutrition is, while rate of malnutrition usually decreases continuously when living standards improve. With a few exceptions, most of the observed countries have high inequalities in underweight comparing with inequalities in stunting and inequalities in wasting.

Similar results have been found by Mariara, Karienyeh and Mwangi in year 2008. They used Demographic and Health surveys (DHS) data of year 1993, 1998 and 2003, which are nationally representative samples. They drew three main conclusions in their paper. First, they found that in rural areas 28 percent of children are poor while that percentage is 19 in urban areas, while 89 percent of child poverty is from rural areas and only 11 percent of child poverty is from urban areas. Second, they concluded that the survival rate of child is positively correlated with assets, which means that children who come from households own lowest level of assets have the highest possibility of experiencing child mortality. Third, among poor children, there is less mortality inequality while the mortality inequality is more popular among rich children.

Child health inequality even exists between advantaged and disadvantaged cities Boutayeb and Helmert (2011) collected data from World Health Organization (WHO), United Nations Development Programme (UNDP), United Nations Children's Fund (UNICEF), the World Bank, Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS). According to their research, inequality exists among different socioeconomic groups. In all of the countries studied in this paper, urban-rural disparity is very obvious while this kind of disparity also exists between advantaged and disadvantaged cities. What is more, the inequality especially health inequality is also significant between rich children and poor children.

Child health inequality also exists in developed countries. Halldórsson, Kunst, Kohler and Mackenbach (2000) used data from a postal survey which is carried out in five developed countries in 1996. They found that inequalities in health status exist even in well-developed countries. In those five sample countries, parents in lower social class reported worse health status for their children. Also, children from the poorest families usually have the lowest height.

When we have both developed and developing countries in our sample, inequalities in health usually favoring non-poor children. Hosseinpoor, Williams, Itani and Chatterji (2012) used data from the World Health Survey (WHS) of year 2002 to 2004. In their paper, they concluded that rich children usually have higher health status in comparison with poor children, while inequalities in health, usually favoring the more educated children as well. Also, in poor countries, the possibility of having ill health children and child mortality is much higher than in rich countries.

2.3 Other causes of child health inequality

In some papers, the authors also look into child health inequality from other prospects, such as parent's education background, mother's age at child birth, and so on. William, Mishra and Navaneetham (2009) examined inequalities in child malnutrition in India by using data from National Family Health Survey (NFHS) of year 1993, 1998 and 2005. In this paper, they found the existence of socio-economic inequalities in childhood malnutrition in all of Indian states. By decomposing all of the families into poor and non-poor, they indicated that poor families are with higher probabilities of having child malnutrition. Finally, they examined the relationship between household income, mother's nutritional status and education background and child malnutrition and concluded that children come from a family with high level of all of these three indicators have lower malnutrition while those come from a family with the lowest level of all of these three indicators have the highest probability of having child malnutrition.

Another paper that also examined the relationship of child health status and mother's education background is from Sastry (2004). In this paper, he used data from the survey conducted by Brazilian population census in year 1970, 1980 and 1991. In this paper, it is shown that mother's education background is highly positively correlated with inequalities in child mortality before children start their schooling. Improving household environment, such as the quality of water supply and sanitation, will make the poorest families benefit the most from this kind of improvement. It also indicates that improving poor families' household income and living environment reduces child health inequalities between the rich and the poor.

Some researchers encourage the decomposition of the national level data into rural and urban area. Wang (2002) used Demographic and Health Surveys (DHS) data between year 1990 and 1999 to investigate the determinants of health status in low-income countries. He examined this question in two steps: first he investigated at the national level, and then did the same research for rural and urban areas separately. He concluded that national level variables are often highly correlated, therefore, disaggregate level analysis, which separate rural and urban areas, is more insightful than country level analysis. He also found that in urban and rural areas, major factors that could influence child mortality rates are quite different.

When children grow up to adults, the situation of health inequality may not change a lot. Chatterji, Lahiri and Song (2011) used data from Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID) of year 1997, 2002 and 2007. They showed that household income related child health inequality does not vary significantly when an individual grows from a child into an adult. Their findings also suggested that when children grow up to adults, the household which has children in poor health status has a household income which increases much slowly comparing with the household which has healthier children.

3. The model

In this section, a parametric class of indices measuring socioeconomic health inequality and health achievement is introduced firstly. Then decomposition of socioeconomic health inequality and health achievement is followed in order to explore the relative contribution of each category of health attribute to total health status and socioeconomic health inequality.

3.1 A parametric class of indices

In this part, we use Makdissi and Yazbeck (2012)'s approach of socioeconomic health inequality and health achievement indices. First let *y* be the individual's income and *F*(*y*) denotes the cumulative distribution of income. For an individual have an income *y*, *p* = *F*(*y*) denotes his or her socioeconomic status. Assume that the health information is in the form of categorical information on *K* health attributes for an individual with socioeconomic status *p*. For individual at socioeconomic rank *p*, $H(p) = (h_1(p), h_2(p), \cdots, h_K(p))$ denotes information on his or her health status.

Makdissi and Yazbeck (2012) suggest focusing on the width of the health problems instead of depth. So we use counting approach to identify the individual's health status. For each health attribute, if the individual suffered the health problem before and his or her record is below a certain threshold, we consider it as a health problem, and then we aggregate the health problems.

Let τ_K be the threshold for each health attribute k, then we count the health problem by transformation $\gamma\big(H(p)\big) = \iota(h_1(p) < \tau_1), \iota(h_2(p) < \tau_2), \cdots, \iota(h_K(p) < \tau_K)$ in which ι ($x<x_0$) is an indicator function that is equals to 1 if $x<x_0$, and 0 if not.

Let $\theta = (\theta_1, \theta_2, \cdots, \theta_K)$ represents a vector of weights for the health attributes and we assume that the taxicab norm $\| \theta \|_1$ is equal to K.

So if we sum the weighted problems of the health attributes, we can get the breath of health problem is $s\big(H(p)\big) = \gamma\big(H(p)\big)\, \theta'$. Then by aggregating the information, we get the quantification of an individual's health status level, as follow:

(1) $\varphi\big(H(p)\big) = \frac{\big(K - s(H(p))\big)}{K}$

This is a ratio-scaled variable which is invariant to any monotonic transformation of

any health attributes. Once we transform the information of health attributes into $\varphi(H(p))$, we can measure the population health by the following index:

(2) $A(H) = \int_0^1 v(p)\varphi(H(p))\,dp$

where $v(p)$ is the weight function for socioeconomic status p. The weight function takes the following form:

(3) $v(p) = \eta(1-p)^{\eta-1}$

where η is the level of socioeconomic health inequality aversion.

