Inequality in Child Mortality: A Household Level Analysis of Pakistan

by

Zainab Jehan & Sadia Sherbaz[1]

Abstract

Existence of health inequalities implies that very basic human rights are not accessible to every individual in the country. Thus we aim to compute the inequality in infant and child mortality on the basis of relative wealth of the households across Pakistan and across various regions within the country by calculating the inequality for each constituency, separately. Using the data from the Demographic and Health Survey (DHS) 2012-13, we have computed inequality in infant and child mortality by employing Concentration Index (CI), Concentration Curves (CC) and Dissimilarity Index (DI) techniques. The negative value of CI signifies the fact that the infant and child mortality is higher in lower quintile of wealth for all regions as well as for the country as a whole. Further, we observed that the lowest inequalities are experienced by KPK while the highest inequalities are found in Islamabad. The results for CC and DI depict a similar situation. However, Islamabad displays lowest rate of child and infant mortality, leading us to conclude that that there is negative association between level and inequality of mortality rates. On the other hand, KPK has emerged as a special case facing lowest mortality rates as well as inequality in infant and under-five mortalities despite not being as well-off as Islamabad and Punjab. This observation lends credibility to the idea that social inequalities may be an outcome of non-economic factors. We can conclude from this exercise that the inequality in the wealth has led to creation of inequalities in the health status in Pakistan.

JEL Classification: *N3, I10, I14, D63*

Keywords: *Mortality Inequality, Concentration Index, Concentration Curve, Dissimilarity*

[1] The authors are Assistant Professor in department of Economic at Fatima Jinnah Women University, Rawalpindi and PhD scholar at PIDE, Islamabad. All the correspondence may kindly be done to the first author at zainabjehan.fjwu@gmail.com

Inequality in Child Mortality: A Household Level Analysis of Pakistan

Zainab Jehan & Sadia Sherbaz

1. Introduction

Inequality of opportunities has been identified as a major cause of poverty, deprivation and under development. The inequality in wealth is an indicator of asymmetry in other aspects of wellbeing. Its implications manifest themselves, at times, as higher mortality among the most vulnerable segment of the society, which includes infants and children under the age of five. This predicament relates in general to low income and also to other aspects of human existence like inadequate public health provisions, insufficient nutritional support, deficient social security arrangements and even lapses in governance [Sen, 1998]. This renders health inequalities as a prevalent phenomenon, which means that the very basic of human rights are not accessible to every individual within the country.

In the 1960s infant mortality was significantly higher in Pakistan, with the female mortality being higher than male mortality. However, during seventies the infant and child mortality quickly declined and the sex differentials were also reversed i.e. the mortality rates among male children became higher than that of females. Urban rural dichotomies in infant and child mortality remained persistently in favor of the urban areas [Afzal, Raja and Mohammad (1988)]. Despite the declining trend, under-five and infant mortality in Pakistan is highest among the South Asian countries, with the exception of Afghanistan. The troubling fact is that this was not always the situation (See, Figure I). Back in the 1970s the under-five mortality rate (death of children under-five years of age per thousand live births) in Pakistan was lower than that in Maldives, Bangladesh, Nepal, India and Bhutan (WDI, 2016). The state of affairs in Figures I & II, is alarming in the sense that that although the trend of infant and under-five mortality in South Asia is negative, the slowest pace of progress is observed in case of Pakistan, making an investigation into the issue even more pertinent.

Figure I

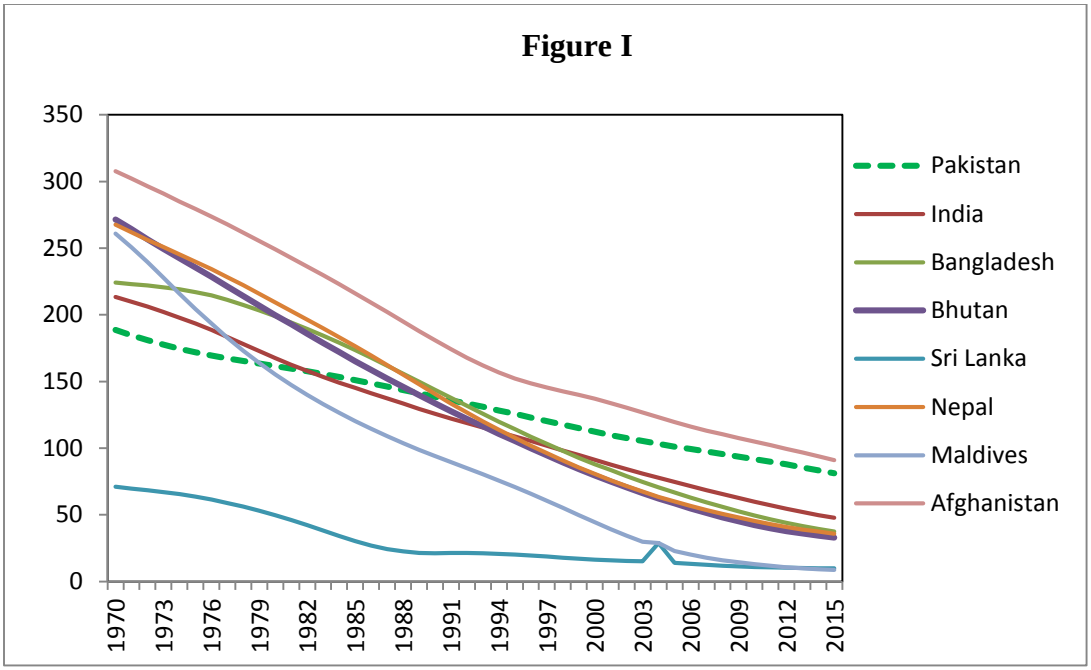
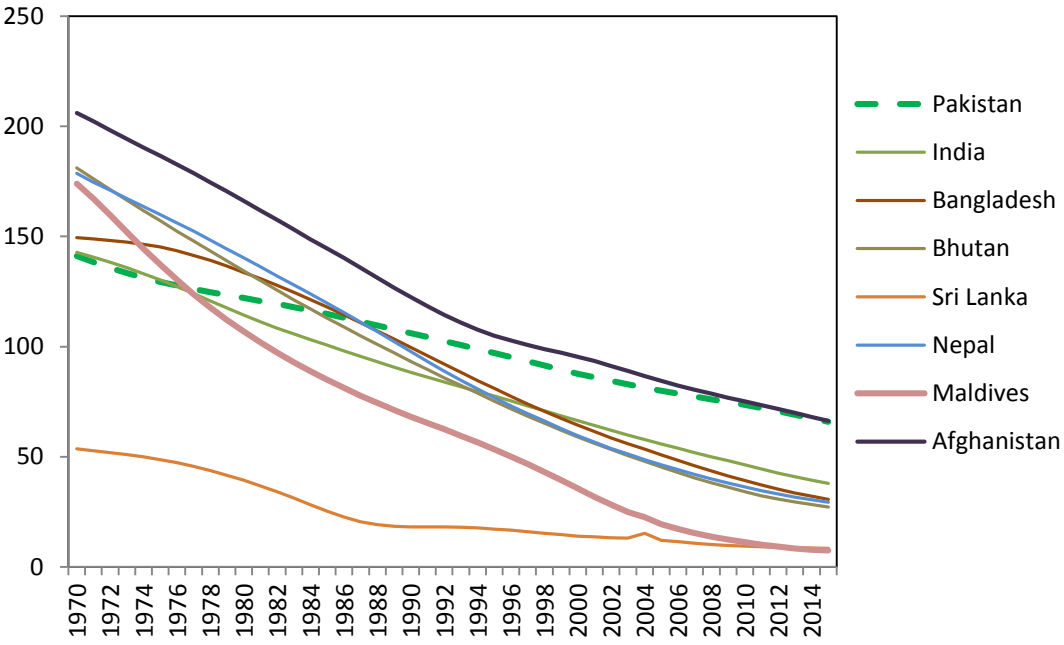


