Inter-Group Inequalities in Child Undernutrition in India: Intersecting Caste, Gender and Place of Residence

Abstract

Despite profound distributional concerns, studies on undernutrition in India (or elsewhere) have exclusively focused on inter-personal inequalities whereas estimates regarding the magnitude of intersecting inequalities are unavailable. As such, an explicit concern for horizontal intersecting inequalities not only substantiates the intrinsic concern for equity but also offers vital policy insights that are evidently lost while engaging with a thoroughgoing individualistic approach. With this motivation, we apply the group analogues of Atkinson's index and Gini coefficient to unravel the disproportionate burden of undernourishment borne by rural and historically vulnerable caste groups. Furthermore, the prominent determinants of inter-group disparities are identified through Blinder-Oaxaca decomposition analysis. In concluding, the paper calls for explicit targeting of backward castes across the country and improved inter-sectoral collaboration to ensure equitable access to education, healthcare, water and sanitation, particularly across underdeveloped regions.

Keywords: Child Undernutrition, Health Inequality, Social Groups, Blinder-Oaxaca Decomposition, India

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1. Introduction

Undernutrition[1] is a prominent cause of child morbidity and mortality in developing countries[2]. It is associated with huge human and economic costs and is a major developmental concern, particularly for South Asia (Horton 1999). India being the largest country in the region - both in terms of geography and population - shares bulk of the problem where over one-half of the children are found undernourished in alternative forms. In fact, Arnold et al (2004) compares India with 58 developing countries to find only one country (Niger) with a higher level of underweight, two countries (Burundi and Madagascar) with higher levels of stunting and six countries (Burkina Faso, Chad, Cote d'Ivoire, Mali, Niger and Cambodia) with higher levels of wasting. Most backward regions of Central and Eastern India have prevalence levels exceeding 50 percent. However, this liaison between economic growth and undernutrition is contested by the fact that recent economic growth and poverty reduction in India had no consequential bearing on undernutrition levels. For example, Deaton & Dreze (2009) observe that the proportion of underweight children (below three years) decreased only marginally from 43 percent in 1998-99 to 40 percent in 2005-06. Clearly, the reciprocity between growth and undernutrition is obstructed by distributional concerns which also deserve analogous focus.

With this motivation, we engage with the most prominent distributional concern pertaining to the disproportionate concentration of undernutrition among marginalised social groups[3] (particularly, scheduled castes, SC and scheduled tribes, ST). Notwithstanding the economic status, there is evidence that these groups are often discriminated against while accessing publicly provided entitlements such as subsidised food grain through the public distribution system (PDS), meal for children at schools (Mid-Day Meal Programme) and nutritional supplements at mother and child care centres (Thorat & Lee 2010). In fact, the vulnerabilities associated with females are direct ramifications of such discriminatory societal outlook (Osmani & Sen 2003, Beherman & Deolalikar 1989, Das Gupta 1987). For instance, in rural areas of north India, relatively higher proportions of female children are undernourished and this disadvantage persists as evident from a lower rate of nutritional improvement among females (Tarozzi & Mahajan 2006).

This group-related inequality is customary referred to as 'horizontal' inequality; a concept that has considerable intrinsic and instrumental value while assessing the nature of a society and its record of 'horizontal' distributive justice (Subramanian 2009, Stewart et al 2005). Undeniably, such patterns of social stratification are evidently lost while engaging with a thoroughgoing individualistic approach to inequality assessment (Majumdar and Subramanian 2001). Despite a wider acknowledgement of inter-group disparities, studies have exclusively focused on income-related inequalities (for example, Pathak & Singh 2011, Joe et al 2010) whereas estimates regarding the magnitude of inter-group inequalities are unavailable (see, however, Joe et al 2009). Moreover, group disparities are generally analysed along a single dimension (gender, religion, ethnicity and so on) thus discounting adversities that intensify with multiple vulnerabilities. For example, health failures are notably high among females from rural and backward caste or community (Sen et al 2009). Given such intricacies, an explicit focus on intersecting inequalities is critical to help resolve this vexed issue.

In particular, we analyse the distribution of undernutrition by broad caste categories to unravel the magnitude of the problem among population subgroups placed at the bottom of the caste hierarchy (the Scheduled Castes). Since these caste identities are inherited, social welfare can be enhanced only with a significant improvement in societal outlook and political will. Examples of similar relative group disadvantages can be traced across the globe including the status of Afro-Americans in the United States, Moslems in Western Europe, Catholics in Northern Ireland, Hutus in Rwanda, and Africans in Apartheid South Africa (Stewart et al 2005). Besides, an analysis of the current nutritional status across such historically oppressed social groups is a plausible way to examine equity or inclusiveness of development in India.

2. Data Source and Variables

The data from National Family Health Survey (NFHS 2005-06) of India is used for the analysis (IIPS and Macro International 2007). The survey focuses on reproductive and child health, and therefore collects vital anthropometric information (age, height and weight) of children and adults to describe the nutritional status. The NFHS contains detailed anthropometric information on 46,655 children with 13,979 children belonging to SC/ST and the rest of the sample interchangeably referred to as the 'remaining population' or 'others'. The anthropometric information is translated into physical growth indices defined in terms of; height-for-age (stunting), height-for-weight (wasting) and weight-for-age (underweight). The identification of undernourished children is based on a methodology advanced by the World Health Organisation (WHO 2006). To elaborate, the anthropometric information collected through the survey is compared with WHO child growth standards drawn from a reference population of children from Brazil, Ghana, India, Norway, Oman, and the United States (WHO 2006). This method assumes that children all over the world have similar growth potential. Based on the reference median and standard deviations (SD) z-scores[4] are devised and children are considered undernourished if the z-score is less than -2 SD. A child is considered stunted, wasted or underweight if it is 2SD below the median score of the reference population. In this paper, we use the anthropometric indicator of underweight (low weight-for-age) as a comprehensive measure of undernutrition to capture elements of both stunting and wasting.

The NFHS facilitates estimation of inter-group inequalities by providing information regarding key individual and household level variables including broad caste categories (SCST and others) and place of residence. Household asset-based wealth index factor scores available through the dataset is used to provide socioeconomic rank to individuals (see, for details, Rutstein & Johnson 2004). Furthermore, we use a set of explanatory variables to comprehend the gaps in nutritional status among children belonging to different social groups and place of residence. Following Van De Poel & Speybroeck (2009) and Burch (2010), the prominent variables included are age and sex of the child that controls for the biological effect and also informs regarding the impact of gender discrimination. Birth order of the child, number of months of breastfeeding and maternal age at birth are also included to explain their influence on nutritional development of children. Prominent maternal correlates such as her education and nutritional status are also included as they are noted to be significantly associated with child nutrition (Burch 2010).

Household wealth index, access to safe sanitation and water and region of residence are also included to examine their respective contribution in explaining the overall group disparities.

3. Methods

Measurement of inequalities can be approached with twin objectives: first, to compare the distribution of nutritional status of individuals (interpersonal inequality) within a well-defined group; and second, to compare nutritional distribution across different subgroups (intergroup inequality). The former concern is elucidated with the help of Concentration Index (CI) that informs regarding the magnitude of income-rank related interpersonal inequalities in child undernutrition. CI could be written in many ways, one being CI = 2 covariance(u_i, r_i)/μ, where u is the undernutrition variable (underweight or low weight-for-age) whose inequality is being measured, μ is its mean, r_i is the i^{th} individual's fractional rank in the socioeconomic distribution (Wagstaff et al 1991). CI is built with a simple but interesting principle of defining equality. The principle involved stipulates that the cumulative proportions of underweight outcomes must match with the cumulative population shares and any mismatch between the two sets is defined as inequality. The CI ranges between +1 and -1 with zero depicting no inequality and large negative values suggesting disproportionately higher concentration of underweight outcomes among the poor.

As discussed above, a group perspective is indispensable to reflect on deprivations among disadvantaged population subgroups. Although, studies have attempted inter-group comparisons but they largely resort to explanation exercises supported by analysis using rate ratios and rate differentials which have considerable limitations (Houweling et al 2007, Chakraborty 2001). One of the major limitations is that such ratios apply only for two groups, and other measures are needed where there are a larger number of groups (Stewart et al 2005). Clearly, in the absence of methodological alternatives it would be rather difficult to assess the performance of policies for reducing inter-group inequalities. Hence to expand the analytical scope, we engage with two illustrative methods to measure inter-group inequalities.