The associated socioeconomic health inequality can be measured by the following index:

(4) $I(H) = 1 - \frac{A(H)}{\mu_\varphi}$

where $\mu_\varphi = \int_0^p \varphi(H(p))\,dp$ is the average health status.

We will use the generalized concentration index in this paper, since it is more flexible for the decision maker to choose the level of socioeconomic health inequality aversion. When η=2, generalized concentration index becomes the standard concentration index.

3.2 Decomposition of class of indices

In this part, we use Makdissi, Sylla and Yazbeck (2012)'s decomposition of class of indices by each category of health problems for counting approach.

From the last part, we can decompose the population index as follow:

(5) $A_\eta(H) = 1 - \frac{1}{K}\sum_{k=1}^{K} \theta_k A\eta(h_k)$

where $A\eta(h_k) = \int_0^1 \eta(1-p)^{\eta-1}(\iota[h_k(p) < \tau_k])\,dp$ indicates a failure in health attribute k, which is socially weighted average of health problem in attribute k. Relative

contributions of problems in each health attributes to the deviation from perfect health can be obtained by $\frac{A\eta(h_k)}{1-A_\eta(H)}$.

The socioeconomic health inequality of health problem in attribute k can be obtained using weighted average of health problem in attribute k.

(6) $I_\eta(h_k) = 1 - \frac{A_\eta(h_k)}{\mu_k}$

where $\mu_k = \int_0^1 \iota[h_k(p) < \tau_k]\, dp$ indicates the population proportion having a problem in health attribute k.

To decompose the socioeconomic health inequality index, we substitute the decomposed population index into the definition of socioeconomic health inequality index, we get the following:

(7) $I_\eta(H) = 1 - \frac{1}{\mu_\varphi}\frac{K-\sum_{k=1}^{K}\theta_k A_\eta(h_k)}{K}$

Then we use the generalized concentration index of health problem in attribute k, and we get the following:

(8) $I_\eta(H) = 1 - \frac{1}{\mu_\varphi}\frac{K-\sum_{k=1}^{K}\theta_k \mu_k(1-I_\eta(h_k))}{K}$

From the formula of aggregating quantification of an individual's health status level, we obtain the following:

(9) $\mu_\varphi = \frac{K-\sum_{k=1}^{K}\theta_k\mu_k}{K}$

Substituting the above equation, we get the decomposition of socioeconomic health inequality index as follow:

(10) $I_\eta(H) = -\frac{1}{K}\sum_{k=1}^{K}\theta_k\frac{\mu_k}{\mu_\varphi}I_\eta(h_k)$

4. Data and Variables

4.1 Data

I use data from the Demographic and Health Surveys (DHS) and from the United Nations Children's Fund (UNICEF). The DHS program was founded by the United States Agency for International Development (USAID) in late 1980s. The DHS is a cross-sectional and household based survey that provides information about the fertility, family planning and health status of adults and children living in about 70 countries in the world. The major population of interests for DHS program are women between age 15 to 49, who are reproductive. The DHS was carried out every overlapping five to six years, such as 1984 to 1990, 1988 to 1993 and 1992 to 1998. On one hand, by providing data which are comparable across countries, DHS program enables policy makers to make correct decisions. On the other hand, DHS program also improves analyzing methodology significantly.

In DHS, we use children's data from Egypt 2008 with 10520 observations, Jordan 2007 with 5148 observations and Morocco 2003-2004 with 5883 observations.

UNICEF aims at monitoring and improving the situation of children and women. It supports approximately 100 countries to collect data about the rights, health status and development of children and women. The main survey UNICEF carried out is Multiple Indicator Cluster Survey (MICS) program. The MICS is carried out every five years. Starting from 1995, three rounds of surveys have been conducted, in year 1995, 2000 and 2005. MICS use scientific methods of collecting and analyzing data to provide trustworthy and comparable data about children and women. By using these data, countries can get access to the situation of children and women. The MICS focuses on

issues about education, health status, children's rights, women's rights, gender equality and the protection given to children and women. These specific fields of interests include child survival and health, child nutrition, maternal health, child protection, child disability, education, HIV/AIDS, and so on. UNICEF is also one of the largest agencies that are responsible for the monitoring of child-related policy results and the child-related Millennium Development Goals (MDGs).

In UNICEF, we use children's data from Syria 2006 with 10968 observations, Yemen 2006 with 3766 observations and for Palestinians in Lebanon 2006 with 2381 observations.

Using child health data sets from DHS and UNICEF, the accuracy problem of the data must be realized. Many factors can lead to some mistakes in the process of collecting data, such as an incorrect record and inaccurate response. Manesh, Sheldon, Pickett and Carr-Hill (2008) pointed out that "child morbidity data collected by DHSs are susceptible to significant bias, probably due to socially patterned differential recall and reporting. Such data may produce misleading information on the distribution of health and disease in developing countries. Better methods need to be applied in these surveys to improve the quality of child morbidity data" (194-200).

4.2 Health Variable Definition

The surveys focus on the health of children between 0 and 5 years old. During this period, children have much higher probability of being ill, getting infected and also have much higher mortality rate. The surveys offer information on malnutrition, diarrhea, cough and fever. We use this information to build an indicator of the health status of children.

One of the major factors that usually lead to mortality is malnutrition, which accounts for more than thirty percents of all child deaths. This is because malnutrition makes children weaker and reduces their resistance to virus and bacteria. Currently, there are approximately 20 million children who are younger than five years old are severely malnourished all around the world.

In order to investigate the malnutrition of children, three anthropometric indices used most frequently in the health economics literature are height-for-age, weight-for-age and weight-for-height. Height-for-age refers to long-term nutritional status, while weight-for-height reflects to the nutritional status in a relatively short period of time. Furthermore, both the height-for-age and weight-for-height can have an impact on weight which usually changes more significantly than height over time; therefore weight-for-age represents both short-term and long-term nutritional status.

On one hand, these three indicators of nutritional status are inter-correlated; on the other hand, they could reflect different aspects of child growth. Compared to the other two indices, weight-for-age is a much more comprehensive index of child malnutrition and it is the most important and dynamic method of observing children's growth and health status. In this paper, I only use the weight-for-age as the anthropometric measurement of nutritional status.

In addition to malnutrition, three more variables have been chosen. The first indicator is diarrhea. Diarrhea refers to a condition that an individual has frequent passage of loose or watery stools more than three times in one day. It is the most common cause of sickness and child mortality among children who are younger than five years old in developing countries and the second common cause of child mortality worldwide. In

2009, it was estimated that 1.1 million children with an age of 5 and up and 1.5 million children under the age of 5 died because of diarrhea.

