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Abstract

This paper tries to highlight the importance of intensity and severity of any deprivation while comparing welfare outcomes across the groups for any given relevant characteristics. It argues that when one compares the distance between groups without taking into consideration the questions 'how much' and 'how severe' the deprivation is, the distance across groups may look modest. It becomes more pronounced once it is adjusted for intensity and severity across each group. For this purpose an application of standard Foster-Greer-Thorbecke method is quite useful. Information on prevalence of underweight among pre-school children from NFHS-3 has been used for the illustration. A comparison of the same measure of undernutrition is also made between NFHS-2 and NFHS-3 rounds for the children of age 0-35 months.

Keywords : Prevalence, Pre-school children, Underweight, Intensity, Severity

JEL Classification : D63, I30, I32

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1. Introduction

The recognition of differential in welfare outcomes is necessary for bridging gaps between varied characteristic groups as regards such outcomes (Mishra and Subramanian, 2006; Chakraborty, 2001). This helps in not only identifying the most vulnerable characteristic group, but appreciating the extent of such vulnerability in comparison with the average prevailing level of the outcome as well as against the most privileged characteristic group (*Ibid*). More often than not, such differentials are assessed against the prevailing average to designate the most advantaged as well as the most disadvantaged group along with the degree of advantage and disadvantage as a ratio to the prevailing average. While such an assessment does reveal the extent of differential in a rough sense of the term, it undoubtedly depends on the robustness of the prevailing average itself. There are hosts of measurement of phenomenon, which are defined in dichotomy (i.e. in two categories) like literacy, nutrition, morbidity similar to that of poverty, wherein the extent of intensity or severity is largely ignored. Alternatively speaking, by ignoring the crucial aspects of severity and intensity, it equates two very different prevailing circumstances and, hence, lacks robustness. Therefore, the differential assessment based on such measures, which in itself are not robust, may hide the differentials more than reveal it.

Given that the simple measurement of dichotomous variables suffers from this limitation, there arises a need to include severity and intensity in the measurement to make it more robust for comparison on the one hand and computation of differential on the other. Here we consider the case of undernourishment (the dichotomous variable) and adopt the Foster-Greer-Thorbecke (FGT) criterion to revise its measurement to

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accommodate the intensity and inequality of undernourishment. This adoption is exactly in keeping with its application in poverty literature wherein the most commonly used measure of head count ratio is perfected with consideration of the intensity (otherwise known as poverty gap) and severity conditioned by the norm of poverty line. This particular procedure of measuring poverty is popularly known as FGT measure of poverty (Foster-Greer-Thorbecke,1984). A novel application of this particular criterion is attempted in comparison of child nutrition outcomes to make it robust for comparison across Indian states (Mishra and Mishra, 2009). As child nutrition outcome is also determined against a fixed norm (weight for age) similar to that of poverty, the intensity and severity of failure in qualifying the norm being incorporated in its measurement does make a difference to the prevalence level of undernourishment, otherwise assessed according to the dichotomous criterion.

Often the head count ratio (proportion) or aggregate head counts (absolute numbers) are used to identify such vulnerable groups, with respect to a normative value to measure deprivations (Subramanian, 2005). The measurement of nutritional deprivation is no different. But the problem in such an approach is that these measures give an idea about the magnitude of the deprivation i.e. 'how many' or 'what proportion' of the population falls below the norm. The problem in such comparison of dichotomous measurement of undernutrition conditioned by a norm neglects the distribution of nutritional outcome on either end of the distribution, which may have substantial implications for prioritizing the groups for targeting. For instance, two situations of similar degree of nutritional deprivation may have different range of distribution of deprivation as against the norm. Hence, there arises the need to adjust the head count equivalence in undernutrition (i.e. the proportion or percentage) along with the intensity and inequality of this deprivation as is computed in case of FGT measures of poverty (Foster et al., 1984) with $\alpha = 1$ and 2. The adjustment of proportion measure with intensity as well as inequality might present a valid comparison of nutritional deprivation across groups. It will also help us to know the magnitude of distance between the most vulnerable group vis-à-vis the most advantageous group for any given characteristics relating to a particular deprivation. For the purpose of illustration we consider in this exercise the prevalence of underweight among pre-school children at all India level across selected individual and households characteristics, as reported in the National Family Health Survey-3 (henceforth NFHS-3).