While one set of estimates is based on the group analogue of Atkinson's (1970) ethical measure of inequality, the other engages with Shorrocks' (1995, 1996) group deprivation profile to arrive at group analogue of Gini coefficient (Subramanian 2006, 2009, 2011). Similar to the CI, both the group inequality measures define perfect equality as a case when proportion of undernutrition shared by each group matches with the respective subgroups' share in total population. These methods view inequalities as a disvalued outcome and provide inequality-adjusted prevalence of undernutrition by penalizing the "averages" for inherent inequalities. The procedure entails inflation of the average prevalence of undernutrition by a factor that captures the extent of inequality in the inter-group distribution of undernutrition. Group analogue of Gini coefficient is unique for its connection with group undernutrition Lorenz curve that facilitates effective visual representation of inter-group inequalities. The group-analogue of Atkinson's index differs from Gini coefficient in the sense that it obtains estimates of 'equally distributed equivalent deprivation level' (Subramanian 2011). It is described as a level of deprivation that, when equally distributed among all subgroups, would give the same level of social ill-fare as is realized with the current 'unadjusted' distribution across groups.

Group analogue of Gini coefficient

Subramanian (2009) presents the group analogue of Gini coefficient by engaging with a graphical device called the group poverty profile (see Shorrocks 1995). In general, there are K ($\geq$2) exclusive and exhaustive subgroups or j(j= 1, …, K) and information is required on U_j, the prevalence of child undernutrition for the i^{th} group, with groups indexed in non-increasing order of deprivation ($U_j \geq U_{j+1}$, j = 1, …, K – 1). U is the headcount ratio or overall (unadjusted) measure of undernutrition prevalence and is decomposable as the aggregate prevalence can be written as the population-share (t_j) weighted average of the group-specific undernutrition prevalence.

$$U = \sum_{j=1}^{k} t_j U_j$$

It could be easily verified that if all the groups are of the same size then the subgroup undernutrition outcomes U_j, are accorded the same weight (1/k). This information on subgroup shares in total population is used to construct a Group Undernutrition Profile (GUP). However, before proceeding, the rationale can be elaborated with the help of Figure 1 (explained later). An inverted image of the GUP resembles the Lorenz curve drawn beneath the line of equality and this connection can be formally established via construction of a related Group Undernutrition Lorenz Profile (GULP). Given the GULP, it is straightforward to apply mensuration formulas to compute the group analogue of Gini coefficient (Subramanian 2009).

INSERT FIGURE 1 ABOUT HERE

The GUP can now be constructed by first arranging the group specific undernutrition outcomes U_j, in non-increasing order. Thereafter, GUP is obtained as a plot of cumulated population share weighted undernutrition levels (D_j) across the subgroups and plotted against the cumulative population shares of the subgroups (T_j). Formally, GUP could be written as a plot of points $\{(T_j,D_j)\}_{j\in(0,1,\ldots,k)}$, where $T_0 = D_o = 0$ and for every (j= 1, …, K);

$$D_j(U,T_j) = \sum_{k=1}^{j} t_k U_k$$

Now in the GUP, the diagonal of the unit square can be defined as the line of maximal undernutrition; i.e., the worst case scenario when $U_j = 1$ (all undernourished), for all j. As shown in figure 1, when GUP is plotted a non-decreasing concave curve is obtained which lies beneath the diagonal of the unit square. It must also be noted that the final point (T_k,D_k) on GUP will be U. Following Subramanian (2009), figure 1 presents a typical GUP for a case where k=4. From the figure it could be revealed that when $U_j = U$, for all j then the GUP would be the straight line connecting the points 0 and U. However, the actual GUP may be found above this line (as represented by the piece-wise curve). The ratio of area beneath the GUP to the area beneath the line of maximal undernutrition expresses the level of undernutrition averaged across subgroups and enhanced by a factor that captures the extent of inequality in the inter-group distribution of undernutrition. This interpretation is apparent after the construction of GULP which can be obtained by first ranking the groups in non-decreasing order of their undernutrition levels, and then plotting the cumulative subgroup shares (L_j) in total undernutrition on y-axis against their cumulative population shares (T_j) on x-axis. Formally, GULP could be written as a plot of points $\{(1-T_{K-j},L_j)\}_{j\in(0,1,\ldots,k)}$, where $T_0 = L_o = 0$ and for every (j= 1, …, K);

$$L_j(U,1-T_{K-j}) = \frac{1}{U}\sum_{k=K-j+1}^{K} t_k U_k$$

Figure 1 illustrates a typical GULP within the unit square for a special case in which k=4. The interpretation of GULP is similar to that of the Lorenz curve i.e., the farther the GULP from the diagonal, greater is the level of intergroup inequality. The area between the GULP and the diagonal is computed geometrically to arrive at the group analogue of Gini coefficient (G);

$$G = 1 + \frac{\left[\sum_{j=1}^{K} t_j^2 U_j - 2\sum_{j=1}^{K} t_j T_j U_j\right]}{U}$$

The index G ranges between zero and one with a higher value denoting greater inequality. The ratio of the area beneath the line of maximal undernutrition and the area beneath the GUP is a direct measure of inequality-adjusted undernutrition U*. As mentioned above, U* is the aggregate undernutrition expressed as the level of undernutrition averaged across subgroups and then enhanced by a factor (G) that captures the extent of inequality in the inter-group distribution of undernutrition[5]. More formally,

$$U^* = U(1 + G)$$

Group analogue of Atkinson's Index

Atkinson (1970) advanced a constant elasticity marginal valuation, ν_A, which is consistent with the notion that with increases in deprivation the social valuation would increase at an increasing rate, i.e., ν be an increasing and strictly convex function of its argument. If $\nu(U_j)$ is the social valuation placed on the j^{th} most deprived group's undernutrition level then, following Subramanian (2004, 2011), $\nu_A(U_j)$ can be written as follows:

$$\nu_A(U_j) = \left(\frac{1}{\lambda}\right) U_j^{\lambda}$$

where $\lambda > 1$, and it reflects inter-group inequality aversion with higher values of λ indicating greater degree of aversion. Based on $\nu_A(U_j)$ the aggregate social ill-fare V is represented as a population-share weighted sum of the group-specific $\nu_A(U_j)$ as follows:

$$\nu_A(U_j) = \left(\frac{1}{\lambda}\right) \sum_{j=1}^{k} U_j^{\lambda}$$

Now following Atkinson (1970), the equally distributed equivalent deprivation level U* can be determined by,

$$\left(\frac{1}{\lambda}\right) U^{*\lambda} = \left(\frac{1}{\lambda}\right) \sum_{j=1}^{k} t_j U_j^{\lambda} \Rightarrow U^* = \left[\sum_{j=1}^{k} t_j U_j^{\lambda}\right]^{1/\lambda}$$

Here, U* is that level of child undernutrition which when shared by all groups would result in aggregate societal ill-fare which is equal to what is obtained under the existing distribution of child undernutrition. Apparently, U* is the Anand-Sen (1995) 'adjusted' measure of deprivation as advanced to arrive at a gender adjusted human development index. The group analogue of Atkinson's ethical measure of inequality, A, would be given by:

$$A = (U^* - U)/U$$

Or alternatively,

$$U^* = U(1 + A)$$

It may as well be noted that the squared coefficient of variation (SCV) in the inter-group distribution of the undernutrition outcomes is a special case where $\lambda = 2$ and is given by;

$$SCV = \left(\frac{1}{U^2}\right)\sum_{j=1}^{k} t_j U_j^2 - 1$$

This implies that U^*_{SCV} can be written as,

$$U^*_{SCV} = U(1 + SCV)^{1/2}$$

For interpretative purposes, a higher value of A and SCV would imply greater between-group inequalities in the distribution of undernutrition. A detailed discussion regarding the properties of the above discussed group inequality indices is available in Subramanian (2004, 2005, 2006, 2009, 2011).