The second indicator of child health is cough. It is frequently caused by a respiratory tract infection which is also one of the leading factors that result in child mortality under five years old. Respiratory tract infections, such as common cold, pneumonia, tuberculosis and so on, are always difficult to be diagnosed.

The third indicator of child health is fever. Since many medical conditions are accompanied by having a fever, we usually regard fever as one of the most common medical signs. The main symptom of having a fever is that the body temperature rises above the normal body temperature range, 36.5–37.5 ℃ (98–100 ℉). Having a fever is also accompanied by muscle tone and chills. In fact, fever is one of the most popular sign among child health problems.

For each country, we have three health indicators to measure child health status. Some health variables available in one data set may not be available in the other data set, so for DHS and UNICEF, we have slightly different health variables chosen. In both data sets, weight-for-age and diarrhea is selected. In DHS fever is selected as the third indicator, while cough is selected in UNICEF. In Morocco and Yemen, only diarrhea, fever and cough is available, so we have two health attributes in these two countries.

4.3 Health Variable Thresholds

For weight-for-age, we will use the Z score evaluation system. The Z score is a measure of the distance from the mean values of the international standard in units of the standard deviation. In this paper, we follow the same methodology with World Health Organization (WHO) for the anthropometric measures. Based on the WHO Global

Database on Child Growth and Malnutrition, if the weight-for-age Z score is 2 standard deviations below the mean values of the international reference, the child is considered as underweight, and if it is 3 standard deviations below the mean values of the international reference, the child is considered as severely underweight. Usually -2 standard deviations is prevalently adopted as a cutoff point in preceding health economics literature. We use both -2 standard deviations and -3 standard deviations as cutoff points to classify low weight-for-age as underweight and severe underweight.

For other health attributes including diarrhea, cough and fever, the thresholds are relatively simple. If the child is ill with the health problem in last two weeks before the interview, threshold is met.

In the next section, we present the empirical illustration result. Household wealth level is used to rank the children's socioeconomic status. For the level of socioeconomic health inequality aversion, four values (1.5, 2, 2.5 and 3) are chosen. For the weight vector, (2, 0.5, 0.5) and (1, 1, 1) is applied to each health attribute respectively.

5. Empirical Illustration Results

In this section, two aspects are presented. In the first part A, the cross country comparison is considered. We will compare the average health achievement, population health index and the socioeconomic health inequality index between each country. In the second part B, within country comparison is conducted. We will compare the contributions of each health problem to the socioeconomic health inequality index and population health index within a country.

A. Cross country comparison

Here we will analyze the child health condition in Egypt, Jordan, Palestinians in Lebanon, Syria, Morocco and Yemen by comparing their estimated value of average health achievement, the socioeconomic health inequality index and population health index.

A1. Average Health Status

Table 1 presents the average health status of Egypt, Jordan, Palestinians in Lebanon and Syria. Weight vectors (2, 0.5, 0.5) and (1, 1, 1) are adopted for each health problem respectively, and two Z score thresholds of weight-for-age is also used. We notice that for all estimated values of average health achievement, Egypt has a higher level of average health status than other countries and Palestinians in Lebanon have the lowest level of average health status. However, it is not robust for the rank between other countries. Reversing of position exists between Jordan and Syria for different weights and different weight-for-age thresholds.

In table 2, we add Morocco and Yemen to the existing countries above and reduce the dimension of health attributes for all countries. We drop the weight-for-age in this case. If we change the dimension of the health attributes from three to two, Egypt and Syria rank the top; Jordan and Morocco stays in the middle; Palestinians in Lebanon and Yemen rank lowest. The dimensions of health attributes do not have much impact on the rank of average health status. This indicates that our comparisons of average health statuses are insensitive to the choice of the health attributes to be included in the health status indicator.

A2. Concentration index

Table 3 to table 6 display the estimated values of the concentration index of Egypt, Jordan, Palestinians in Lebanon and Syria. We consider four levels of socioeconomic health inequality aversion between 1.5 and 3. Again the weight-for-age thresholds and weight vectors differ from each table to test the sensitivity. For all estimated values of the socioeconomic health inequality indices, the Palestinians in Lebanon have the highest level of socioeconomic health inequality, while Jordan has the lowest level of socioeconomic health inequality. The rank between Egypt, Jordan and Syria switches according to different weights and different weight-for-age thresholds. Also, underweight and severe underweight may contribute differently to the total socioeconomic health inequalities. So it may lead to different rank depending on the health variables chosen. Therefore the relative contribution of categories of health problems to the total socioeconomic health inequality becomes significant to be investigated. We will discuss this in the next section.

Moreover, in table 7, Egypt, Jordan, Palestinians in Lebanon, Syria, Morocco and Yemen are put together. Palestinians in Lebanon and Yemen have a much higher level of socioeconomic health inequality than other countries.

A3. Achievement index

The achievement index is a mix of average health achievement and the socioeconomic health inequality index since it is obtained by $\mu_{\varphi}[\,1 - I(H)]$, where μ_{φ} is average health status. So it is a comprehensive index of measurement of population health in a country.

There are two possible ways to affect the value of the achievement index. One way is that a higher average health status leads to a higher value of the achievement index. The other way is a lower value of the socioeconomic health inequality increases the achievement index. With our construction of decreasing weight function associated with the socioeconomic status *p*, the achievement index also shows aversion to the socioeconomic health inequality. So for the same rank of average health status across these countries, their rank of achievement index can be changed through the effect of various socioeconomic health inequalities.

From table 8 to table 11, the achievement index of Egypt, Jordan, Palestinians in Lebanon and Syria is shown. Again, four levels of socioeconomic health inequality aversion between 1.5 and 3 are considered. According to the estimated values displayed in four tables, Egypt has the highest population health, and Palestinians in Lebanon has the lowest population health.

For all levels of socioeconomic health inequality aversion, the ranks of population health are identical to the ranks of average health achievement except for φ_3 with η=2.5 or higher. In addition, if we compare Egypt, Jordan, Palestinians in Lebanon, Syria, Morocco and Yemen together in table 12, it is obvious that the rank in achievement index stays the same with average health achievement. As a result, we can conclude that the socioeconomic health inequality do not affect the rank of population health significantly. Therefore, population health achievement mainly depends on the average health status rather than socioeconomic health inequality.

B. Decomposition by categories of health problems for each country

In this section, we will decompose the concentration index and achievement index by categories of health problems. Furthermore, relative contribution tables are presented to make it more straightforward to identify the relative importance of each category of health problems in the total socioeconomic health inequality and total health achievement. We will also change the weighting vector and Z score threshold for weight-for-age in order to do sensitivity test.