Figure II
Infant Mortality in South Asia (1970-2014)



Source: World Development Indicators, 2016

Further, the analysis of Zahid (1996) identified various factors responsible for child mortality using Pakistan Demographic and Health Survey (PDHS) 1990-91. The study found that infant and child mortality is higher for rural areas as compared to urban areas, giving credence to the assertion that infant and child mortality is not evenly distributed within the country. This reinforces the conclusions drawn by Sathar (1987), who further identifies income and availability of healthcare as factors that affect infant mortality in Pakistan. Hence, the

issue of child mortality needs to be investigated with the view of determining the inequalities in child mortality that would help us in identifying the most vulnerable segments of population.

Considering the fact that Pakistan, throughout its history, has faced a severe constraint of resources, a blanket policy for reducing infant and child mortality for all areas and regions within the country may be financially and administratively infeasible. This makes the identification of target population and areas for intervention all the more important. We aim to compute the inequality in infant and child mortality on the basis of relative wealth of the households across Pakistan and among the various regions within the country by calculating the inequality for each constituency separately. Using the data from the Demographic and Health Survey (DHS) 2012-13[2] published by USAID, we have computed the inequality in under-five mortality and infant mortality for Pakistan. Multiple indicators were employed to calculate inequalities in order to assess robustness of our findings and the results remain consistent.

2. Literature Review

Health Inequalities are an important concern for both developed and developing countries. Particularly, in recent years, international organizations such as world Health Organization (WHO), United State AID (USAID) and World Bank (WB) have shown their concerns regarding the health sector of developing countries. In addition, at national level, many governments have directed their policies towards improving the health opportunities and reducing the inequalities in health facilities across different segments of population. The growing importance of health inequalities has given impetus to empirical literature to identify the factors which affects health status notably child mortality and inequality in child mortality. The empirical literature on health inequalities has covered developed and developing countries to estimate inequality in child mortality. At large, these empirical studies have shown that there exist inequalities in child mortality rate both in developed and developing countries [Haines (1990), Hill (1992)].

The pioneering work on identifying the socioeconomic inequalities in health sector is carried out by Kakwani *et al.* (1997) by using concentration index (CI) and relative index of inequalities (RII). Their study use data of 1980-1981 from Dutch Health Interview Surveys (DHIS). By dividing the sample into income deciles, the study concludes that socioeconomic groups in the lower deciles face more ill-health relative to socioeconomic groups in the higher deciles. In the similar vein, Wagstaff (2000) stresses the importance of measuring mortality rate and inequality in mortality rates between different income groups. He estimated mortality rates of poor and non-poor households for nine developing countries including Pakistan from 1987 to 1996. The inequality in child mortality has been computed through CI. The study reports that inequality in mortality of under-five children is more severe than the inequality in mortality of infants. In addition, Gakidou *et al.* (2000) proposes multiple approaches to measure health inequality. The study suggests that in measuring health inequality, the whole

[2] The latest available survey conducted for Pakistan

range of mortal and non-mortal health outcomes should be considered by using the concept of whole span of healthy life. Gakidou and King (2002) provide an estimate of overall health inequality by incorporating all possible inequalities among individuals. The study focuses on children under two years of age for the measurement of health inequalities for fifty middle and low-income nations and employed beta binomial regression model. The important finding of the study is that there is significant difference in total health inequality among countries even if the average child mortality in these countries is similar.

Recently, the literature has identified household's socioeconomic status as the major cause of inequality in child mortality. In Particular, Hanmer et al. (2003) analyze the relationship between income per capita and child mortality for a set of developing countries. The study argues that income per capita is not the indicator of health status of a country. Countries with higher per capita income may observe higher mortality rates and vice versa. Similarly, Wang (2003), based on DHS database for 1990 and 1999, also reports that inequality in under-five mortality is more prevalent in low-income countries relative to infant mortality inequality. The study stresses that it is more important to improve living conditions and geographical conditions of marginalized income groups by providing better medical facilities, clean drinking water and other health facilities in order to moderate the inequality in child mortality. Reza et al. (2006) employ Principal Component Analysis (PCA) to measure health status of Iranian households by using DHS data from 1990-1999. The study provides evidence that inequality in the economic status of the household is the dominant factor contributing in the inequalities in child mortality. Therefore, the study recommends, it is important to direct policies towards improving the living conditions in terms of providing better health facilities in order to curtail the incidence and inequality in child mortality. Vapattanawong et al. (2007) also provide evidence that improvement in household socioeconomic status leads to decline in under-five mortality during 1990-2000. In addition, Houweling and Kunst (2010) argue that infant and child mortality is a phenomenon more relevant to low and middle-income countries. In these countries, the parental socioeconomic structure is the most important factor determining the probability of infant and/ or child mortality. More recently, Jankowska et al. (2013) investigated inequality within 16 urban areas for birth cohorts from 1987 to 2006 of Ghana. By applying Rajaratnam et al. (2010) methodology, the study reports variations in child mortality across selected zones and concluded that the surroundings of the household significantly affects the mortality rate. Quentin et al. (2014) examine the inequalities in child mortality by using DHS survey across ten cities of Africa. The study concludes, based on the CI estimates, that child mortality is more prevalent in poor quintiles as compared to the rich.