Blinder-Oaxaca Decomposition

The differences in the average underweight z-score, U, for any two groups could be explained with the help of a set of variables in a regression model (see O'Donnell et al 2008). For example, assume the two groups to be labelled as K1 and K2, then a simple linear regression model can be set up to examine the relative effectiveness of various correlates as follows;

$U_i^{K1} = \beta^{K1} x_i^{K1} + e_i^{K1}$, if group is K1

and

$U_i^{K2} = \beta^{K2} x_i^{K2} + e_i^{K2}$, if group is K2

where, the intercept term is also incorporated in the vector of β parameters and e_i is the error term. Now the gap between the outcomes of these two groups could be expressed as;

$U^{K2} - U^{K1} = \Delta x \beta^{K1} + \Delta\beta x^{K1} + \Delta\beta\Delta x$

where, $\Delta\beta = (\beta^{K2} - \beta^{K1})$, $\Delta x = (x^{K2} - x^{K1})$.

The first term ($\Delta x\beta^{K1}$) on the right hand side is referred as the endowment effect, the second term ($\Delta\beta x^{K1}$) is the coefficient effect and the third term ($\Delta\beta\Delta x$) is an interaction effect. This method distinguishes the outcome gap into a part attributable to the fact that the one group have worse x's than the other, or the explained component (endowment effect), and a part attributable to the fact that one group has worse β's than the other, or the unexplained component (coefficient effect). The latter component is interpreted as the efficiency of translating endowments into outcomes. This analysis is conducted in STATA 10 software by using Ben Jann's *decompose* program (O'Donnell et al 2008).

4. Results

4.1. Prevalence of Undernutrition: Intersecting Caste, Gender and Place of Residence

According to national report for NFHS (2005-06), 43 percent children (below five years) in India were underweight for their age (IIPS & Macro International 2007). The problem is widespread though a few states display much higher levels of prevalence than others (Table 1). Madhya Pradesh, Bihar, and Jharkhand are amongst the high prevalence states where over one-half of the children are underweight whereas Kerala and Punjab have the lowest prevalence of 23 and 25 percent, respectively. Undernutrition outcomes are worse in rural areas (46% underweight) than in urban areas (33% underweight) with female children in northern, central and eastern India at relatively greater risk. Across the broad caste categories, undernutrition is disproportionately concentrated among children belonging to Scheduled Castes (SC), Scheduled Tribes (ST) and Other Backward Castes (OBC). While the classification of children based on gender, caste and place of residence reveals disadvantages for the vulnerable group, their intersections can have catastrophic consequences for nutritional health.

To elaborate on such concerns, further analysis subdivides the population into eight mutually exclusive sub-groups; namely: Rural, Female, Scheduled Caste/Scheduled Tribe (RFSCST); Urban, Female, Scheduled Caste/Scheduled Tribe (UFSCST); Rural, Female, Others (RFO); Urban, Female, Others (UFO); Rural, Male, Scheduled Caste/Scheduled Tribe (RMSCST); Urban, Male, Scheduled Caste/Scheduled Tribe (UMSCST); Rural, Male, Others (RMO); and Urban, Male, Others (UMO). The classification exposes the stark nutritional failures among rural children affiliated to historically disadvantaged caste group. For all India, around 50 percent of the rural SC/ST children are underweight (Table 1). Poverty-laden states like Bihar, Madhya Pradesh, Jharkhand and Chhattisgarh have the highest proportion of underweight children (around 60 percent and more) from this group. Such appalling distribution of undernutrition reflects the failures in delivering equity health and development.

INSERT TABLE 1 ABOUT HERE

The pattern of gender differentials across rural SC/ST households varies across the states. For example, in Andhra Pradesh, Haryana, Madhya Pradesh, Maharashtra, Odisha, Uttar Pradesh and Uttarakhand proportion of underweight children is high among females. However, in Assam, Chhattisgarh, Jharkhand, Karnataka and Kerala the proportion of underweight children are higher among males. Further comparisons reveal that, irrespective of place of residence and gender, children from non-SC/ST households tend to have relatively better nutritional health. This observation is valid for most of the major states of the Indian union. Although urban centres have considerable advantage over rural areas but the magnitude is much higher in states such as Madhya Pradesh and Bihar where around 50 percent children are underweight. For all-India, the differential between the most advantaged group (urban, male and non-SC/ST) and the most disadvantaged (rural, female and SC/ST) groups is 19 percent. Across states, the widest differential of 32 percent is observed for Uttar Pradesh. In fact, such acute sub-national welfare divisions can be unveiled by comparing the most advantaged (urban and non-SC/ST females from Kerala) with the worst performers (rural and SC/ST females in Madhya Pradesh). For the latter group, the underweight prevalence at 73 percent exceeds that of the latter (11 percent), by over six and a half times.

Health status of the population varies with developmental status and regions with higher (lower) average incomes often display lower (higher) levels of health deprivations. The Indian states also follow a similar pattern where poorer regions of central and eastern India display higher underweight. However, a less highlighted aspect is that with economic development and rising average incomes the worst-off groups tend to gain lesser than the advantaged groups. Although time-series data is desirable to verify such arguments, but some preliminary evidence is available through a cross-section view. Consider the case of Punjab and Bihar which are at different levels of economic prosperity. Punjab is a richer state with higher per capita income whereas Bihar is grappling with income deprivations and economic backwardness. The ratio of undernutrition levels for the most disadvantaged groups from these two states shows that underweight among the rural and SC/ST females of Bihar is around 1.9 times than that of the same group in Punjab. However, the same is 2.8 times when the least disadvantaged groups of urban and non-SC/ST males are compared. Given the widening ratios, it is plausible to argue that economic growth in India is shared unequally as some socioeconomic groups benefit more than others.

4.2. Inter-Group Inequalities and Inequality-Adjusted Prevalence

Group-analogues of Gini coefficient and Atkinson's Index are applied to arrive at inequality-adjusted aggregate prevalence. The group underweight profile (GUP) for Madhya Pradesh (highest prevalence of underweight), Punjab (lowest prevalence of underweight) and India are plotted in figure 2. In each GUP, the endpoints of the straight lines depict the unadjusted prevalence level in the respective regions. Also, the straight line represents the line of equality defined as a condition where each subgroup shares the average underweight level of the respective region. Thus in case of India if all the groups had an average underweight outcome of 43 percent then the GUP would coincide with the line of equality. However, the GUP reveals that the distribution of underweight outcomes is unequally shared by various population subgroups.

INSERT FIGURE 2 ABOUT HERE

Since the actual GUP lies above the line of equality, an inverted image of GUP could be devised into a measure of group inequality analogous to the familiar Lorenz curve. To this effect, the group undernutrition Lorenz profile (GULP) for Madhya Pradesh, Punjab and India are constructed to present an account of inter-group inequalities in underweight outcomes (see figure 2). The GULP suggests that inter-group inequalities based on the identified dimensions of caste, gender and place of residence are higher in Punjab. Inter-group inequalities for Madhya Pradesh and all India appear similar in magnitude but a careful scrutiny reveals that Madhya Pradesh has less inter-group inequality which is conditioned by a widespread prevalence across the population. High inequalities in Punjab and Kerala indicate lack of equitable progress – a fact is corroborated by high magnitude of consumption inequalities prevailing in the states.

Table 2 presents the estimates of inter-group inequalities for the states based on different methods. The estimates based on Gini coefficient (G) informs that inter-group inequalities are highest in Punjab (G = 0.17), Kerala (G = 0.16) and Tamil Nadu (G = 0.14). Madhya Pradesh, Odisha and Uttar Pradesh, display lower Gini coefficient of 0.05, 0.05 and 0.06, respectively. Other indicators of inter-group inequalities, namely squared coefficient of variation (SCV or $\lambda = 2$) and the Atkinson's index (A(4) or $\lambda = 4$), reveal similar pattern across states albeit with minor rank-reshuffles across states. It must be noted that higher values of λ imply greater inequality aversion and would yield higher magnitude of inter-group inequalities.