2. Objective

This exercise attempts a revision of the reported prevalence of underweight among Indian children by selected household and individual characteristics accounting for intensity and inequality in qualifying the norm designating underweight. Following this, a computation of characteristic differential in prevalence of underweight is made in terms of the existing measure as well as the revised measure. The indicator of underweight is chosen for the analysis from among a range of alternative nutritional indicators like height-for-age (stunting), weight-for-height (wasting), mid-arm-circumference and anaemia among children. Such information is available for children below five years of age in the recently conducted NFHS-3 survey and for children below three years of age in the preceding NFHS-2 Survey. The choice of underweight criterion for nutritional assessment is made on the basis of it being sensitive to both short term and long term nutritional failure among children (WHO, 1995). Further, underweight or low weight for age reflects both wasting (weight-for-height) and stunting (height-for-age) and, hence, represents a synthesis of current status of body proportion and linear growth (Blossner and de Onis, 2005). Apart from such robustness in describing nutritional make-up, it has a systematic linear bearing with under five mortality (WHO, 1995) and underweight criterion appears in the list of MDG targets as well as serves as a component of Hunger Index (CSO, 2009; United Nations, 2010; IFPRI, 2010).

3. Source of Data

The analysis is based on the unit record data on children obtained during two rounds of NFHS - 1998-99 and 2005-06. The data contains information on pre-school children for their anthropometric measures to determine their nutritional status as well as socio-economic factors like place of residence, caste, religion, economic status of the households, mother's education, mother's nutritional status in terms of Body-Mass-Index (BMI) as well as the age of the individual children. Both the rounds of NFHS used the World Health Organisation's reference standard - weight-for-age - to designate child undernourishment. The national sample count of children of below age three years is 32,393 in NFHS-2 and 28,690 in NFHS-3 (total of 55,155 children below age five for the latter round). Out of these, information on height and weight is available for 24,381 children in NFHS-2 and 26,611 children in NFHS-3 (with consideration of appropriate national weight). Total number of children for age below five years is 45,377 (after introducing

appropriate national weight). It must be noted that both the data sets are not comparable directly because they are drawn from different populations with a gap of seven years. But a comparison of change in levels of the phenomenon is very well possible given the homogeneity in defining relevant household, individual and maternal characteristics along with the nutritional profile in both the rounds of data collection. Though in NFHS-3 the WHO growth standards are used to assess undernutrition among children, we have applied these new standards to NFHS-2 data set for comparison purpose.[1]

4. Methodology

The prevalence of underweight among children of age 0-59 months against a set of household, maternal and child related characteristics as obtained in NFHS-3 are presented towards understanding the characteristic differential in childhood undernutrition. While making such an attempt at describing differential in childhood undernutrition at the All India level, we make a comparison of differential assessment under specific revision in assessment of undernutrition as discussed above. Such revision is towards measuring undernutrition with inclusion of intensity and inequality within it. While the existing prevalence of undernutrition is made in accordance with the dichotomous criterion of qualifying/disqualifying the required normative weight corresponding to specific age and sex of children, the inclusion of intensity and inequality considers the gap in such disqualification.

Given that a male child of age 'x months' has a weight of W_x which is less than the normative weight of NW_x the child is said to be undernourished. The ratio of the number of such children to the total children gives us the prevalence of undernourishment. Further, the same prevalence according to certain characteristic group will describe the prevailing characteristic differential in this outcome. The inclusion of intensity and inequality in this measurement is made as below:

$$FGT_a = \frac{1}{n}\sum_{i=1}^{q}\left[(NW_x - W_x)/NW_x\right]^{\alpha}$$

With varying values of a = 1 and 2, the above measures FGT 1 (intensity) and FGT 2 (severity) are computed for assessing undernourishment in children. This measurement when carried out by characteristic gives rise to characteristic differential across categories that is different form the differential depicted by the traditional measure of undernutrition.

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1 See the introductory chapters of the all India reports NFHS-2 and NFHS-3.

5. Results

As per NFHS-3, prevalence of underweight among children of age 0-59 months is 42.5 per cent at all India level. This aggregate prevalence varies for the children by their place of residence, socio-economic status of the household, child's own age and sex and educational and nutritional status of her mother. For example, one can say a child from scheduled tribe (ST) community is more vulnerable to underweight vis-à-vis a child from a socially better-off group by looking at the respective aggregate prevalence level of underweight for ST and socially better-off groups respectively. As reported in NFHS-3, prevalence of underweight is 32.7 per cent for children in urban areas, while that of rural children it is 45.6 per cent. If one goes on to comprehend this differential, it can be said that rural children are 1.073 times more likely to have underweight by computing a ratio of prevalence of underweight for these children (45.6 per cent) to that of aggregate prevalence level of the same for the entire country (42.5 per cent).