The inequality literature, in recent years, has also explored the role of factors other than the socioeconomic status of households in infant/child mortality as well as its inequality. The important contribution in this regard is of Brockerhoff and Hewett (2000). The study has estimated inequality in child mortality across different ethnic groups of eleven African countries by using data from DHS. The study provides the evidence of inequality in child mortality in all countries at least in one age group of children. In addition, they conclude that

socioeconomic status of households plays an important role in explaining the inequality in child mortality. Furthermore, Macassa and Burström (2006), based on DHS (1997) dataset, report that ethnicity has stronger impact on child mortality. In the similar vein, Antani et al. (2009) use Nageria Demographic and Health Survey (2003) to examine the role of religion in under-five mortality. By using multivariate modeling technique, the study substantiates that mother's religion or religious affiliation significantly affects mothers' attitude towards prenatal and postnatal healthcare services which creates inequality in child mortality. The study suggests that the availability of health services and prenatal care must be ensured irrespective of the mothers' religious believes. Bathacharaya and Chikwama (2012) estimate the inequality in child mortality and causes behind this inequality in various districts of India. The study identifies that access to clean water, share of agriculture labor in total labor force are important factors in reducing the child mortality. In addition, access to medical facilities increases inequality in child mortality by 20 percent to the advantage of developed districts. McKinnon et al. (2014) measure absolute inequality (using slope index of inequality) and relative inequality (using relative index of inequality) with respect to two socioeconomic status; maternal education and wealth index of households. The study has done a comparative analysis by using two DHS surveys with ten-year gap. The findings of the study identify a decline in absolute as well as relative mortalities based on household wealth and education level in most of the low and middle-income countries. Bendavid (2014) argues that among the low and middle-income countries, under-five mortality is higher where governance structure is comparatively poor. Based on DHS data from 2002-2012, the study reports a decline in the relative mortality between poorest and least poor wealth quintile. In addition, under-five mortality shows a declining trend among the poorest relative to least poor quintile in low and middle-income countries. Using three waves of Cambodian DHS (2000, 2005, and 2010), Jimenez-Soto (2014) measure absolute and relative disparities in child mortality with respect to rural/urban regions as well as household wealth. The findings bare a significant decline in under-five mortality rates while the neonatal mortality exhibits a slower decline. However, the findings reveal an increase in relative as well as absolute inequality in child mortality across regions. Romaric (2015) identified childbirth order, maternal age, and household size as the main contributing factor in inequalities in child mortality. By using CI, to measure inequality in under-five mortality in West Africa, the study evidenced that the most disadvantaged wealth groups have the highest mortality rates.

3. Methodology and Data

To measure inequality in child mortality, the study will use three methods: (i) Concentration index (CI), (ii) concentration Curve derived from CI (iii) the index of dissimilarity. The CI is developed by Kakwani (1977, 1980). This index helps in quantifying the socioeconomic related inequality in health sector [Wagstaff, van Doorslaer, and Paci (1989), Kakwani, Wagstaff, and van Doorslaer (1997)]. The existing empirical literature has used the CI and concentration curve to measure the socioeconomic related inequality in child mortality [

Wagstaff (2000)], child immunization [Gwatkin et al. (2003) and Wagstaff et al. (2003)], and health subsidies [O'Donnell et al. (2007)].

The CI is built up on the basis of concentration curve and therefore defined as "twice the area between the concentration curve and the line of equality (the 45-degree line). The CI can obtain three possible values: (i) The index value is zero in case of no socioeconomic-related inequality, (ii) a negative value when it lies above the equality line. Moreover, the negative value of CI implies that the inequality is concentrated towards a lower socioeconomic (disadvantage) group, (iii) and a positive value when it lies below equality line and indicates the concentration of inequality towards high socioeconomic group. The CI is similar to relative index of inequalities (RII) which is widely used in the existing literature to measure socioeconomic inequalities.

The concentration index is explained as follows

$$C = 1 - 2\int_0^1 L_h(p)dp. \qquad 3.1$$

The index ranges between -1 and +1. For a discrete living standard variable, it is written as:

$$C = \frac{2}{N\mu}\sum_{I=1}^{n} h_i r_i - 1 - \frac{1}{N}, \qquad 3.2$$

where h_i reflects the health variable, μ is mean, and r_i=$\frac{i}{N}$ is the fractional rank of individual i in the distribution of living standards ($i = 1$ indicates poorest and $i = N$ reflects richest). Alternatively, CI can be computed as the covariance between heath sector variable and the relative rank in the distribution of living standard [Kakwani (1980), Jenkins (1988), and Lerman and Yitzhaki (1989)]. This can be done by using the following formula:

$$C = \frac{2}{\mu} Cov(h, r) \qquad 3.3$$

Notably, the CI shows the relation between a health variable and indicator of the living standards rank.

In computation of CI both size and sign of the index plays an important role. The sign reflects the nature of relationship between the economic status and child mortality, whereas the magnitude indicates the strength of the relationship. Also, it also identifies the degree of variability in the child mortality. Moreover, the index is more appropriate for a variable measured on a ratio scale with a non-negative values.

Estimation for grouped data

Following Fuller and Lury 1977), the CI for *t*=1,…,*T* groups can be computed as follows:

$$C = (p_1 L_2 - p_2 L_1) + (p_2 L_1 - p_1 L_2) + \ldots\ldots\ldots\ldots\ldots\ldots + (p_{T-1} L_T - p_T L_{T-1}) \qquad 3.4$$

where p_t is the cumulative percentage of the sample which is ranked by their economic status in group t, and $L_t$is the coordinate of the corresponding concentration curve.

A standard error of the *CI* in the grouped data can be computed by following Kakwani et al. (1997). Let f_t be the proportion of sample in the t^{th}group, and relative rank of this group is defined as:

$$R_t = \sum_{k=1}^{t-1} f_k + \frac{1}{2}\ f_t \qquad 3.5$$

this is the cumulative fraction of the population up to the midpoint of each group interval. The variance of *C* is as follows:

$$Var(\widehat{C}) = \frac{1}{n}\ [\sum_{t=1}^{T} f_t\ a_t^2 - (1+C)^2] + \frac{1}{n\mu^2}\ \sum_{t=1}^{T} f_t\ \sigma_t^2\ (2R_t - 1 - C)^2 \qquad 3.6$$

where *n* is the sample size, σ_t^2 is the variance of the health variable in the group, μ is its mean,

$\alpha_t = \frac{\mu_t}{\mu}\ (2R_t - 1 - C) + 2 - q_{t-1} - q_t$, and $q_t = \frac{1}{\mu}\sum_{k=1}^{t} \mu_k f_k$

which is the ordinate of $L_h(p), q_0 = 0$, and $p_t = \sum_{k=1}^{t} f\ _k R_k$ [Kakwani et al. (1997).

Data Sources

The study has used the data of Demographic and Household Survey (DHS) published by USAID. The data provides detailed information on Health related variables as well as on other relevant variables which we intend to use in the analysis. We have used the latest DHS available for the year 2012-13. The advantage of using this dataset over other data set is that the instruments are identical across countries and also nationally representative. Also the estimates of mortality rates are also obtained by using consistent method.