B1. Egypt

B1.1 Concentration Index

Firstly, in the tables of the health concentration index, we can find that all the estimated values of the health concentration index in each health attribute are negative, which signifies a point that all categories of health problems are concentrated at the bottom of the income distribution. In Egypt, socioeconomic health inequalities are unfavorable to poor population group.

Secondly, in table 13.2, it shows that underweight contributes most to the total socioeconomic health inequality, followed by diarrhea and fever. However, as we increase the level of socioeconomic health inequality aversion, the contribution of fever goes up gradually and ranks before contribution of diarrhea. Therefore, if the policy maker shows more aversion to the socioeconomic health inequality, fever should be paid more attention than diarrhea to reduce the socioeconomic health inequality.

Thirdly, from table 13.2 to table 13.3, we change the weight vector of each category of health attribute from (2, 0.5, 0.5) to (1, 1, 1). For equal weight, underweight still

contributes most to the total socioeconomic health inequality. Given the same weight as underweight, diarrhea and fever contributes relatively more to the total socioeconomic health inequality than in table 2. Again, fever shows more aversion to socioeconomic health, since for η =3, fever's contribution almost catches up with underweight's contribution.

Finally, comparing table 13.2 to table 13.5, we put more restrictions to underweight, where we use severe underweight to replace underweight as a measurement of child malnutrition status. In table 13.5, severe underweight contributes the least to the total socioeconomic health inequality. Other things being equal, the contribution of severe underweight is quite small, compared to the contribution of underweight in table 13.2. So there is less socioeconomic health inequality in severe underweight than in underweight. As we move to table 13.6, we can see the contribution of severe underweight becomes trivial under weight (1, 1, 1). The distribution of severe underweight shows more equality over all socioeconomic groups.

B 1.2 Achievement Index

Firstly, table 13.7 gives a picture of the proportion of children experiencing the problems in categories of health attributes. The rank is fever, diarrhea, underweight and severe underweight. Fever and diarrhea are more prevalent than underweight and severe underweight in Egypt.

Secondly, in table 13.9, underweight contributes most to the total deviation from perfect health, followed by fever and diarrhea. The rank of each health attribute remains

consistent as we increase the level of socioeconomic health inequality aversion. The achievement index is insensitive to the level of socioeconomic health inequality aversion.

Thirdly, from table 13.9 to table 13.10, the weight vector of each category of health attribute is changed from (2, 0.5, 0.5) to (1, 1, 1). It shows that underweight becomes less important than fever and diarrhea. In this case, fever ranks highest in contribution of each category of health attribute to the total deviation from perfect health.

Finally, comparing table 13.9 to table 13.12, we use severe underweight instead of underweight as the indicator of child malnutrition status. In table 13.12 and table 13.13, severe underweight contributes less than fever and diarrhea. It is reasonable that proportion of children experiencing health problems in severe underweight is less than in underweight.

B2. Jordan

B 2.1 Concentration Index

Firstly, in table 14.1, the values of health concentration index for underweight is negative. It indicates that the health problems in underweight are concentrated at the bottom of the income distribution in Jordan. However, the values of health concentration index for diarrhea and fever is positive. It indicates that the health problems in diarrhea and fever are concentrated at the top of the income distribution in Jordan. This is a surprising result that socioeconomic health inequalities in diarrhea and fever are unfavorable to rich population group. It is the similar case for Syria and Morocco in which cough and fever are unfavorable to rich population group. We will discuss this later in this paper. Caution should be taken when dealing with this kind of results. It may

be the consequence of observational error. In table 14.2, underweight contributes a lot the socioeconomic health inequality, while the contributions of diarrhea and fever go to the opposite direction and reduce the socioeconomic health inequality.

Secondly, from table 14.2 to table 14.3, the weight vector of each category of health attribute is changed from (2, 0.5, 0.5) to (1, 1, 1). The relative contributions of each category of health problems stay the same patterns. From table 14.3, when η =3, the contribution of diarrhea to total socioeconomic health inequality turns to be positive. In this way, having problems in diarrhea increases the total socioeconomic health inequality.

Thirdly, moving from table 14.2 to table 14.5, we use severe underweight instead of underweight as the measurement of child malnutrition status. The total socioeconomic health inequality comes from the contribution of severe underweight. From table 14.5 to table 14.6, the weight vector of each category of health attribute is changed from (2, 0.5, 0.5) to (1, 1, 1), and the sign of the relative contributions of each category of health problems gets reversed. That is because the value of total socioeconomic health inequality consist of severe underweight, diarrhea and fever with weight (1, 1, 1) for in Jordan is negative in table 6 of part A. So in fact the structure of relative contributions in table 14.5 and table 14.6 is the same.

B 2.2 Achievement Index

Firstly, table 14.7 describes the proportion of children experiencing the problems in categories of health attributes. The rank is diarrhea, fever, underweight and severe underweight. Diarrhea and fever are most important health problems in Jordan.

Secondly, in table 14.9, underweight contributes most to the total deviation from perfect health, followed by fever and diarrhea. The relative contributions of each health attribute change little as we increase the level of socioeconomic health inequality aversion.

Thirdly, from table 14.9 to table 14.10, the weight vector of each category of health attribute is changed from (2, 0.5, 0.5) to (1, 1, 1). In this case, diarrhea ranks highest in contribution of each category of health attribute to the total deviation from perfect health followed by fever and underweight.

Finally, comparing table 14.9 to table 14.12, we use severe underweight instead of underweight as the indicator of child malnutrition status. In table 14.12 and table 14.13, the rank of contribution is diarrhea, fever and severe underweight which is consistent with the rank of proportion of children experiencing the problems in categories of health attributes.

B3. Palestinians in Lebanon

B3.1 Concentration Index

Firstly, in the tables of the health concentration index, we can find that all the estimated values of the health concentration index in each health attribute are negative. It means that all categories of health problems are concentrated at the bottom of the income distribution. For Palestinians in Lebanon, socioeconomic health inequalities are unfavorable to poor population group.

Secondly, in table 15.2, it shows that cough contributes most to the total socioeconomic health inequality, followed by diarrhea and underweight. As we increase

the level of socioeconomic health inequality aversion, the rank of relative contribution stays the same, but the contributions of cough and underweight increases with the declining contribution of diarrhea.

Thirdly, from table 15.2 to table 15.3, we change the weight vector of each category of health attribute from (2, 0.5, 0.5) to (1, 1, 1). The rank of relative contribution does not change. Cough is still the main source for the total socioeconomic health inequality, while the contribution of underweight becomes negligible.