INSERT TABLE 2 ABOUT HERE

To complement the discussion, table 2 presents the estimates of inter-personal inequality obtained using the concentration index (CI). The negative CI values for all states confirm that undernutrition is concentrated among low income households. At the all India level the CI value is computed to be -0.165 and it presents a much wider range across states (from -0.082 in

Madhya Pradesh to -0.280 in Punjab). Punjab, Kerala and Tamil Nadu have the highest levels of income-related inequality thus confirming the analogy between the distribution of income and the distribution of disadvantaged subgroups.

Table 2 also presents information on both the 'unadjusted' (U) and between-group disparity 'adjusted' (U*) values of underweight outcomes. The adjustment is based on the rationale that inequality is a disvalued outcome and should be penalized while assessing the average performance of any region. Specifically, the average prevalence of underweight (U) is enhanced by a factor reflecting the extent of inter-group inequality in the distribution of undernutrition. This method of adjustment is widely used in the literature where the penalizing factor is basically the estimates of inter-group inequality (Subramanian 2011, Wagstaff 2002). In table 2, U^*_{CI}, U^*_G, $U^*_{A(4)}$ and U^*_{SCV} are all underweight prevalence measures of a type, where the aggregate prevalence is expressed as the level of underweight average across subgroups and then enhanced by a factor that captures the extent of inequality in the inter-group distribution of undernutrition.

Using Gini coefficient, at the all-India level, the inequality-penalised or 'adjusted' underweight headcount ratio (U^*_G) increases to 45 percent from its 'unadjusted' value of 42.5 percent. It may as well be emphasised that, for the GUP of India (Figure 2) the ratio of area below the line of maximal undernutrition and the area below the GUP will equal to the adjusted underweight headcount ratio of 0.45 or 45 percent. Furthermore, five of the states present an escalation factor of 110 percent and above. In particular, the 'adjusted' estimate of underweight incidence for Punjab and Kerala gets inflated to the extent of around 116 percent and 117 percent, respectively. Similarly, a glance at the U^*_{SCV} based estimates informs regarding the level of undernutrition which, if it were equally distributed, would give the same level of social ill-fare as is realized with the current distribution. Here the adjusted prevalence based on A(4) (with $\lambda = 4$) indicates that an equally distributed $U^*_{A(4)}$ of 43.7 percent for all population subgroups in India is the 'ill-fare equivalent' of the currently unevenly distributed prevalence rate of 42.5 percent. It must be noted that the value of λ can be increased to represent a greater degree of inequality aversion. The last column in the table shows that concentration index based adjustment (U^*_{CI}) yields an inequality-adjusted prevalence of 49.5 percent for India.

INSERT FIGURE 3 ABOUT HERE

Pearson correlation was computed to examine the association between underweight prevalence and inter-group inequalities in the distribution of underweight outcomes (also see Figure 3). The correlation coefficients (not reported here) across all the inequality indicators (CI, G, A(4) and SCV) bears a significant and negative relationship with the level of the phenomenon. This cross-section view indicates that undernutrition inequalities increase with reduction in the prevalence of undernutrition and vulnerable socioeconomic groups have slower pace of improvement than others. Interestingly, for a given level of prevalence, some states display relatively lower degree of inequalities then others. For instance, Karnataka and Maharashtra have similar prevalence level (around 37 percent) but Karnataka has lower group inequality than Maharashtra (refer Table 1). Assam also has similar prevalence but much lesser inequalities than Maharashtra. Uttarakhand could also be used as a comparator that displays much higher inequalities than Maharashtra. Such observed variations in group inequalities around a similar prevalence level are an indication of variability in equity-enhancing performance of health and development policies across these states. Nevertheless, a time-series analysis is desirable to confirm this cross-section view.

4.3. Decomposition Analysis: Gaps between SC/ST - Others and Rural - Urban

An approach that emphasizes and identifies important social determinants of health can offer vital insights for equity enhancing policies. With this contention, the Blinder-Oaxaca decomposition method is used to understand the relative importance of different socioeconomic factors in explaining the gaps in underweight outcomes (difference in average weight-for-age z-scores) between 1) SC/ST and the remaining Indian population and also for 2) rural and urban sectors. This method helps distinguish between two important explanations of the gap – one, due to differences in the distribution of the determinants or endowments and another, because of differences in the effects of these determinants or endowments. The results of the decomposition analysis are reported in Table 3 (SC/ST and others) and Table 4 (rural and urban).

INSERT TABLE 3 ABOUT HERE

Table 3 explains the mean differences in weight-for-age z-scores among the SC/ST and non SC/ST population subgroups[6]. The parameters in the obtained regression coefficient vector are tested to conclude that they differ systematically from zero[7]. The results indicate that children affiliated to SC/ST group tend to have a lower weight-for-age z-score (-1.984) than the non SC/ST group (-1.697). The significant mean difference of 0.285 (p-value<0.001) indicates worse underweight outcomes for SC/ST population. Differences in the distribution of the endowments accounts for over one-half (57 percent) of this gap in mean underweight z-scores whereas coefficient effects explain 39 percent of the gap. Table 3 further reports the estimated contributions of various endowments and their effect in explaining the gap between the two subgroups. Here, a positive (negative) contribution implies that the determinant is widening (narrowing) the gap between the SC/ST and non SC/ST population subgroups.

The decomposition reveals that poverty status (defined as household belonging to bottom two wealth quintiles), mother's' education and nutritional status are important endowments that widen the gap between SC/ST and other children. In other words, there are relatively more numbers of poor, illiterate and undernourished mothers among the SC/ST population. Immunization, birth order, breastfeeding, size at birth and improved sanitation are also significant in explaining the endowment related gap in z-score. This indicates that the SC/ST population are more likely to be deprived of healthcare services and basic household amenities. The coefficient effect or the efficiency of translating endowments into outcomes also differs across the two subgroups and this component explains 39 percent of the differences in mean z-scores. For example, with similar level of maternal education, children belonging to non-SC/ST group are more advantaged because the effect of education improves if it is complemented with other resources such as income or safe water. Similar conclusions emerge for variables such as maternal age at birth and place of residence.

A similar decomposition was conducted to understand the difference in z-scores across rural-urban dichotomy. These results[8] indicate that differences in the distribution of the determinants (endowments), accounts for around 93 percent of the gap in z-score. The coefficient effects contribute to around 1.2 percent of the difference whereas the rest is confounded by the interaction effect. The relevance of determinants is similar to that of the previous decomposition analysis. However, it is worthwhile to highlight that the coefficient effects are fairly sizeable with respect to caste-based difference but not for the rural-urban dichotomy. To some extent, a greater coefficient effect between SC/ST and remaining population can be attributed to the fact that a considerable proportion of SC households reside in urban areas and are therefore expected to be more familiar with modern child caring practices (Van De Poel & Speybroeck 2009). Also a given endowment can influence the outcome differently as it depends on the operational pathways through which it operates. For instance, within rural areas disadvantaged castes are not necessarily located further from educational and health care facilities but rather find themselves 'socially excluded' from accessing these basic services (Thorat & Sadana 2009, Van de Poel & Spreybroeck 2009, Acharya 2010).

5. Discussion and Conclusion

Assessment of group deprivations in a diverse and developing society is critical to reduce inequalities that proliferate along the lines of gender, ethnicity and place of residence. Given the salience of groups in developmental discourse, such an analysis can be an effective complement for the individualistic approach. With this backdrop, we computed the magnitude of inter-group inequalities in the prevalence of child undernutrition in India by engaging with two different methods - group analogue of Gini coefficient and Atkinson's index. The graphical devices, namely, the group undernutrition profile and group undernutrition Lorenz profile were used for analysis and interpretation of the group Gini coefficient. The analysis exposed the biased distribution of nutritional health in India which can be treated as an evidence for disadvantages of certain subgroups and underperformance of several developmental initiatives. It is disquieting to note that these deprivations mirror the societal caste hierarchy with disadvantaged groups placed in the lowest rung of development.

The analysis unravels the inter-group distribution of child undernutrition which is much worse than what is projected through distributional-insensitive sub-national averages. We find that undernutrition is heavily concentrated among disadvantaged groups, particularly the rural and the SC/ST community. Given the non-trivial implications of undernutrition on development, immediate focus is warranted to meet the nutritional requirements of rural SC/ST children from Bihar, Jharkhand, Madhya Pradesh, and Chhattisgarh. The disquieting prevalence across these states is largely an outcome of the iniquitous social hierarchy. These groups are burdened with twin problems of privation and backwardness (Sengupta et al 2008) implying that social hierarchy has not only restricted private incomes but also constrained development catalysts (education and public health infrastructure).