4. Child Mortality in Pakistan: Discussion of Results

4.1. Descriptive Statistics

Moving towards geographical territories, we can observe that in case of under-five mortalities, Punjab has the highest score (10.97%) while Sindh has the lowest incidence (9.43%) of under-five mortalities. The capital city exhibits the lowest incidence (5.34%) of mortality. Moving to the infant mortality, the incidence of infant mortality is 7.99% in case of Pakistan. Among selected territories, the incidence is highest in Punjab (9.30%) followed by Baluchistan (9.15%), Gilgit Baltistan (8.47%), Sindh (7.72%), and lowest in KPK (6.32%), respectively. The incidence of infant mortality is the lowest (4.62%) in Islamabad.

The regional disparities are stark. Baluchistan and Punjab are experiencing the highest incidence of infant as well as under-five mortality. This is a startling observation since Baluchistan is considered to be the least developed region in the country and Punjab is considered to be the most developed. Among the provinces, KPK has the lowest infant and under-five mortality rates. However, regionally, Islamabad (capital territory) faces the lowest infant and child mortality rates. The significant Pearson's chi square coefficient value reflects variation in infant and under-five mortality across regions.

Among the socioeconomic groups, poorest tend to have the highest infant and child mortality for Pakistan as well as for most of the regions. However, the capital territory depicts an interesting variation to this trend where the highest mortality occurs in the middle socioeconomic group. In the four provinces the richest welfare group depicts lowest incidence of infant and under-five mortality but for Gilgit Baltistan and Islamabad the lowest incidence of mortality is the "Richer" wealth group. The picture becomes clearer when we combine the two

subgroups i.e. “poorest” with “poor” and “richer” with “richest”. The situation in Islamabad becomes consistent with the rest of the country where the highest incidence of infant and under-five mortality occurs in the “poor” and the “poorest” socioeconomics groups combined and the least mortalities incur in the “richer” and the “richest” groups combined. However, in case of Gilgit Baltistan, “richer” and “richest” groups combined face an inexplicably high rate of infant and child mortality, albeit lower than the “poor” and “poorest” wealth groups combined, infant and child mortality. These anomalies may reflect certain non-economic attributes that may be contributing to infant and child mortality in these regions. In Gilgit Baltistan for instance, geographical proximity, or its lack thereof, to healthcare facility may be responsible for high infant and child mortality among well-off households.

The Pearson correlation coefficient is highly significant for all the regions and Pakistan as a whole, indicating a strong correlation between wealth status and infant and under-five mortality and giving credence to the hypothesis that infant and child mortality is unequally distributed across wealth groups. In order to assess the inequality of infant and child mortality, we need to utilize specialized indicators for making the situation clearer.

Table 1
Incidence of Mortality Across Regions

Region	**Infant Mortality (%)**	**Under-Five Mortality (%)**
Pakistan	7.99	9.45
Punjab	**9.30**	**10.92**
Sindh	7.72	9.43
Khyber Pakhtunkhwa	6.32	7.31
Baluchistan	9.15	10.62
Gilgit Baltistan	8.47	10.37
Islamabad (Capital Territory)	4.62	5.34
Pearson χ^2	**132.0857**	**164.0155**
Probability	**0.00**	**0.00**

Table 2 Incidence of Under-Five Mortality Across Wealth Groups							
Wealth Groups	**Pakistan**	**Punjab**	**Sindh**	**Khyber Pakhtunkhwa**	**Baluchistan**	**Gilgit Baltistan**	**Islamabad (Capital)**
Poorest	13.01	16.41	12.47	8.22	14.87	12.22	11.68
Poor	10.49	13.69	11.89	8.28	7.93	10.42	5.31
Middle	9.36	10.26	11.20	7.45	8.73	8.86	12.19
Richer	8.58	10.80	7.47	7.15	9.48	6.04	4.83
Richest	5.46	6.27	5.44	4.57	7.30	9.91	3.83
Total	9.45	10.92	9.43	7.31	10.62	10.37	5.34
Pearson χ^2	**362.034**	**128.810**	**109.982**	**21.872**	**82.286**	**18.759**	**49.092**
Probability	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.001**	**0.00**

Table 3 Incidence of Infant Mortality Across Wealth Groups							
Wealth Groups	**Pakistan**	**Punjab**	**Sindh**	**Khyber Pakhtunkhwa**	**Baluchistan**	**Gilgit Baltistan**	**Islamabad (Capital)**
Poorest	10.67	13.55	9.90	5.41	12.57	10.05	10.95
Poor	8.68	11.35	9.82	7.04	6.65	8.32	3.54
Middle	8.08	8.61	9.35	6.85	7.63	7.55	10.94
Richer	7.32	9.27	6.59	5.99	8.42	4.56	3.28
Richest	4.91	5.91	4.32	4.43	6.83	8.93	3.56
Total	7.99	9.30	7.72	6.32	9.15	8.47	4.64
Pearson χ^2	**243.706**	**84.078**	**84.477**	**12.723**	**61.634**	**16.547**	**48.634**
Probability	**0.000**	**0.00**	**0.00**	**0.013**	**0.00**	**0.002**	**0.00**

4.2. Concentration Index and Concentration Curve

CI is widely used in the health literature to measure health inequalities. We use child mortalities (both infant and under-five) to assess the health outcomes in Pakistan, as these are largely recognized as the key indicators

of health status.[3] The inequalities in mortality are computed with respect to wealth status of households. In this regard, the households are divided into five categories; richest, richer, middle, poor, poorest. Later, based on the CIs, CCs are drawn for more clear understanding of the spread of mortality rates among selected set of wealth groups and cumulative mortality rates. The CI and CC are obtained for Pakistan as well as for all the constitutional territories, namely Punjab, Sindh, Baluchistan, KPK, Gilgit Baltistan, and Islamabad. The estimates of CI are presented in Table 4.[4] Column 2 of Table 4 presents the inequality in infant mortality rates while column 3 displays the inequality in under-five mortality rates. The corresponding CCs are displayed in Figures 3-6.

The estimates reveal that the CI, in all cases, is negative. The statistical significance, though, varies. The negative value of CI signifies the fact that the inequality in mortality, in both measures of mortalities, is higher in lower quintile of wealth. Kakwani et al. (1997), Wang (2003), Bado *et al.* (2015) among others also reported a negative value of the CI and that the child mortality is more among poorest quintiles of the wealth group.

Considering the inequalities in infant mortalities, we can observe that the lowest inequalities are experienced by KPK (-0.056%) while the highest inequalities are again found in Sindh (-0.163%) followed by Punjab (-0.127%), Baluchistan (-0.118%), and Gilgit Baltistan(-0.091%), respectively. The infant mortality inequalities are insignificant only in case of KPK where the inequality rate is the lowest. Islamabad, as the capital city of Pakistan, faces the highest infant mortality inequality (-0.189%) as well though statistically insignificant. It is important to note that in each territory and for Pakistan, too, the mortality is biased in favor of the richest quintile of the population.