Finally, comparing table 15.2 to table 15.5, we use severe underweight to capture child malnutrition status. Again, the rank of relative contribution is consistent. So for all health attributes, levels of socioeconomic health inequality aversion and weight vectors, the distribution of cough and diarrhea shows more inequality over all socioeconomic groups than underweight and severe underweight. To reduce the socioeconomic health inequality for Palestinians in Lebanon, most efforts should be put in health problems in cough and diarrhea.

B3.2 Achievement Index

Firstly, in table 15.7 the proportion of children experiencing the problems in categories of health attributes is provided. The rank is cough, diarrhea, underweight and severe underweight. Cough is the most serious health problem for Palestinians in Lebanon.

Secondly, in table 15.9, cough contributes most to the total deviation from perfect health, followed by underweight and diarrhea. The rank of each health attribute remains the same for all levels of socioeconomic health inequality aversion.

Thirdly, from table 15.9 to table 15.10, the weight vector of each category of health attribute is changed from (2, 0.5, 0.5) to (1, 1, 1). Cough still ranks highest in contribution of each category of health attribute to the total deviation from perfect health. It shows that underweight becomes less important than fever and diarrhea.

Finally, comparing table 15.9 to table 15.12, we use severe underweight as the indicator of child malnutrition status. Cough remains most the important health attribute for both weight vectors. For weight (2, 0.5, 0.5), the relative contribution of severe underweight and diarrhea to deviation from perfect health is very close. Moving to weight (1, 1, 1), the contribution of diarrhea is much higher than severe underweight.

B4. Syria

B4.1 Concentration Index

Firstly, in table 16.1, the values of health concentration index for underweight and diarrhea are negative. It means that the health problems in underweight and diarrhea are concentrated at the bottom of the income distribution in Syria. However, the values of health concentration index for cough are positive. It means that the health problems in cough are concentrated at the top of the income distribution in Syria. As a result, in table 16.2, the total socioeconomic health inequality comes from the contribution of underweight and diarrhea. On the contrary, cough reduces the socioeconomic health inequality.

Secondly, from table 16.2 to table 16.3, the weight vector of each category of health attribute is changed from (2, 0.5, 0.5) to (1, 1, 1). The relative contributions of each category of health problems stay the same patterns. In table 16.3, underweight still

contributes to the total socioeconomic health inequality followed by diarrhea. Also, the contribution of underweight increases with the level of socioeconomic health inequality aversion, while the contribution of diarrhea decreases with the level of socioeconomic health inequality aversion

Thirdly, moving from table 16.2 to table 16.5, we use severe underweight as the measurement of child malnutrition status. Severe underweight contributes most to the total socioeconomic health inequality followed by diarrhea. From table 16.5 to table 16.6, the weight vector of each category of health attribute is changed from (2, 0.5, 0.5) to (1, 1, 1). Diarrhea ranks higher than severe underweight for low socioeconomic health inequality aversion, while severe underweight ranks higher than diarrhea for high socioeconomic health inequality aversion.

B4.2 Achievement Index

Firstly, table 16.7 provides the proportion of children experiencing the problems in categories of health attributes. The rank is fever, underweight, diarrhea, and severe underweight. Fever and underweight are most popular health problems in Syria.

Secondly, in table 16.9, underweight contributes most to the total deviation from perfect health, followed by cough and diarrhea. As we increase the level of socioeconomic health inequality aversion, the relative contributions of each health attribute do not change much.

Thirdly, from table 16.9 to table 16.10, the weight vector of each category of health attribute is changed from (2, 0.5, 0.5) to (1, 1, 1). In this case, cough ranks highest in

contribution of each category of health attribute to the total deviation from perfect health followed by underweight and diarrhea.

Finally, comparing table 16.9 to table 16.12, we use severe underweight instead of underweight as the indicator of child malnutrition status. In table 16.12 and table 16.13, for all level of socioeconomic health inequality aversion, cough remains the most important health attribute for both weights, but the rank of severe underweight and fever switches with the different weight vectors.

B5 Morocco

B5.1 Concentration Index

In table 17.1, the values of health concentration index for diarrhea are negative. It indicates that the health problems in diarrhea are concentrated at the bottom of the income distribution. While the values of health concentration index for fever are positive. It indicates that the health problems in cough are concentrated at the top of the income distribution. As a result, in table 17.2, diarrhea increases the socioeconomic health inequality and cough reduces the socioeconomic health inequality.

B5.2 Achievement Index

Table 17.3 tells that there are more children experiencing fever than diarrhea in Morocco. In table 17.5, fever contributes twice as large as diarrhea to the total deviation from perfect health. In addition, as the level of socioeconomic health inequality aversion increases, the contribution of diarrhea increases.

B6 Yemen

B6.1 Concentration Index

In table 18.1, the values of health concentration index in diarrhea and cough are all negative. So the health problems in Yemen are concentrated on the poor group children. In table 18.2, cough contributes about twice more than diarrhea to the socioeconomic health inequality.

B6.2 Achievement Index

In table 18.3, it is shown that there are slightly more children experiencing diarrhea than cough in Yemen. In table 18.4, for η =1.5, the contribution of diarrhea and cough to the deviation from perfect health is the same, but as we raise the level of socioeconomic health inequality aversion, cough contributes more.

B7. Discussion

There are three paths affecting the relative contribution for one health attribute to the total socioeconomic health inequality. One is that a higher socioeconomic health inequality in this health attribute apparently contributes more to the total socioeconomic health inequality. The other is that weight assigned to the health attribute will have impact on its contribution to the total health inequality. In addition, it is obvious that if more weight is put on the bottom side of income distribution, the associated socioeconomic health inequality will increase. Moreover, the level of socioeconomic health inequality aversion also influences the relative contribution for one health attribute to the total socioeconomic health inequality. Therefore, with the different levels of

socioeconomic health inequality aversion of the policy maker, different health attributes should be paid more attention.

In fact, it is the similar case for relative contribution to the total deviation from perfect health as well. If failure in one health attribute is high, its contribution to the total deviation from perfect health will be high. Then a large weight given to the health attribute will result in a high relative contribution the total deviation from perfect health for that health attribute. However, unlike the relative contribution to the total socioeconomic health inequality, the relative contribution for one health attribute to the total deviation from perfect health does not fluctuate a lot with the change of the level of socioeconomic health inequality aversion.

6. Conclusion

In this paper, using DHS and UNICEF data, I examine the child health inequality and the child health achievement in six Middle East and North Africa countries, and pay particular attention to the relative contribution of each category of health attributes to total socioeconomic health inequality and to the deviation from perfect health within each country.