With recent turnaround in economic growth, policymakers are confronted with yet another conundrum of persistent undernutrition amidst rising income per caput. High-income states like Maharashtra and Gujarat are displaying such paradoxical outcomes. This reinforces that in the absence of improved maternal health and education, reduction in economic growth alone would not ensure improved nutrition. States such as Punjab and Kerala are among better economic performers who also have improved health and educational infrastructure. However, these states suffer from high magnitude of inter-group inequalities thus necessitating state action for ensuring fairness in access to quality education and healthcare. In particular, the inequalities can be reduced with improved targeting of services for vulnerable subgroups, particularly from rural areas and strict punitive actions on any reported act of discrimination.

The decomposition analysis accords a central role to maternal education in the quest for reducing the undernutrition. In fact, there is abundant international evidence to support promotion of female and maternal education as the most significant policy alternative (Burchi 2010). As such, better-educated mothers are expected to allocate economic resources more efficiently and can also be effective in caring for their children. Also, an educated mother would possess valuable nutritional knowledge and would be aware of the detrimental effects of unhygienic household environment on child's health. The decomposition analysis also highlighted that maternal and child healthcare is a critical dimension of nutritional health. In this context widespread discrimination faced by the SC women and children is only violating the principle of horizontal distributive justice. For example, Acharya (2010) provides evidence of the discriminatory access of SC women and children to primary health services leading to lower utilisation of the health services. This can have dire consequences for child immunisation and other aspects of child healthcare. Thorat and Sadana (2009) also note such systematic health disadvantages for the backward caste categories (specifically, Scheduled Castes and Scheduled Tribes, SC/ST) that arise due to discrimination against them at the governance or institutional level.

It is important to note that mother's nutritional status is significantly associated with child's health and explains much of the group disparities in nutritional health. Therefore, interventions in the form of food supplements during pregnancy with regular and adequate pre- and postpartum care are critical to avoid the vicious cycle where underweight babies become underweight mother and again give birth to underweight babies. Demographic factors including age at childbearing and birth order are crucial in determining child's nutritional profile. Household hygiene and exposure to environmental risk (inadequate water and sanitation) is yet another significant determinant of undernutrition in India. These results form the basis for greater inter-sectoral collaboration, especially among the departments of water and sanitation, health, women empowerment and child development.

To round up this discussion, the problem of undernutrition in India is viewed from the perspective of major nutritional supplementation programmes in India such as Integrated Child Development Services[9] (ICDS) and Mid-Day Meal Programme (MDMP). It is disconcerting to note that the regional concentration of undernutrition follows the pattern of regressive nature of ICDS programme placement across states. In other words, the states with the greatest number of undernourished children apparently have the lowest coverage and budgetary allocations (Das Gupta et al 2005) which directly curtails the efficacy of such interventions. To some extent, underperformance of these development initiatives can be attributed to poor institutional design and governance. For instance, the worst performing states such as Bihar and Uttar Pradesh do not spend the available funds for the ICDS activities. Problems in distribution of food supplementation, location of ICDS units, poor targeting and accountability further constrains the efficiency of available state support (Das Gupta et al 2005, Chatterjee 1996). Discrimination in access to publicly provided entitlements such as subsidised food grain for households from the public distribution system (PDS), cooked meal for children at schools (Mid-Day Meal Programme, MDMP) and distribution of nutritional supplements at mother and child care centres (*anganwadis*) has been a common feature (Thorat and Lee 2010). Given the patterns of undernutrition across social groups, it is imperative to develop an inclusive and effective policy environment to promote fairness in the distribution of social entitlements.

There is a need to adopt a rights perspective on child health and view policies as an institutional medium for the provision of 'opportunities and facilities' with close monitoring to facilitate and motivate people to claim their entitlements (Swaminathan 2009, Dreze 2006). In fact, India's most recent and largest social welfare program - National Rural Employment Guarantee Act (NREGA) - reasonably echoes the rights perspective and is expected to reduce the prevalence of adult and child undernutrition through increased food security via provision of guaranteed employment (and income). NREGA ensures 100 days employment guarantee to every rural household that demands work and could render positive impact on poverty and rural infrastructure. In this regard, recently released NREGA Report to the People (2012) is appreciative of the coverage of the programme primarily because of a considerable representation of women and marginalised sections (SC/ST) in employment activities. For instance, women accounted for over 49 percent of the employment generated under NREGA in India whereas the SC and ST population had a share of 23 percent and 17 percent, respectively. However, this reasonable but distribution-insensitive national average masks the performance of regions with greater concentration of undernutrition (such as Bihar and Maharashtra) which had lower representation of SC and ST population. Moreover, the share of women in total employment was only 17 percent and 28 percent in Uttar Pradesh and Bihar, respectively. Also, it is essential to integrate components of child care, maternal health and education in such developmental programmes with significant female participation. In fact, an effective implementation of NREGA and ICDS across nutritionally deprived groups and regions can go a long way in promoting health equity.

In concluding, it can be reiterated that the distribution of undernutrition in India mirrors the unfair distribution of endowments and entitlements across various socioeconomic groups. Given the figures, there is considerable scope to reduce the prevalence by extending impartial social and developmental support to vulnerable social groups; the justifications for which emanates from the principle of horizontal distributive justice.

References

Acharya, S. (2010) Public health care services and caste discrimination: A case of Dalit children, in: T. Sukhadeo & N. Katherine (Eds), **Blocked by Caste-Economic Discrimination and Social Exclusion in Modern India**, (New Delhi, Oxford University Press).

Anand, S. & Sen, A. (1995) Gender inequality in human development: theories and measurement, Occasional Paper, 19, Human Development Report Office (New York: UNDP).

Arnold, F., Nangia, P. & Kapil, U. (2004) Indicators of nutrition for women and children: current status and recommendations, **Economic and Political Weekly**, 39(7), pp. 664-70.

Atkinson, A. B. (1970) On the measurement of inequality, **Journal of Economic Theory**, 2(3), pp. 244-63.

Beherman, J. R. & Deolalikar A. B. (1989) Health and nutrition, in H. Chenery & T. N. Srinivasan (Eds), **Handbook of Development Economics** (Amsterdam: North Holland).

Burchi, F. (2010) Child nutrition in Mozambique in 2003: The role of mother's schooling and nutrition knowledge, **Economics and Human Biology**, 8(3), pp. 331-45.

Chakraborty, A. (2001) The concept and measurement of group inequality, Working Paper 315, Centre for Development Studies, Trivandrum.

Chatterjee, M. (1996) The nutritional challenge to health and development, Das Gupta, M., L. C. Chen and T.N. Krishnan (ed), **Health, Poverty and Development in India**. Oxford University Press.

Das Gupta, M. (1987) Selective discrimination against female children in rural Punjab, India, **Population and Development Review**, 13(1), pp. 77-100.

Das Gupta, M., Lokshin, M., Gragnolati, M., & Ivaschenko, O. (2005), Improving child nutritional outcomes in India: Can the integrated child development services programme be more effective? World Bank Policy Research Working Paper-3647, The World Bank.

Deaton, A. & Dreze, J. (2009) Food and nutrition in India: facts and interpretation, **Economic and Political Weekly**, 44(7), pp. 42-65.

Dreze, J. (2006) Universalisation with quality: ICDS in rights perspective, **Economic and Political Weekly**, 41(34), pp. 3706-15.

Haddad, L. (2009) Lifting the curse: Overcoming persistent undernutrition in India, **IDS Bulletin** 40(4) pp.1-8.

Horton, S. (2009) Opportunities for investments in nutrition in low-income Asia, **Asian Development Review**, 17(2), pp. 246-273.

Houweling T. A. J., Kunst, A. E., Huisman, M., & Mackenbach, J. P. (2007) Using relative and absolute measures for monitoring health inequalities: Experiences from cross-national analyses on maternal and child health, **International Journal for Equity in Health**, 6(15), pp. 1-9.

International Institute for Population Sciences (IIPS) & Macro International (2007), **National Family Health Survey 2005-06: India**, (Mumbai: IIPS).