The CCs for infant mortality inequality show that the CC is farthest from the equality line in the case of Sindh for which we report highest inequality amongst provinces, followed by Punjab. The CC for KPK shows the minimal difference of CC from the equality line for which we obtain the lowest inequality in infant mortalities. In case of Islamabad, we can observe that the CC lies significantly above the equality line indicating large inequalities in the capital city. From the above findings, we have an interesting conclusion that there is negative association between level and inequality of mortality rates.

In case of inequalities in under-five mortality, it should be noted that, for Pakistan, the incidence of under-five mortality is higher than the infant mortality. However, the inequality of under-five mortality (0.09%) is lower than the infant mortality (0.12%). This outcome is supported by Wang (2003), who reports that regions with higher level of mortality have lower level of inequality.

Moving towards the inequalities in under-five mortalities in selected territories, the CI indicates that the lowest

[3] The alternate measure of health status is morbidity, which, however, is not available across countries as frequently as mortality rates are. Life expectancy is an alternate measure of health status but it is also drawn from the mortality rates. Therefore, we prefer using mortality rates as the indicator of health status.

[4] The detailed computation of CI is not provided for the sake of brevity. It is, however, available upon request form authors.

inequalities in under-five mortality rates are experienced by KPK (-0.07%) while the highest inequality is reported in Sindh (-0.167%) followed by Baluchistan (-0.130), Gilgit Baltistan (-0.074) and Punjab (-0.097%), respectively. Notably, the inequalities in the case of Punjab and KPK are statistically insignificant while the inequalities in other regions as well as Pakistan are statistically significant. Islamabad, as the capital city of Pakistan, faces the highest under-five mortality inequality (-0.189%) where the incidence of mortality is reported as lowest.

The CC based on the CI also supports the above analysis. CC above the parity line implies that the inequality in health is biased against the disadvantaged economic group. Our findings also show that all the CCs lie above the respective parity lines (see Figures 3-6) this means that the disadvantaged wealth group namely the poorest have the highest mortality rates while the richest quintiles have the lowest mortality rates. This observation is true for both under-five as well as infant mortality rates. In case of Pakistan, we can see that for infant mortality, the CC is relatively at a larger distance from the equality line with respect to under-five mortality. This is in line with our CI estimates, as infant mortality inequality is higher than the under-five mortality inequality.

As we move upwards in the wealth groups, from poorest to richest, there is gradual decline in the incidence of infant as well as under-five mortality rates. This finding is also supported by the existing literature [Wang (2003), and Wagstaff (2000)]. This finding also reflects that the child survival amongst the disadvantaged groups is weak relative to their wealthy counterparts. Alternatively, the prospects of child survival improve with the up-gradation in the wealth status. We can conclude from this exercise that the inequality in the wealth has led to creation of inequalities in the health status in Pakistan. The better-off groups enjoy better life chances relative to poorer ones. Further, the most prosperous region in Pakistan i.e. Islamabad and Capital territory exhibits highest inequality in infant and under-five mortality, giving credence to the Wang (2003) hypothesis. On the other hand KPK has emerged as a special case depicting lowest mortality rates and inequality in infant and under-five mortality despite not being relatively less well-off than Islamabad, Sindh and Punjab. This observation lends credibility to the idea that social inequalities may be an outcome of non-economic factors. Further, not only does the province exhibit the lowest infant and under-five mortality, it also fares much better in terms of inequality in child mortality. The province has the lowest value of the concentration index for both infant and under-five mortality, which is also insignificant. Haq and Zia (2008) by ranking the districts of Pakistan in terms of human well-being demonstrated that in KPK, 12 of the 26 districts were ranked as having “High” or “Fair” human development while in Sindh only 7 out of 29 districts fell in those categories. This might explain the low mortality and low inequality in mortality in KPK and high inequality as well as incidence in Sindh. Jabeen and Khan (2016) concluded that citizens of KPK are happier than people from any other province. This combined with the view of Guven and Saloumidis (2009) that happiness reduces the chances of mortality in a community explains lower infant and under-five mortality inequality in KPK.

T**able 4** **Concentration Indices**		
Region	**Infant Mortality**	**Under-Five Mortality**
Pakistan	-0.129*** (0.043) [-3.006]	-0.097** (0.046) [-2.136]
Punjab	-0.127*** (0.048) [-2.631]	-0.013 (0.296) [-0.043]
Sindh	-0.163*** (0.053) [-3.104]	-0.167*** (0.039) [-4.256]
KPK	-0.056 (0.040) [-1.395]	-0.073 (0.045) [-1.631]
Baluchistan	-0.118*** (0.035) [-3.379]	-0.130*** (0.033) [-3.865]
Gilgit	-0.091** (0.046) [-1.981]	-0.074* (0.038) [-1.947]
Islamabad	-0.189 (0.125) [-1.505]	-0.189** (0.086) [2.117]

Concentration Curves

Figure III
Infant Mortality Inequality in Pakistan

Figure IV
Under-Five Mortality Inequality in Pakistan

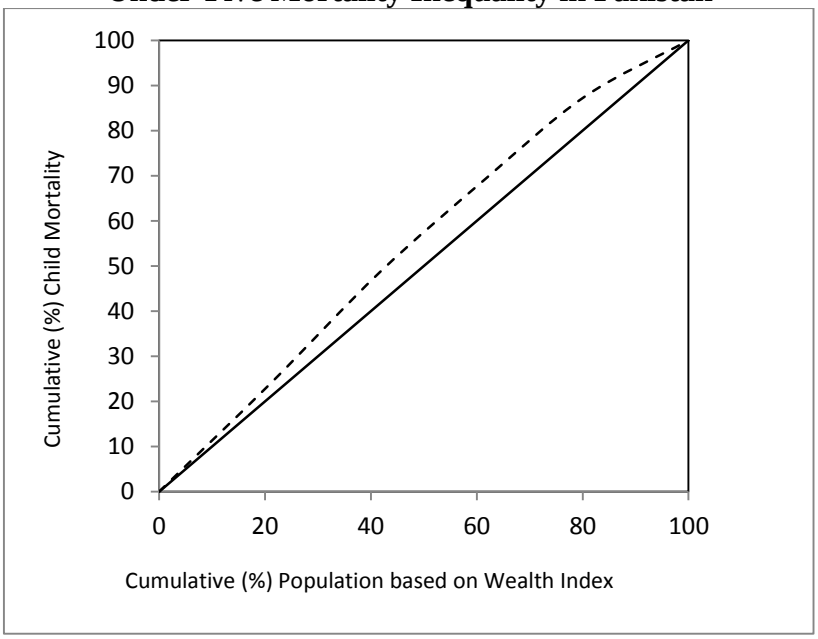
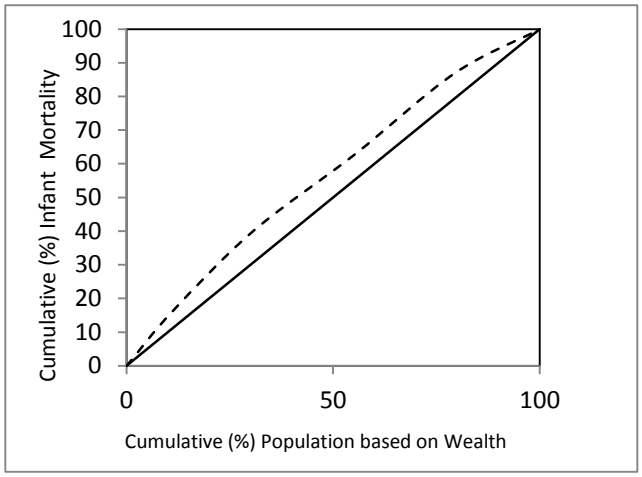