According to the results, Egypt has the highest health achievement and Palestinians in Lebanon have the highest level of socioeconomic health inequality. Socioeconomic health inequality is sensitive to the level of socioeconomic health inequality aversion, health attribute thresholds chosen and the weight vectors. In the population health achievement, average health achievement contributes much more than socioeconomic health inequality.

In addition, the analysis in this paper points out that the relative contribution of each category of health attribute to the socioeconomic health inequality also fluctuates with the choice of the level of socioeconomic health inequality aversion, health attribute thresholds and the weight vectors. In other words, our findings suggest that to reduce socioeconomic health inequality efficiently, the public policy makers with various preferences should focus on different health attributes in different countries.

Admittedly, there are some limitations in this paper. Firstly, the accuracy of DHS and UNICEF data sets should be taken into consideration. Secondly, more health attributes may be added to capture the children health status. Finally, it is more interesting to have more than one year data in each country so that the evolvement of socioeconomic health inequality and health achievement can be captured. Future research can be explored to further this option.

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Cross country comparison

Table 1 Mean of health achievement by each country for three health attributes

	$\varphi_1(2,0.5,0.5)$	$\varphi_2(1,1,1)$	$\varphi_3(2,0.5,0.5)$	$\varphi_4(1,1,1)$
Egypt	0.9279266	0.9096080	0.9562657	0.9237776
Jordan	0.9141428	0.8734503	0.9375538	0.8851559
Palestinians in Lebanon	0.8684726	0.7982640	0.8931121	0.8105838
Syria	0.8888280	0.8844203	0.9410407	0.9105266

Note:

1. $\varphi_1(2,0.5,0.5)$ is the health achievement using underweight, diarrhea and fever/cough with the weight vector (2, 0.5, 0.5)

2. $\varphi_2(1, 1, 1)$ is the health achievement using underweight, diarrhea and fever/cough with the weight vector (1, 1, 1)

3. $\varphi_3(2,0.5,0.5)$is the health achievement using severe underweight, diarrhea and fever/cough with the weight vector (2, 0.5, 0.5)

4. $\varphi_4(1, 1, 1)$is the health achievement using severe underweight, diarrhea and fever/cough with the weight vector (1, 1, 1)

Table 2 Mean of health achievement by each country for two health attributes

	$\varphi(1,1)$
Egypt	0.8912894
Jordan	0.8327579
Morocco	0.8039869
Palestinians in Lebanon	0.7280554
Syria	0.8800125
Yemen	0.6684711

Note:

$\varphi(1, 1)$ is the health achievement using diarrhea and fever/cough with weight vector (1, 1)

Table 3 Concentration Index for φ_1 (2, 0.5, 0.5)

φ_1 (2,0.5,0.5)	v=1.5	v=2	v=2.5	v=3
Egypt	0.0024	0.0046	0.0064	0.0080
Jordan	0.0030	0.0054	0.0075	0.0093
Palestinians in Lebanon	0.0073	0.0123	0.0159	0.0186
Syria	0.0051	0.0088	0.0117	0.0139

Table 4 Concentration Index for φ_2 (1, 1, 1)

φ_2 (1,1,1)	v=1.5	v=2	v=2.5	v=3
Egypt	0.0023	0.0044	0.0063	0.0078
Jordan	0.0001	0.0005	0.0009	0.0015
Palestinians in Lebanon	0.0158	0.0264	0.0339	0.0391
Syria	0.0029	0.0048	0.0061	0.0070

Table 5 Concentration Index for φ_3 (2, 0.5, 0.5)

φ_3 (2,0.5,0.5)	v=1.5	v=2	v=2.5	v=3
Egypt	0.0008	0.0016	0.0023	0.0029
Jordan	0.0000	0.0002	0.0006	0.0010
Palestinians in Lebanon	0.0073	0.0123	0.0159	0.0186
Syria	0.0022	0.0039	0.0053	0.0065

Table 6 Concentration Index for φ_4 (1, 1, 1)

φ_4 (1,1,1)	v=1.5	v=2	v=2.5	v=3
Egypt	0.0014	0.0029	0.0041	0.0052
Jordan	-0.0014	-0.0022	-0.0026	-0.0028
Palestinians in Lebanon	0.0156	0.0261	0.0335	0.0387
Syria	0.0015	0.0024	0.0030	0.0034

Table 7 Concentration Index for φ (1, 1)

φ (1,1)	v=1.5	v=2	v=2.5	v=3
Egypt	0.0021	0.0043	0.0061	0.0077
Jordan	-0.0030	-0.0050	-0.0063	-0.0071
Morocco	0.0013	0.0002	-0.0017	-0.0038
Palestinians in Lebanon	0.0259	0.0432	0.0552	0.0637
Syria	0.0007	0.0008	0.0005	0.0001
Yemen	0.0245	0.0395	0.0498	0.0570

Table 8 Achievement Index for φ_1 (2, 0.5, 0.5)

φ_1 (2,0.5,0.5)	v=1.5	v=2	v=2.5	v=3
Egypt	0.925700	0.923700	0.921988	0.920503
Jordan	0.911400	0.909200	0.907287	0.905641
Palestinians in Lebanon	0.862100	0.857800	0.854664	0.852319
Syria	0.884300	0.881000	0.878429	0.876473

Table 9 Achievement Index for φ_2 (1, 1, 1)

φ_2 (1,1,1)	v=1.5	v=2	v=2.5	v=3
Egypt	0.907516	0.905606	0.903877	0.902513
Jordan	0.873363	0.873014	0.872664	0.872140
Palestinians in Lebanon	0.785651	0.777190	0.771203	0.767052
Syria	0.881855	0.880175	0.879025	0.878229

Table 10 Achievement Index for φ_3 (2, 0.5, 0.5)

φ_3 (2,0.5,0.5)	v=1.5	v=2	v=2.5	v=3
Egypt	0.955501	0.954736	0.954066	0.953493
Jordan	0.937554	0.937366	0.936991	0.936616
Palestinians in Lebanon	0.886592	0.882127	0.878912	0.876500
Syria	0.938970	0.937371	0.936053	0.934924

Table 11 Achievement Index for φ_4 (1, 1, 1)

φ_4 (1,1,1)	v=1.5	v=2	v=2.5	v=3
Egypt	0.922484	0.921099	0.919990	0.918974
Jordan	0.886395	0.887103	0.887457	0.887634
Palestinians in Lebanon	0.797939	0.789428	0.783429	0.779214
Syria	0.909161	0.908341	0.907795	0.907431

Table 12 Achievement Index for φ (1, 1)