Joe W, U. S. Mishra and K. Navaneetham (2009), Inequalities in Childhood Malnutrition in India: Some Evidence on Group Disparities, **Journal of Human Development and Capabilities** 10(3) 417-39.

Joe, W., Mishra, U. S., & Navaneetham, K. (2010) Socioeconomic inequalities in child health: recent evidence from India, **Global Public Health**, 5(5), pp. 493-508.

Majumdar, M, & Subramanian, S. (2001) Capability failure and group disparities: some evidence from India for the 1980s, **Journal of Development Studies**, 37(5), pp. 104-40.

O'Donnell O. et al (2008), **Analyzing Health Equity Using Household Survey Data: A Guide to Techniques and their Implementation**, (Washington DC: The World Bank).

Osmani, S. & Sen, A. K. (2003) The hidden penalties of gender inequality: Foetal origins of ill-health, **Economics and Human Biology**, 1(1), pp. 105-21.

Pathak, P. K. & Singh, A. (2011) Trends in malnutrition among children in India: Growing inequalities across different economic groups, **Social Science and Medicine**, 73(4), pp. 576-85.

Pelletier, D. L., Frongillo, E. A., Schroeder, D. G. & Habicht, J. P. (1995) The effects of malnutrition on child mortality in developing countries, **Bulletin of the World Health Organisation**, 73(4), pp 443-48.

Pelletier, D & Frongillo, E. (2003) Changes in child survival are strongly associated with changes in malnutrition in developing countries, **Journal of Nutrition***,* 133(1), pp 107-19.

Rutstein, S & Johnson, K. (2004) The DHS wealth index. Comparative report 6, Demographic and Health Survey, ORC Macro.

Sen, A. K. (1992) **Inequality Reexamined**, (Oxford: Clarendon Press).

Sen, G., Iyer, A. & Mukherjee, C. (2009) A methodology to analyse the intersections of social inequalities in health, **Journal of Human Development &Capabilities,** 10(3), pp. 397-415.

Sengupta, A., Raveendran, G. & Kannan, K. P. (2008) India's common people: who are they, how may are they and how do they live, **Economic & Political Weekly**, 44(11), pp. 49-63.

Shorrocks, A. F. (1995) Revisiting the Sen Poverty Index, **Econometrica** 63, pp. 1225–30.

Shorrocks, A. F. (1996) Deprivation profiles and deprivation indices, in: S. Jenkins, A. Kapteyn & B. Vaan Praag (Eds), **The Distributions of Welfare and Household Production: International Perspectives**, (London: Cambridge University Press).

Stewart, F., Brown, G., & Mancini, L. (2005) Why horizontal inequalities matter: some implications for measurement, CRISE Working Paper 19, CRISE Queen Elizabeth House, University of Oxford.

Subramanian, S. (2004), Social groups and economic poverty: A problem in measurement, Research Paper No. 2004/59, UNU WIDER.

Subramanian, S. (2005), Reckoning Inter-group Poverty Differentials in the Measurement of Aggregate Poverty, Research Paper No. 2005/59, UNU WIDER.

Subramanian, S. (2006), Social groups and economic poverty: a problem in measurement. In: McGillivray, M. (Ed). **Inequality, Poverty, and Wellbeing**. (London: Palgrave Macmillan).

Subramanian, S. (2009) Reckoning inter-group poverty differentials in the measurement of aggregate poverty, **Pacific Economic Review**, 14(1), pp. 46-55.

Subramanian, S. (2011), Inter-group disparities in the distributional analysis of human development: concepts, measurement, and illustrative applications, **Review of Black Political Economy**, 38, pp. 27–52.

Sukhadeo, T. & Sadana, N. (2009), Discrimination and children's nutritional status in India, **IDS Bulletin**, 40(4), pp. 25-29.

Svedberg, P. (2000) **Poverty and Undernutrition: Theory, Measurement and Policy** (Oxford: Oxford University Press).

Swaminathan, M. S. (2009), Undernutrition in infants and young children in India: A leadership agenda for action, **IDS Bulletin**, 40(4), pp. 103-10.

Tarozzi, A. & Mahajan, A. (2006) Child nutrition in India in the nineties, Unpublished manuscript.

Thorat, S. & Lee, J. (2010) Caste Discrimination and Government Food Security Programme, In: T. Sukhadeo & N. Katherine (Eds), **Blocked by Caste-Economic Discrimination and Social Exclusion in Modern India** (New Delhi: Oxford University Press).

Van de Poel, E. & Speybroeck, N. (2009) Decomposing malnutrition inequalities between Scheduled Castes and Tribes and the remaining Indian population, **Ethnicity and Health**, 14(3), pp. 1465–3419.

Wagstaff, A. (2002), Inequality aversion, health inequalities and health achievement, **Journal of Health Economics**, 21, pp. 627–641.

Wagstaff, A., Paci, P., & Van Doorslaer, E. (1991), On the measurement of inequalities in health, **Social Science and Medicine** 33(5), pp. 545-557.

World Health Organization (WHO) (2006) WHO child growth standards: Length/height-for-age, weight-for-age, weight-for-height and body mass index-for-age: Methods and Development, World Health Organization, Geneva.

Table 1. Group specific child underweight prevalence (in %), India, 2005-06

States	RMSCST	UMSCST	RMO	UMO	RFSCST	UFSCST	RFO	UFO	Total
Andhra Pradesh	34	35	33	28	41	45	35	24	32
Assam	47	23	33	24	42	32	39	27	36
Bihar	70	68	52	48	68	62	57	44	56
Chhattisgarh	58	45	49	31	35	39	53	30	47
Gujarat	44	57	50	39	44	30	47	36	44
Haryana	49	37	39	36	51	38	36	33	40
Jharkhand	71	64	61	38	55	44	60	37	56
Karnataka	46	29	40	33	43	28	39	29	37
Kerala	39	34	26	15	26	39	24	11	23
Madhya Pradesh	64	45	62	49	73	54	60	53	59
Maharashtra	45	39	38	29	51	22	39	29	36
Odisha	41	37	41	27	49	51	42	27	40
Punjab	36	25	19	17	36	37	18	19	25
Rajasthan	50	43	41	30	48	27	40	29	40
Tamil Nadu	41	49	31	22	34	39	26	23	29
Uttar Pradesh	46	28	39	23	55	18	39	26	38
Uttarakhand	48	32	41	33	50	43	43	35	42
West Bengal	46	22	39	23	45	33	42	24	38
All India	**50**	**38**	**43**	**31**	**50**	**38**	**45**	**31**	**43**

Note: Group description: 1-Rural-Male-Scheduled Caste/Scheduled Tribe (RMSCST), 2-Urban-Male-Scheduled Caste/Scheduled Tribe (UMSCST), 3-Rural-Male-Others (RMO), 4-Urban-Male-Others (UMO), 5-Rural-Female-Scheduled Caste/Scheduled Tribe (RFSCST), 6-Urban-Female-Scheduled Caste/Scheduled Tribe (UFSCST), 7-Rural-Female-Others (RFO), 8-Urban-Female-Others (UFO).