But such a differential assessment has certain limitation in the sense that it depends on the prevailing average on the one hand and suffers from the problem of dichotomy in measurement as stated above on the other. While this will reflect higher likelihood of being underweight among rural children, it will not account for the kind of departure these children have from the required norm of ideal weight-for-age. In fact, it may be ideal to revise the primary measurement of undernourishment itself with accommodation of intensity and inequality therein to obtain a sensible comparative measure in the first place. Secondly, the same needs to be adopted even while comprehending the levels of undernourishment across groups as well. Such an exercise will not only make the measure of undernourishment robust, but also pronounce differentials better between characteristic groups.

Here in this exercise a differential analysis of undernourishment is presented with and without adoption of FGT criterion in correcting the dichotomous nature of measurement across characteristic groups. Considering the prevalence of underweight among Indian children as obtained by the NFHS -3 the characteristic differential in this outcome is presented in Table 1. This reveals wider differentials according to the education of the mother, nutritional status of mothers, religion, caste categories as well as wealth quintiles. While these differentials are reasonably wide across few characteristic groups, they are minimal when observed by sex and residence.

Further, when differentials are to be observed against the prevailing average, the size representation of each characteristic group might influence the measure of the differential. The limitation of the dichotomous measurement itself could be compromising with the robustness of the differential.

Interpreting the differential prior to its adjustment reveals that the width of the differential varies across characteristic group with religion and wealth quintiles depicting widest gaps as against residence and sex of the child. With an overall prevalence of undernourishment among pre school children based on this criterion (underweight) being 42.5 per cent, the characteristic differentials observed across a host of characteristic is computed. They reveal the most disadvantageous group along with their extent of disadvantage against the prevailing average as well as the most better off group with their extent of advantage. Such differential when assessed in terms of a ratio of the prevalence among the better-off group vis-à-vis the worse-off group differs from the one that is assessed against the prevailing average. Hence let us describe the characteristic differential in undernourishment among children based on both the approaches.

The characteristic differential observed against the prevailing average does not greatly differ across characteristics except for being quite low in case of residence and sex of the child. In fact, differential assessed against the prevailing average need to be weighed with the extent of representation of the particular characteristic group. Therefore, an alternative differential assessment as proposed above in terms of a ratio between the better off and the worse off category within each characteristic group may serve the purpose better. Obviously with adoption of such a differential measurement the magnitude of differential (i.e. ratio between better-off and worse-off groups) gets pronounced although the pattern remains the same. For instance, the differential observed according to the characteristic of mother's education increases five-fold compared to it being depicted when computed with aggregates. However, this exposition of differential with either approach has its own interpretation. The one computed in relation to aggregate prevalence is conditioned by the prevailing level and therefore needs to be read in terms of the pattern of differential with varying levels of the phenomenon. On the contrary, the differential assessed according to the gap between the best and the worst group within a specific characteristic category informs on the kind of gap that prevails as regard the outcome.

For prevalence of underweight among children for their age, it is found that children below age of five months have the lowest prevalence, intensity as well as severity. Whereas children of age 18-23 months have the highest prevalence of underweight, the intensity and severity is found to be the highest for children of age 48-59 months. For female children the prevalence, intensity and severity of the underweight are higher than their male counterparts.

As expected children of illiterate mothers have not only the highest prevalence of underweight, but the highest intensity and severity of the same compared to their counterparts whose mothers have some years of education. Children of mothers with low BMI score (undernourished) also have highest prevalence, intensity and severity of the underweight compared to the children mothers who are not undernourished.

As regard household characteristics, children of rural households have higher prevalence as well as severity of underweight than their urban counterparts, whereas urban children have higher intensity of underweight than rural children.

It is interesting to see that by religion of head of the households, children from 'other' households have the highest prevalence of underweight, but the lowest intensity and severity of the same among all religious categories (zero and little more than zero respectively). It strengthens our argument that higher prevalence always does not mean higher intensity or severity of any deprivation. Whereas the prevalence of underweight among children from households where head of household reportedly profess 'Sikh' religion is the lowest among all the religious categories (22.0 per cent), the intensity of underweight is the highest among children of 'Hindu' households. Children from both 'Hindu' and 'Muslim' households have the highest inequality of underweight among pre-school children.