φ (1,1)	v=1.5	v=2	v=2.5	v=3
Egypt	0.889418	0.887457	0.885853	0.884426
Jordan	0.835256	0.836922	0.838004	0.838670
Morocco	0.802942	0.803826	0.805354	0.807042
Palestinians in Lebanon	0.709199	0.696603	0.687867	0.681678
Syria	0.879396	0.879308	0.879572	0.879924
Yemen	0.652094	0.642066	0.635181	0.630368

Egypt 2008

Table 13.1 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Underweight	-0.0457	-0.0843	-0.1160	-0.1425
Diarrhea	-0.0253	-0.0471	-0.0627	-0.0742
Fever	-0.0121	-0.0272	-0.0419	-0.0559

Table 13.2 Relative contributions of each attribute to total socioeconomic health inequality for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Underweight	73%	71%	70%	69%
Diarrhea	16%	15%	15%	14%
Fever	11%	14%	15%	17%

Table 13.3 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Underweight	39%	37%	36%	36%
Diarrhea	35%	33%	31%	29%
Fever	26%	30%	33%	35%

Table 13.4 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Severe Underweight	-0.0227	-0.0407	-0.0544	-0.0642
Diarrhea	-0.0253	-0.0471	-0.0627	-0.0742
Fever	-0.0121	-0.0272	-0.0419	-0.0559

Table 13.5 Relative contributions of each attribute to total socioeconomic health inequality for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Severe Underweight	22%	20%	18%	17%
Diarrhea	45%	42%	40%	38%
Fever	33%	38%	42%	45%

Table 13.6 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Severe Underweight	6%	5%	5%	5%
Diarrhea	54%	50%	47%	44%
Fever	40%	45%	48%	51%

Table 13.7 Proportion of population having problems in each health attribute

Underweight	0.0537548
Severe Underweight	0.0112461
Diarrhea	0.0850620
Fever	0.1323593

Table 13.8 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Underweight	0.056211	0.058286	0.059990	0.061415
Diarrhea	0.087214	0.089068	0.090395	0.091374
Fever	0.133961	0.135959	0.137905	0.139758

Table 13.9 Relative contributions of each attribute to deviation from perfect health for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Underweight	50%	51%	51%	52%
Diarrhea	20%	19%	19%	19%
Fever	30%	30%	30%	29%

Table 13.10 Relative contributions of each attribute to deviation from perfect health for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Underweight	20%	20%	21%	21%
Diarrhea	32%	32%	31%	31%
Fever	48%	48%	48%	48%

Table 13.11 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Severe Underweight	0.011501	0.011704	0.011858	0.011968
Diarrhea	0.087214	0.089068	0.090395	0.091374
Fever	0.133961	0.135959	0.137905	0.139758

Table 13.12 Relative contributions of each attribute to deviation from perfect health for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Severe Underweight	17%	17%	17%	17%
Diarrhea	33%	33%	33%	33%
Fever	50%	50%	50%	50%

Table 13.13 Relative contributions of each attribute to deviation from perfect health for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Severe Underweight	5%	5%	5%	5%
Diarrhea	37%	38%	38%	38%
Fever	58%	57%	57%	57%

Jordan 2007

Table 14.1 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Underweight	-0.1178	-0.2110	-0.2862	-0.3477
Diarrhea	0.0062	0.0064	0.0036	-0.0007
Fever	0.0256	0.0466	0.0638	0.0778

Table 14.2 Relative contributions of each attribute to total socioeconomic health inequality for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Underweight	129%	128%	126%	123%
Diarrhea	-6%	-4%	-2%	0%
Fever	-23%	-24%	-24%	-23%

Table 14.3 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Underweight	2030%	727%	546%	400%
Diarrhea	-428%	-87%	-29%	4%
Fever	-1502%	-540%	-417%	-304%

Table 14.4 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Severe Underweigh	-0.1279	-0.2396	-0.3438	-0.4398
Diarrhea	0.0062	0.0064	0.0036	-0.0007
Fever	0.0256	0.0466	0.0638	0.0778

Table 14.5 Relative contributions of each attribute to total socioeconomic health inequality for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Severe Underweigh	*	850%	409%	312%
Diarrhea	*	-110%	-19%	2%
Fever	*	-640%	-290%	-214%

Note:

* indicates severe underweight moves to opposite direction with respect to diarrhea and fever, so it cancels out with each other.

Table 14.6 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Severe Underweigh	-35%	-41%	-50%	-59%
Diarrhea	30%	19%	9%	-2%
Fever	105%	122%	141%	161%

Table 14.7 Proportion of population having problems in each health attribute

Underweight	0.0451647
Severe Underweight	0.0100482
Diarrhea	0.1807324
Fever	0.1537519

Table 14.8 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Underweight	0.050485	0.054694	0.058091	0.060868
Diarrhea	0.179612	0.179576	0.180082	0.180859
Fever	0.149816	0.146587	0.143943	0.141790

Table 14.9 Relative contributions of each attribute to deviation from perfect health for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Underweight	38%	40%	42%	43%
Diarrhea	34%	33%	32%	32%
Fever	28%	27%	26%	25%

Table 14.10 Relative contributions of each attribute to deviation from perfect health for weight (1, 1 , 1)

	v=1.5	v=2	v=2.5	v=3
Underweight	13%	14%	15%	16%
Diarrhea	47%	47%	47%	47%
Fever	40%	39%	38%	37%

Table 14.11 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Severe Underweigh	0.011333	0.012456	0.013503	0.014467
Diarrhea	0.179612	0.179576	0.180082	0.180859
Fever	0.149816	0.146587	0.143943	0.141790

Table 14.12 Relative contributions of each attribute to deviation from perfect health for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Severe Underweigh	12%	13%	14%	15%
Diarrhea	48%	48%	48%	48%
Fever	40%	39%	38%	37%

Table 14.13 Relative contributions of each attribute to deviation from perfect health for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Severe Underweigh	3%	4%	4%	4%
Diarrhea	53%	53%	53%	54%
Fever	44%	43%	43%	42%

Palestinians in Lebanon 2006

Table 15.1 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Underweight	-0.0005	-0.0047	-0.0104	-0.0165
Diarrhea	-0.0665	-0.0892	-0.0929	-0.0859
Cough	-0.0700	-0.1216	-0.1601	-0.1892

Table 15.2 Relative contributions of each attribute to total socioeconomic health inequality for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Underweight	1%	2%	3%	4%
Diarrhea	17%	14%	11%	9%
Cough	82%	84%	86%	87%

Table 15.3 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Underweight	0%	0%	1%	1%
Diarrhea	17%	14%	11%	9%
Cough	83%	86%	88%	90%

Table 15.4 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Severe underweight	-0.0133	-0.0240	-0.0398	-0.0601
Diarrhea	-0.0665	-0.0892	-0.0929	-0.0859
Cough	-0.0700	-0.1216	-0.1601	-0.1892