Source: Authors, using NFHS 2005-06

Table 2: Inter-group inequalities in child underweight in India and states, NFHS 2005-06

States	U	G	U^*_G	SCV	U^*_{SCV}	$A_{(4)}$	$U^*_{A(4)}$	CI	U^*_{CI}
Andhra Pradesh	32.7	0.085	35.5	0.025	33.1	0.036	33.9	-0.154	37.7
Assam	36.5	0.076	39.2	0.021	36.8	0.030	37.6	-0.137	41.5
Bihar	56.1	0.066	59.8	0.016	56.5	0.024	57.5	-0.102	61.8
Chhatisgarh	47.7	0.090	51.9	0.032	48.4	0.040	49.5	-0.111	53.0
Gujarat	44.7	0.073	47.9	0.018	45.1	0.025	45.8	-0.149	51.4
Haryana	39.6	0.068	42.3	0.019	40.0	0.030	40.8	-0.144	45.3
Jharkhand	57.0	0.073	61.2	0.026	57.8	0.033	58.9	-0.096	62.5
Karnataka	37.6	0.073	40.3	0.018	37.9	0.025	38.6	-0.171	44.0
Kerala	22.7	0.156	26.3	0.091	23.7	0.119	25.4	-0.226	27.8
Madhya Pradesh	59.9	0.049	62.8	0.009	60.1	0.014	60.7	-0.082	64.8
Maharashtra	36.7	0.100	40.4	0.035	37.4	0.051	38.6	-0.194	43.8
Odisha	40.8	0.054	43.0	0.017	41.2	0.022	41.7	-0.188	48.5
Punjab	24.6	0.169	28.7	0.111	25.9	0.157	28.4	-0.28	31.5
Rajasthan	40.4	0.073	43.4	0.022	40.8	0.030	41.6	-0.138	46.0
Tamil Nadu	29.9	0.142	34.2	0.068	30.9	0.102	33.0	-0.198	35.8
Uttar Pradesh	42.3	0.061	44.9	0.013	42.6	0.019	43.2	-0.124	47.5
Uttarakhand	38.1	0.121	42.7	0.056	39.2	0.074	40.9	-0.216	46.3
West Bengal	38.6	0.098	42.3	0.038	39.3	0.046	40.3	-0.167	45.0
All India	**42.5**	**0.076**	**45.7**	**0.021**	**42.9**	**0.029**	**43.7**	**-0.165**	**49.5**

Note: U – Child underweight prevalence in state, G – Gini coefficient for inter-group inequality, U*G – Inequality adjusted prevalence using Gini coefficient [$U^* = U(1+G)$], SCV – Squared coefficient of variation for inter-group inequality, U*SCV - Inequality adjusted prevalence using SCV [$U^* = U(1+SCV)^{0.5}$], A(4) – Atkinson's ethical measure of inequality with $\lambda = 4$, $U^*_{A(4)}$ - Inequality adjusted prevalence using $A_{(4)}$ [$U^* = U(1+A_{(4)})$], CI – the concentration index, U^*_{CI} – Inequality adjusted prevalence using CI [$U^* = U(1 - CI)$]. The groups used for the analysis are described in Table 2.

Eight mutually exclusive groups were defined as follows: 1-Rural-Male-Scheduled Caste/Scheduled Tribe (RMSCST), 2-Urban-Male-Scheduled Caste/Scheduled Tribe (UMSCST), 3-Rural-Male-Others (RMO), 4-Urban-Male-Others (UMO), 5-Rural-Female-Scheduled Caste/Scheduled Tribe (RFSCST), 6-Urban-Female-Scheduled Caste/Scheduled Tribe (UFSCST), 7-Rural-Female-Others (RFO), 8-Urban-Female-Others (UFO).

Source: Authors, using NFHS 2005-06

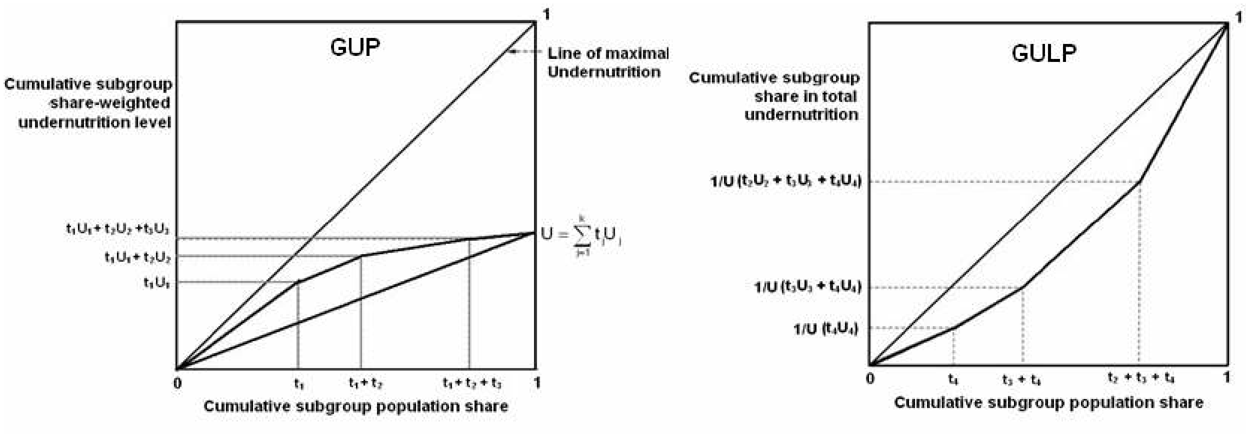
Table 3. Blinder-Oaxaca decomposition: Contributions to overall gap between SC/ST and non SC/ST in weight-for-age z-scores, India 2005-06

	Endowment effect		**Coefficient effect**		**Interaction effect**	
Variables	z-score gap	in %	z-score gap	in %	z-score gap	in %
(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*	*(vi)*	*(vii)*
Child's age (*18 months or more = 1*)	0.000	0.00	-0.075	-66.96	0.000	0.00
Child's size at birth (*below average size = 1*)	0.003	1.85	-0.011	-9.82	0.001	9.09
Child's birth order (*four or more = 1*)	0.012	7.41	0.000	0.00	0.000	0.00
Sex of the child (*male = 1*)	0.000	0.00	0.016	14.29	0.001	9.09
Child's immunisation status (*complete immunisation = 1*)	0.005	3.09	0.001	0.89	0.000	0.00
Recent history of diarrhoea (*yes, in last two weeks = 1*)	0.000	0.00	-0.004	-3.57	0.000	0.00
Months breastfed (*in months*)	0.007	4.32	-0.004	-3.57	0.000	0.00
Birth in past year (*yes = 1*)	0.000	0.00	-0.029	-25.89	0.002	18.18
Maternal education (*secondary and above = 1*)	0.034	20.99	0.023	20.54	0.015	136.36
Mother's Body Mass Index (*normal and above = 1*)	0.023	14.20	0.025	22.32	0.004	36.36
Mother's age at child birth (*in years*)	0.001	0.62	0.079	70.54	0.000	0.00
Poverty status of household (*non-poor = 1*)	0.048	29.63	-0.003	-2.68	-0.002	-18.18
Improved drinking water facility (*safe water = 1*)	0.001	0.62	-0.066	-58.93	-0.004	-36.36
Improved toilet facility (*safe toilet = 1*)	0.022	13.58	-0.002	-1.79	-0.002	-18.18
Sector (*rural = 1*)	0.004	2.47	0.020	17.86	-0.002	-18.18
Region of residence *(Not in Central-Eastern India = 1)*	0.003	1.85	-0.031	-27.68	-0.001	-9.09
Constant	0.000	0.00	0.172	153.57	0.000	0.00
Total	0.162	100	0.112	100	0.011	100

Note: Estimated using NFHS-3 unit level records with the help of Ben Jann's STATA routine 'decompose' programme, which is downloadable from the STATA Website.

Source: Author, using NFHS 2005-06

Figure 1: Group Undernutrition Profile (GUP) and Group Undernutrition Lorenz Profile (GULP)