By 'social category', children from ST households have the highest prevalence of underweight as well as intensity and severity among the four social groups.

This exercise helps one to pronounce differential across categories within characteristic groups, as can be seen form the Table 1. Such an observation is made by comparing differentials conceived as the difference between the highest and lowest prevalence across categories within characteristic groups. For instance, considering the characteristic group of age of children the conventional differential is as wide as 16.4 units, which conveys the distance between the highest and lowest response ratios of groups for given characteristics. We have calculated the response ratio of child underweight for each group of the above characteristics with respect to given prevalence level at all India level i.e. 42.5 per cent. Similarly, such distance for intensity and inequality (severity) are also calculated with respect to intensity and severity observed at all India level (0.126 and 0.039 respectively). It is observed that the distance between groups for any given characteristics gets wider after adjustment, for all the selected characteristics, with some exceptions, especially for severity for characteristics like BMI of the mother and place of residence (Graph 1).

Table 1 : Prevalence, Intensity and Severity of Underweight among Pre-school Children across Different Group Characteristics: 2005-06

Characteristic	Prevalence of Underweight (in %)	Intensity (FGT1)	Severity (FGT2)
All India	42.5	0.199	0.069
Age of children in months			
<= 5	29.5 (L)	0.170 (L)	0.099 (H)
6-8	34.7	0.168	0.054
9-11	36.7	0.176	0.049 (L)
12-17	40.2	0.180	0.049 (L)
18-23	45.9 (H)	0.207	0.075
24-35	44.9	0.201	0.078
36-47	45.6	0.212	0.070
48-59	44.8	0.217 (H)	0.065
Sex of children			
Male	41.9 (L)	0.195 (L)	0.062 (L)
Female	43.1 (H)	0.204 (H)	0.077 (H)
Education of mothers in years			
0	52.0 (H)	0.230 (H)	0.083 (H)
1-4	45.8	0.214	0.061
5-7	38.5	0.189	0.057
8-9	34.9	0.174	0.077
10-11	26.8	0.149	0.042
12	17.9 (L)	0.112 (L)	0.036 (L)
BMI score of mothers			
< 18.5	52.0 (H)	0.231 (H)	0.076 (H)
18.5-24.9	38.7	0.187	0.069
>= 25.0	20.1 (L)	0.120 (L)	0.036 (L)
Place of residence			
Urban	32.7 (L)	0.167 (L)	0.059 (L)
Rural	45.6 (H)	0.210 (H)	0.073 (H)

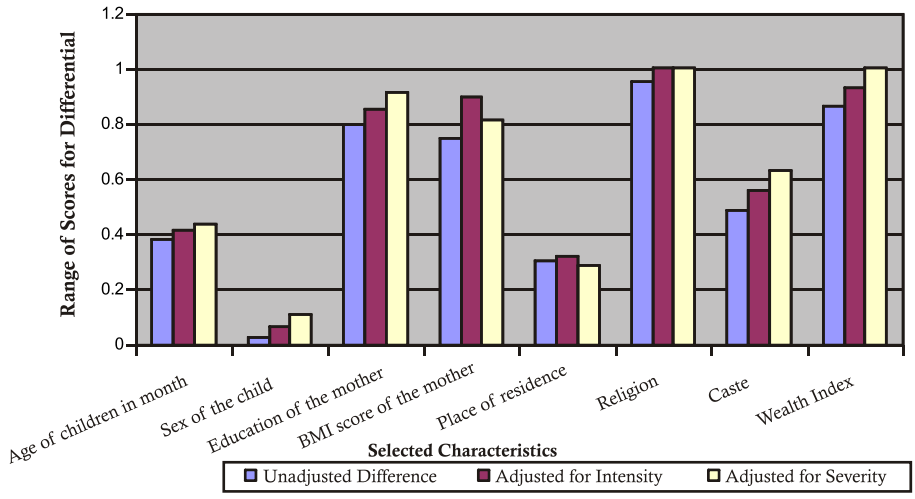
[Contd...

[Table 1 Contd...