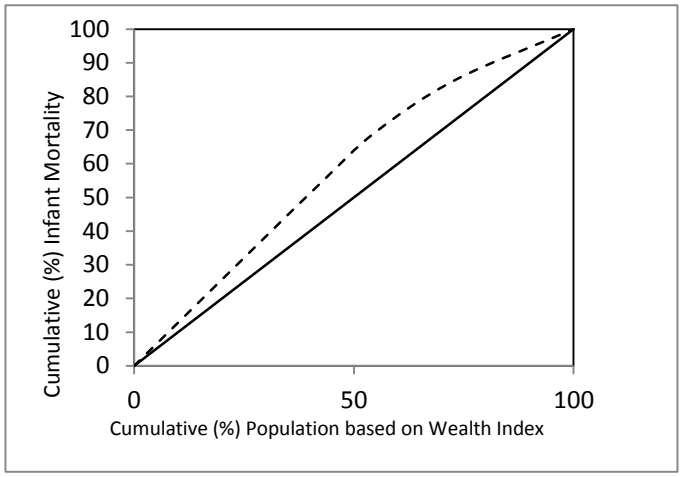
Figure V

Infant Mortality Inequality (Regional Comparisons)

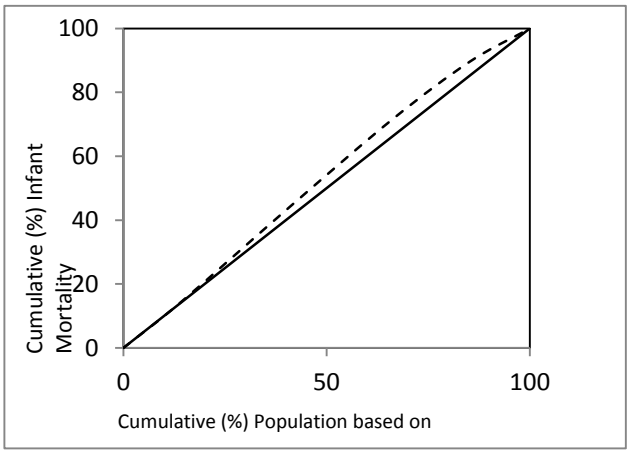
Punjab



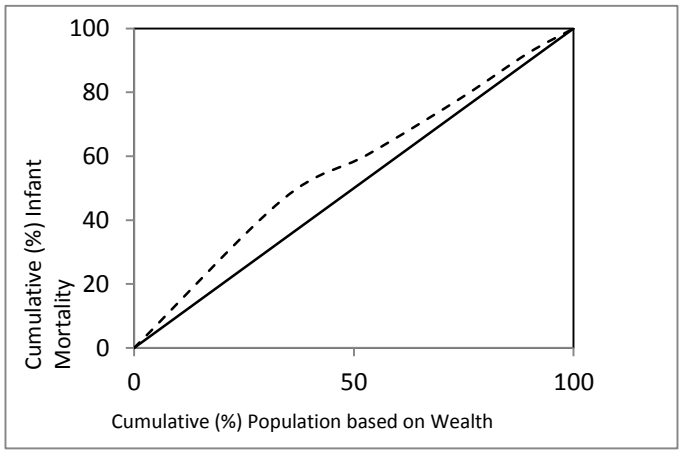
Sindh



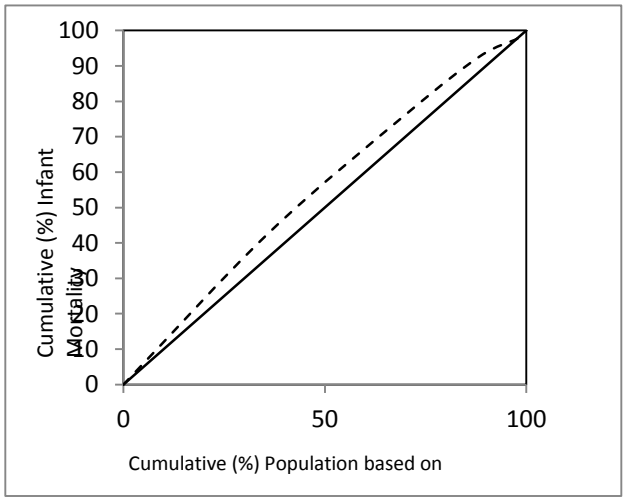
KPK



Baluchistan



Gilgit Baltistan



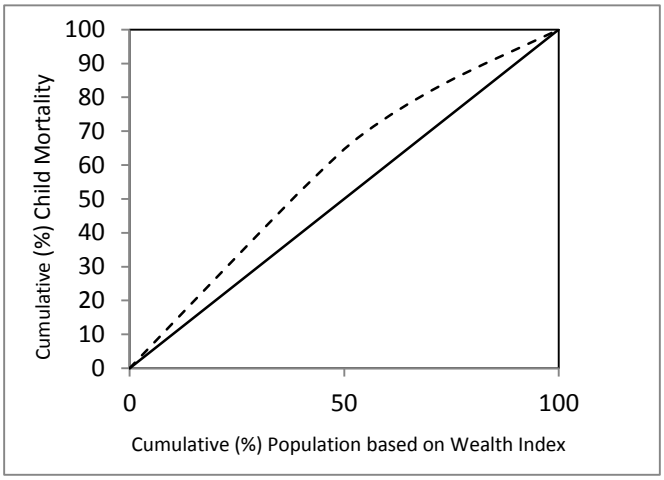
Islamabad (Capital Territory)

Figure VI

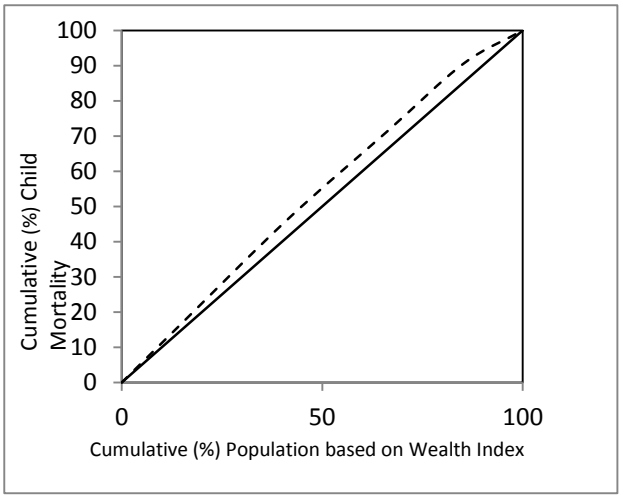
Under-Five Mortality Inequality (Regional Comparisons)