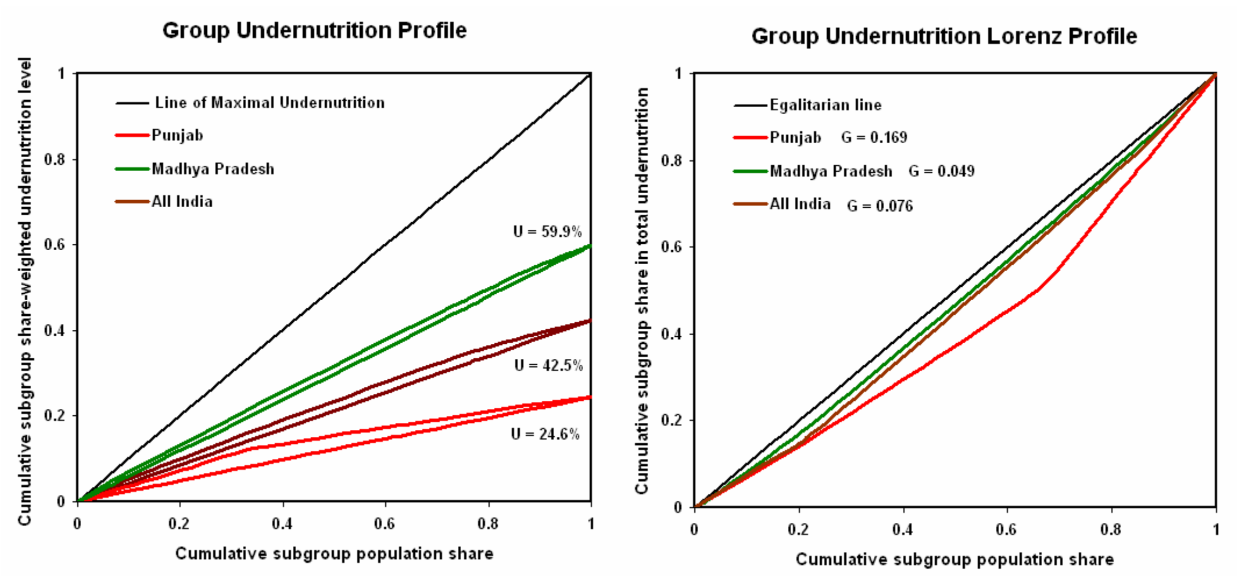


Source: Adapted from Subramanian (2009)

Note: The Group Undernutrition Profile (GUP) can be constructed by first arranging the group specific undernutrition outcomes (U_j), in non-increasing order. Thereafter, the population share weighted undernutrition levels (t_jU_j), can be cumulated across the subgroups and plotted against the cumulative population shares (t_j) of the subgroups.

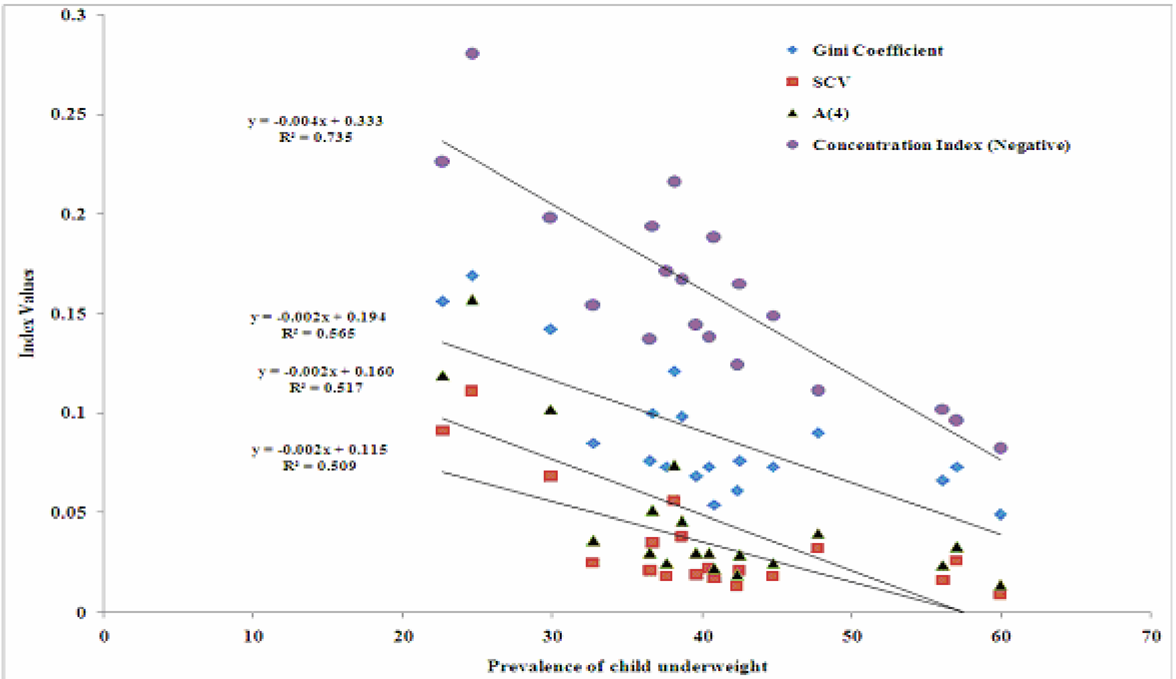
The Group Undernutrition Lorenz Profile (GULP) can be obtained by first ranking the groups in non-decreasing order of their undernutrition levels (U_j), and then plotting the cumulative subgroup shares in total undernutrition (t_jU_j), against their cumulative population shares (t_j).

Figure 2: GUP and GULP for Punjab, Madhya Pradesh and All-India, NFHS 2005-06



Source: Authors, using NFHS 2005-06

Figure 3: Relationship between level of underweight prevalence and inequalities



Source: Authors, using Table 3.

Endnotes

[1] It is important to distinguish between the terms *undernutrition* and *malnutrition*. Some studies use malnutrition when they are referring to energy inadequacy; still others use it to cover all types of nutritional deficiencies. Following Svedberg (2000), we focus on *undernutrition* as it clearly represents an economic 'macro' issue related to food entitlement, poverty and socio-economic structure of the society. Malnutrition - though it may be caused due to certain socioeconomic deprivations - is considered as more of a 'technical' medical problem on which economists have little analytical competence (see Svedberg 2000).

[2] For instance, it is both clinically and empirically established that undernourished children are at high risks of morbidity and mortality and can also suffer from poor cognitive skills and intellectual achievement thus reducing their overall capability (Pelletier et al 1995, Pelletier & Frongillo 2003).

[3] The Government of India classifies some of its citizens based on their social and economic condition as Scheduled Caste (SC), Scheduled Tribe (ST), and Other Backward Class (OBC). The SCs and the STs are two groupings of historically disadvantaged people that are given express recognition in the Constitution of India. In 1935 the British passed the Government of India Act 1935, that also brought the term "Scheduled Castes" into use, and defined the group as including "such castes, races or tribes or parts of groups within castes, races or tribes, which appear to His Majesty in Council to correspond to the classes of persons formerly known as the 'Depressed Classes', as His Majesty in Council may prefer". This discretionary definition was clarified in The Government of India (Scheduled Castes) Order, 1936 which contained a list, or Schedule, of castes. After independence, the Constituent Assembly continued the prevailing definition of Scheduled Castes and Tribes, and gave (via articles 341, 342) the President of India and Governors of states responsibility to compile a full listing of castes and tribes, and also the power to edit it later as required. The OBC list is dynamic in the sense that castes and communities can be added or removed based on their vulnerability identified through social, educational and economic factors.

[4] For example, consider a 12 months old girl who weighs 8.0 kg. In the reference population, the median weight is 9.5 kg and standard deviation in the reference population is 1, then z-score for this girl can be computed as follows;

z-score (weight-for-age) = (8.0 – 9.5)/1 = -1.5

Since, individuals with z-score less than -2 standard deviations below the reference median are considered undernourished, this concerned girl will not be identified as an underweight child.

[5] Majumdar and Subramanian (2001) present an alternative method for adjusting the aggregate deprivation for inter-group disparities.

[6] A similar analysis for SC/ST and the remaining population based on NFHS 1998-99 is available in Van De Poel and Speybroeck (2009).

[7] A regression analysis checks whether there are significant differences in the effects of the determinants on the weight-for-age z-score. For this purpose, the determinants were interacted with the dummy variable separating SC/ST from the remaining population. The joint test on these interaction effects was highly significant (p-value<0.001), indicating that a Blinder-Oaxaca decomposition could be applied here. The null hypothesis that the parameters are equal to zero was rejected; $F(17, 428376) = 80.70$ ($p>F = 0.00$).

[8] Due to space considerations, the results are not reported here but are available upon request.

[9] Started in 1974, ICDS provides eight types of services to its beneficiaries - children and mothers. These are supplementary feeding, immunisation, health checkups, referral, and nutrition and health education for mothers, micronutrient supplementation, and introduction to formal education to child aged between three to six years. However, recent government policies and judicial verdict by the Honourable Supreme court of India makes it mandatory for ICDS to universalise it for all the children in the country. While MDMP directly focuses on school attending children, the ICDS primarily has pre-school children (aged below six years) as the focus group. Through ICDS children are provided necessary dietary supplements, disease control vaccinations, and better health care (including their mother)