Characteristic	Prevalence of Underweight (in %)	Intensity (FGT1)	Severity (FGT2)
Religion			
Hindu	43.2	0.201 (H)	0.065
Muslim	41.8	0.199	0.093(H)
Christian	29.7	0.170	0.053
Sikh	22.0 (L)	0.121 (L)	0.036 (L)
Buddhist/Neo-Buddhists	39.2	0.198	0.058
Jain	24.0	0.137	0.041
Others	62.7(H)	0.121 (L)	0.051
Caste			
Scheduled Caste	47.9	0.217	0.078
Scheduled Tribe	54.5 (H)	0.245 (H)	0.079 (H)
Other Backward Caste	43.2	0.202	0.071
Others	33.7 (L)	0.170 (L)	0.057
Do not know	35.1	0.183	0.050 (L)
Wealth Index			
Lowest	56.6 (H)	0.244 (H)	0.090 (H)
Second	49.2	0.223	0.079
Middle	41.4	0.199	0.063
Fourth	33.6	0.170	0.062
Highest	19.7 (L)	0.123 (L)	0.037 (L)

Source : IIPS and ORC Macro (2007).

Graph 1
Differential across Selected Characteristics for Underweight among Children in India Below Five Years of Age: 2005-06



5.1 Comparisons for Prevalence of Underweight among Children of Age 0-35 Months between NFHS-2 and NFHS-3

In the above section we have presented the results for children of age 0-59 months. But the NFHS-3 follows World Health Organisation (WHO) growth standards 2006 for assessing the undernutrition among children in India, whereas in NFHS-2 (1998-99) the WHO growth references developed in late 1970s were used (WHO, 2006: xvii). Since the above growth reference was found to be inadequate to assess the nutritional health of the children. A new set of standards were developed by WHO between 1997 and 2003 from a sample size of 8440 healthy breastfed children brought up in healthy living conditions from widely diverse ethnic backgrounds and cultural settings from countries lie, Brazil, Ghana, India, Norway, Oman and USA (*ibid*). For our purpose, we have adopted WHO growth standards for children covered in NFHS-2 as well, for making comparison between intensity and severity of prevalence of underweight among children from NFHS-2 as well as NFHS-3. Though the sampling structure for the two data sets varied (they are drawn from two different populations with a gap of seven years), still a comparison can be made of the trends. From both data sets only children of 0-35 months are considered (26,611 children from NFHS-3 and 24,831 from NFHS-2). The results are presented in Table 2.

Table 2 : Prevalence, Intensity and Severity of Underweight among Pre-school Children across Different Group Characteristics for NFHS-2 and NFHS-3

Characteristic	NFHS-3			NFHS-2		
	Prevalence of Underweight (in %)	Intensity (FGT1)	Severity (FGT2)	Prevalence of Underweight (in %)	Intensity (FGT1)	Severity (FGT2)
All India	40.4	0.189	0.071	41.9	0.179	0.052
Age of children in months						
<= 5	29.5 (L)	0.170	0.099 (H)	29.5 (L)	0.134 (L)	0.176 (H)
6-8	34.7	0.168 (L)	0.054	34.6	0.145	0.133
9-11	36.7	0.176	0.049 (L)	37.5	0.167	0.066 (L)
12-17	40.2	0.180	0.049 (L)	42.6	0.168	0.134
18-23	45.9 (H)	0.207 (H)	0.075	47.3	0.201	0.093
24-35	44.9	0.201	0.078	48.8 (H)	0.207 (H)	0.116
Sex of children						
Male	40.7 (H)	0.189	0.062 (L)	42.3 (H)	0.175 (L)	0.050 (L)
Female	40.1 (L)	0.189	0.081 (H)	41.4 (L)	0.182 (H)	0.055 (H)
Education of mothers in years						
0	50.2 (H)	0.221 (H)	0.087 (H)	51.2 (H)	0.207 (H)	0.063 (H)
1-4	45.4	0.211	0.062	44.2	0.188	0.053
5-7	36.4	0.177	0.058	35.8	0.162	0.044
8-9	33.1	0.168	0.074	30.5	0.147	0.039
10-11	24.5	0.138	0.040	24.1	0.121	0.033
12	17.1 (L)	0.103 (L)	0.037 (L)	18.6 (L)	0.099 (L)	0.028 (L)
BMI of mothers						
< 18.5	49.8 (H)	0.222 (H)	0.074 (H)	51.1 (H)	0.208 (H)	0.060 (H)
18.5-24.9	36.2	0.175	0.073	37.4	0.164	0.048
>= 25.0	18.0 (L)	0.105 (L)	0.034 (L)	16.3 (L)	0.094 (L)	0.029 (L)
Place of residence						
Urban	30.0 (L)	0.155 (L)	0.063 (L)	33.1 (L)	0.149 (L)	0.041 (L)
Rural	43.8 (H)	0.200 (H)	0.073 (H)	44.6 (H)	0.188 (H)	0.055 (H)

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[Table 2 Contd...