Table 15.5 Relative contributions of each attribute to total socioeconomic health inequality for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Severe underweight	3%	4%	5%	6%
Diarrhea	17%	14%	11%	9%
Cough	80%	82%	84%	85%

Table 15.6 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Severe underweight	1%	1%	1%	2%
Diarrhea	17%	14%	11%	9%
Cough	82%	85%	88%	89%

Table 15.7 Proportion of population having problems in each health attribute

Underweight	0.0613188
Severe Underweight	0.0243595
Diarrhea	0.0986980
Cough	0.4451911

Table 15.8 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Underweight	0.061349	0.061607	0.061957	0.062331
Diarrhea	0.105261	0.107502	0.107867	0.107176
Cough	0.476354	0.499326	0.516466	0.529421

Table 15.9 Relative contributions of each attribute to deviation from perfect health for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Underweight	29%	29%	29%	28%
Diarrhea	13%	12%	12%	12%
Cough	58%	59%	59%	60%

Table 15.10 Relative contributions of each attribute to deviation from perfect health for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Underweight	10%	9%	9%	9%
Diarrhea	16%	16%	16%	15%
Cough	74%	75%	75%	76%

Table 15.11 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Severe underweight	0.024683	0.024944	0.025329	0.025824
Diarrhea	0.105261	0.107502	0.107867	0.107176
Cough	0.476354	0.499326	0.516466	0.529421

Table 15.12 Relative contributions of each attribute to deviation from perfect health for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Severe underweight	15%	14%	14%	14%
Diarrhea	15%	15%	15%	14%
Cough	70%	71%	71%	72%

Table 15.13 Relative contributions of each attribute to deviation from perfect health for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Severe underweight	4%	4%	4%	4%
Diarrhea	17%	17%	17%	16%
Cough	79%	79%	79%	80%

Syria 2006

Table 16.1 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Underweight	-0.0610	-0.1072	-0.1439	-0.1738
Diarrhea	-0.0453	-0.0691	-0.0845	-0.0954
Cough	0.0156	0.0273	0.0383	0.0486

Table 16.2 Relative contributions of each attribute to total socioeconomic health inequality for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Underweight	95%	97%	99%	100%
Diarrhea	14%	12%	11%	10%
Cough	-9%	-9%	-10%	-10%

Table 16.3 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Underweight	84%	90%	95%	100%
Diarrhea	48%	44%	42%	42%
Cough	-32%	-34%	-37%	-42%

Table 16.4 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Severe underweight	-0.0980	-0.1826	-0.2569	-0.3223
Diarrhea	-0.0453	-0.0691	-0.0845	-0.0954
Cough	0.0156	0.0273	0.0383	0.0486

Table 16.5 Relative contributions of each attribute to total socioeconomic health inequality for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Severe underweight	90%	94%	97%	100%
Diarrhea	30%	26%	23%	21%
Cough	-20%	-20%	-20%	-21%

Table 16.6 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Severe underweight	69%	80%	89%	99%
Diarrhea	91%	86%	85%	84%
Cough	-60%	-66%	-74%	-83%

Table 16.7 Proportion of population having problems in each health attribute

Underweight	0.1067642
Severe Underweight	0.0284452
Diarrhea	0.0816933
Fever	0.1582817

Table 16.8 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Underweight	0.113277	0.118209	0.122128	0.125320
Diarrhea	0.085394	0.087338	0.088596	0.089487
Cough	0.155813	0.153961	0.152220	0.150589

Table 16.9 Relative contributions of each attribute to deviation from perfect health for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Underweight	65%	66%	67%	68%
Diarrhea	12%	12%	12%	12%
Cough	23%	22%	21%	20%

Table 16.10 Relative contributions of each attribute to deviation from perfect health for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Underweight	32%	33%	34%	35%
Diarrhea	24%	24%	24%	24%
Cough	44%	43%	42%	41%

Table 16.11 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Severe underweight	0.031233	0.033639	0.035753	0.037613
Diarrhea	0.085394	0.087338	0.088596	0.089487
Cough	0.155813	0.153961	0.152220	0.150589

Table 16.12 Relative contributions of each attribute to deviation from perfect health for weight (2, 0.5, 0.5)

	v=1.5	v=2	v=2.5	v=3
Severe underweight	34%	36%	37%	38%
Diarrhea	23%	23%	23%	23%
Cough	43%	41%	40%	39%

Table 16.13 Relative contributions of each attribute to deviation from perfect health for weight (1, 1, 1)

	v=1.5	v=2	v=2.5	v=3
Severe underweight	12%	12%	13%	14%
Diarrhea	31%	32%	32%	32%
Cough	57%	56%	55%	54%

Morocco 2003-04

Table 17.1 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Diarrhea	-0.0287	-0.0421	-0.0496	-0.0542
Fever	0.0049	0.0175	0.0321	0.0466

Table 17.2 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1)

	v=1.5	v=2	v=2.5	v=3
Diarrhea	165%	1578%	-218%	-107%
Fever	-65%	-1478%	318%	207%

Table 17.3 Proportion of population having problems in each health attribute

Diarrhea	0.1203854
Fever	0.2716407

Table 17.4 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Diarrhea	0.123840	0.125454	0.126357	0.126910
Fever	0.270310	0.266887	0.262921	0.258982

Table 17.5 Relative contributions of each attribute to deviation from perfect health for weight (1. 1)

	v=1.5	v=2	v=2.5	v=3
Diarrhea	31%	32%	32%	33%
Fever	69%	68%	68%	67%

Yemen 2006

Table 18.1 Concentration of health problem by attributes

	v=1.5	v=2	v=2.5	v=3
Diarrhea	-0.0352	-0.0518	-0.0607	-0.0660
Cough	-0.0636	-0.1081	-0.1405	-0.1645

Table 18.2 Relative contributions of each attribute to total socioeconomic health inequality for weight (1, 1)

	v=1.5	v=2	v=2.5	v=3
Diarrhea	36%	33%	30%	29%
Cough	64%	67%	70%	71%

Table 18.3 Proportion of population having problems in each health attribute

Diarrhea	0.3338101
Cough	0.3292478

Table 18.4 Failures in each health attribute

	v=1.5	v=2	v=2.5	v=3
Diarrhea	0.345560	0.351101	0.354072	0.355842
Cough	0.350188	0.364839	0.375507	0.383409

Table 18.5 Relative contributions of each attributes to deviation from perfect health for weight (1. 1)

	v=1.5	v=2	v=2.5	v=3
Diarrhea	50%	49%	49%	48%
Cough	50%	51%	51%	52%