Punjab

Sindh

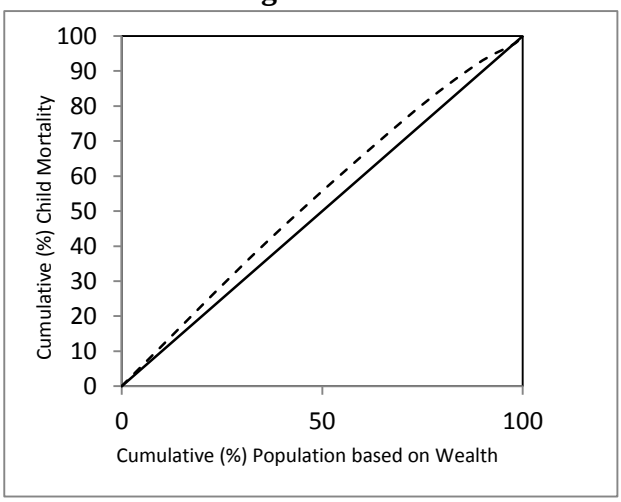


KPK

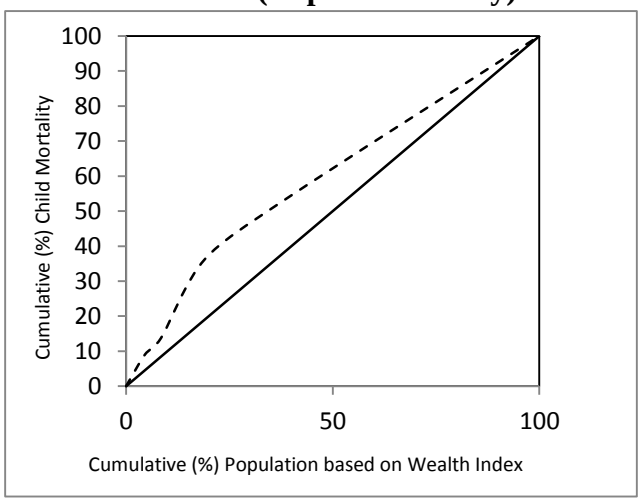


Baluchistan

Gilgit Baltistan



Islamabad (Capital Territory)



Dissimilarity Index: Robustness Check

In order to ascertain the robustness of our results we have employed the dissimilarity index (DI) as specified by Wagstaff *et al.* (1991). The formula of this index is as follows:

$$ID = \frac{1}{2}\sum_j \left|s_{jh} - s_{jp}\right|$$

j represents socioeconomic groups, which in our analysis are identified through the wealth index. s_{jh} is thej^{th} socioeconomic group's share in the incidence of mortality and s_{jp} the j^{th} group's share in total population. The absolute difference between health share and population share is expected to reflect the degree of inequality in mortality.

Table 5
Dissimilarity Index

	Infant Mortality	**Under-Five Mortality**
Pakistan	0.0912	0.0765
Punjab	0.0939	0.1079
Sindh	0.1449	0.1475
KPK	0.0539	0.0534
Baluchistan	0.1266	0.1317
Gilgit Biltistan	0.0687	0.0576
Islamabad (Capital Territory)	0.2088	0.1722

The values of the dissimilarity index confirm our concentration index and concentration curve analysis. Among the provinces, Sindh depicts the highest value dissimilarity index (0.1449 for infant mortality and 0.1475 for

under-five mortality). However, regionally Islamabad and Capital Territory has the highest dissimilarity index (0.2088 for infant mortality and 0.1722 for under-mortality mortality), depicting highest inequality in the most affluent region of the country. This outcome is striking as the infant mortality rate for Islamabad is the lowest among all regions. Baluchistan is experiencing the highest level of dissimilarity after Islamabad and Sindh. On the other hand, KPK and Gilgit Baltistan experience the lowest values of infant and under-five mortality dissimilarity index. Since KPK also happens to have the lowest infant mortality rate, depicting low inequality accompanied by lowest incidence of infant and under-five mortality in the province. This may attributable to the cultural aspects and close community ties leading to strengthening of the social safety nets in the province.

Conclusion

The most tragic manifestation of lack of development and failure in meeting basic needs is mortality among the most vulnerable segment of the society, namely, infants and children under-five. Pakistan has the highest infant and under-five mortality in South Asia, excluding Afghanistan, making an in-depth probe into this matter necessary. We aimed to assess inequality in infant and under-five mortality in Pakistan and also conduct a comparative regional analysis using a variety of methods to ensure robustness of our arguments.

The results revealed existence of significant inequalities in infant and under-five mortality in Pakistan and across its constituencies. Highest inequality is observed in the capital territory and Sindh and lowest was observed in KPK and Gilgit Baltistan. However, the high inequality in capital territory was accompanied by low infant and under-five mortality in Islamabad, while KPK experiences lowest levels of inequality with low mortality rates. Punjab, despite being relatively more developed than other provinces, experiences the highest mortality rates along with high inequality. While inequality in infant and under-five mortality exists across wealth groups, its asymmetric prevalence across the different regions in the country may be attributed to the existence of non-economic factors at the regional, as well as, household level. The existing literature has identified various factors which contribute towards inequalities in infant/child mortalities that may explain these aberrations. For instance, at household level, parents' characteristics such as education, occupation, per capita income, and household living conditions, geographical area of residence, access to various health facilities such as clean drinking water, utilization of health services, type of food. In addition, the regional health policies and reforms also play catalytic role in determining the mortality rate as well as inequalities in mortalities (Liu, Gao & Yan, 2014).

References

Afzal, M., T. A. Raja & A. Mohammad (1988), 'Some Differentials in Infant and Child Mortality Risks in Pakistan 1962-1986', *The Pakistan Development Review*, Vol. XXVII, No. 4, Part II.

Antai, D., Ghilagaber, G., Wedrén, S., Macassa, G., & Moradi, T. (2009). Inequities in Under-Five Mortality in Nigeria: Differentials by Religious Affiliation of the Mother. *Journal of religion and health*, *48*(3), 290-304.

Bado, A. R., & Appunni, S. S. (2015). Decomposing Wealth-Based Inequalities in Under-Five Mortality in West Africa. *Iranian Journal of Public Health*, *44*(7), 920-930.

Bendavid, E. (2014). Changes in child mortality over time across the wealth gradient in less-developed countries. *Pediatrics*,134(6):e1551–e1559

Bhattacharya, P. C., & Chikwama, C. (2011). Inequalities in child mortality in India: A district-level analysis. *Asian Population Studies*, *7*(3), 243-261.

Brockerhoff, M., & Hewett, P. (2000). Inequality of child mortality among ethnic groups in sub-Saharan Africa. *Bulletin of the World Health Organization*, *78*(1), 30-41.

Fuller, M. F., & Lury, D. A. (1977). Statistics Workbook for Social Science Students. Phillip Allan.

Gakidou, E. E., Murray, C. J., & Frenk, J. (2000). Defining and measuring health inequality: An approach based on the distribution of health expectancy. *Bulletin of the World Health Organization*, *78*(1), 42-54.

Gakidou, E., & King, G. (2002). Measuring total health inequality: Adding individual variation to group-level differences. *International journal for equity in health*, *1*(1), 1-12.

Gwatkin, D. R., S. Rustein, K. Johnson, R. Pande, and A. Wagstaff. 2003. *Initial Country-Level Information about Socio-Economic Differentials in Health, Nutrition and Population,* Volumes I and II. Washington, DC: World Bank Health, Population, and Nutrition.

Haines, R. M.(1985). Inequality and childhood mortality: A comparison of England and Wales, 1911, and the United States, 1900. The Journal of Economic History, 45(4), 885-912

Hanmer, L., Lensink, R., & White, H. (2003). Infant and child mortality in developing countries: analysing the data for robust determinants. *The Journal of Development Studies*, *40*(1), 101-118.

Hill, K. (1991). Approaches to the measurement of childhood mortality: A comparative review. *Population Index*, 57(3), 368-382.

Hosseinpoor, A. R., Van Doorslaer, E., Speybroeck, N., Naghavi, M., Mohammad, K., Majdzadeh, R., ... & Vega, J. (2006). Decomposing socioeconomic inequality in infant mortality in Iran. *International journal of epidemiology*, *35*(5), 1211-1219.

Houweling, T. A., & Kunst, A. E. (2009). Socio-economic inequalities in childhood mortality in low-and middle-income countries: a review of the international evidence. *British medical bulletin*, *93*(1), 7-26.

Jankowska, M. M., Benza, M., & Weeks, J. R. (2013). Estimating spatial inequalities of urban child mortality. *Demographic research*, *28(2)*, 33-62

Jenkins, S. (1988). Calculating income distribution indices from micro-data. *National Tax Journal*, *41*(1), 139-142.

Jimenez-Soto, E., Durham, J., & Hodge, A. (2014). Entrenched geographical and socioeconomic disparities in child mortality: trends in absolute and relative inequalities in Cambodia. *PloS one*, *9*(10), e109044.

Kakwani, N. C. (1977). Measurement of tax progressivity: An international comparison. *The Economic Journal*, *87*(345), 71-80.

Kakwani, N. C. 1980. Income Inequality and Poverty: Methods of Estimation and Policy Applications.New York: Oxford University Press.

Kakwani, N., Wagstaff, A., & Van Doorslaer, E. (1997). Socioeconomic inequalities in health: measurement, computation, and statistical inference. *Journal of econometrics*, *77*(1), 87-103.

Lerman, R. I., & Yitzhaki, S. (1989). Improving the accuracy of estimates of Gini coefficients. *Journal of econometrics*, *42*(1), 43-47.

Macassa, G., & Burström, B. (2006). Determinants of social inequalities in child mortality in Mozambique: What do we know? What could be done?. *African Journal of Health Sciences*, *13*(1), 139-142.

McKinnon, B., Harper, S., Kaufman, J. S., & Bergevin, Y. (2014). Socioeconomic inequality in neonatal mortality in countries of low and middle income: a multicountry analysis. *The Lancet Global Health*, *2*(3), e165-e173.

O'Donnell, O., Van Doorslaer, E., Rannan-Eliya, R. P., Somanathan, A., Adhikari, S. R., Harbianto, D., ... & Leung, G. M. (2007). The incidence of public spending on healthcare: comparative evidence from Asia. *The World Bank Economic Review*, *21*(1), 93-123.

Poston, D. L. & L. F. Bouvier (2010), *Population and Society,* Cambridge University Press: New York.

Poston, D. L. & R. G. Rogers (1985), 'Toward a Reformulation of the Neonatal Mortality Rate', *Social Biology*, Vol. 32.

Quentin, W., Abosede, O., Aka, J., Akweongo, P., Dinard, K., Ezeh, A., ... & Te Bonle, M. (2014). Inequalities in child mortality in ten major African cities. *BMC medicine*, *12*(1), 1-11.

Rajaratnam, J. K., Tran, L. N., Lopez, A. D., & Murray, C. J. (2010). Measuring under-five mortality: validation of new low-cost methods. *PLoS Medicine*, *7*(4), e1000253.

Sathar, Z. A. (1987), 'Seeking Explanations for High Levels of Infant Mortality in Pakistan', *The Pakistan Development Review,* Vol. XXVI, No. 1.

Sen, A., 1998. Mortality as an indicator of economic success and failure. *The Economic Journal*, 108(446), 1-25.

van Doorslaer, E., A. Wagstaff, H. Bleichrodt, S. Calonge, U. G. Gerdtham, M. Gerfi n, J.Geurts, L. Gross, U. Hakkinen, R. E. Leu, O. O'Donnell, C. Propper, F. Puffer, M. Rodriguez, G. Sundberg, and O. Winkelhake. 1997. "Income-Related Inequalities in Health: Some International Comparisons." *Journal of Health Economics* 16(1): 93–112.

Van Doorslaer, E., Masseria, C., Koolman, X., & OECD Health Equity Research Group. (2006). Inequalities in access to medical care by income in developed countries. *Canadian medical association journal*, *174*(2), 177-183.

Vapattanawong, P., Hogan, M. C., Hanvoravongchai, P., Gakidou, E., Vos, T., Lopez, A. D., & Lim, S. S. (2007). Reductions in child mortality levels and inequalities in Thailand: analysis of two censuses. *The Lancet*, *369*(9564), 850-855.

Wagstaff, A. (2000). Socioeconomic inequalities in child mortality: Comparisons across nine developing countries. *Bulletin of the World Health Organization*, *78*(1), 19-29.

Wagstaff, A., E. van Doorslaer, and P. Paci. 1989. "Equity in the Finance and Delivery of Health Care: Some Tentative Cross-Country Comparisons." *Oxford Review of Economic Policy* 5(1): 89–112.

Wagstaff, A., Van Doorslaer, E., & Watanabe, N. (2003). On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam. *Journal of econometrics*, *112*(1), 207-223.

Wang, L. (2003). Determinants of child mortality in LDCs: empirical findings from demographic and health surveys. *Health policy*, *65*(3), 277-299.

Zahid, G. M. (1996), 'Mother's Health-seeking Behaviour and Childhood Mortality in Pakistan', *The Pakistan Development Review,* Vol. 3, No. 4, Part II.