Characteristic	NFHS-3			NFHS-2		
	Prevalence of Underweight (in %)	Intensity (FGT1)	Severity (FGT2)	Prevalence of Underweight (in %)	Intensity (FGT1)	Severity (FGT2)
Religion						
Hindu	41.2	0.193	0.063	42.8	0.182	0.053
Muslim	39.2	0.180	0.113 (H)	42.3	0.179	0.053
Christian	29.2	0.162	0.054	24.2	0.125	0.036
Sikh	21.5 (L)	0.107 (L)	0.034 (L)	21.8	0.108 (L)	0.033
Buddhist/ Neo-Buddhists	37.8	0.200	0.057	36.5	0.162	0.040
Jain	22.4	0.116	0.038	19.7 (L)	0.114	0.029 (L)
Others	64.0 (H)	0.253 (H)	0.086	59.6 (H)	0.213 (H)	0.057 (H)
Caste						
Scheduled Caste	46.4	0.210	0.085 (H)	47.0	0.196	0.058
Scheduled Tribe	52.7 (H)	0.236 (H)	0.079	53.2 (H)	0.209 (H)	0.065 (H)
Other Backward Caste	40.9	0.191	0.068	42.2	0.182	0.053
Others	31.5 (L)	0.156	0.060	36.2 (L)	0.159 (L)	0.045 (L)
Do not know	36.2	0.163 (L)	0.042 (L)	-	- -	
Household Standard of Living Index*						
Low	52.8 (H)	0.232 (H)	0.089 (H)	52.7 (H)	0.213 (H)	0.065 (H)
Medium	44.0	0.199	0.085	40.9	0.176	0.050
High	26.3 (L)	0.141 (L)	0.045 (L)	22.1 (L)	0.115 (L)	0.032 (L)

Source : IIPS and ORC Macro (2000, 2007).

Notes:

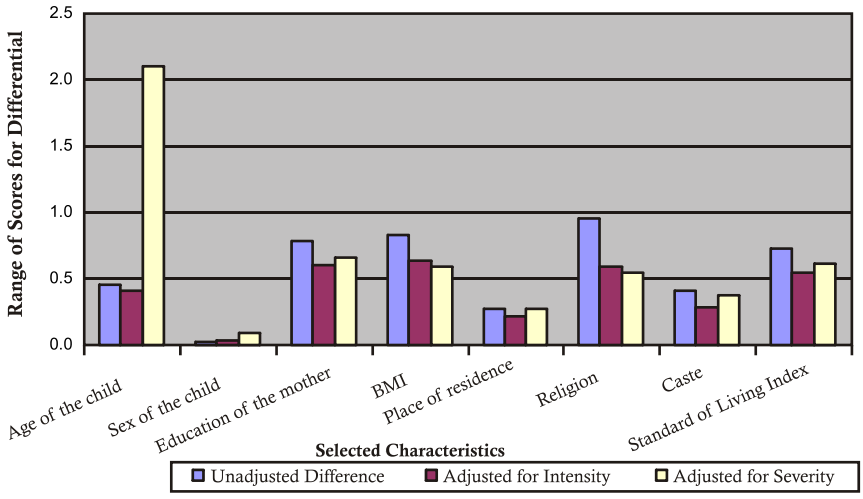
1. Since this indicator to assess economic status is common in both the data sets we have chosen it for comparison instead of wealth scores presented in Table 1. Though the 'Wealth Quintile method' used in NFHS-3 and Household Standard of Living Index' used in NFHS-2 refer to economic status of the surveyed households their method of computation is different[2].
2. For both NFHS-2 and NFHS-3, unit record data from respective child files have been used for above computation.
3 The total sample size for children below age of three years for NFHS-2 and NFHS-3 are 24,821 and 26,611 respectively. We have taken into account all those children for whom the height and weight information are available in the unit record data.

[2] For a detailed discussion on the relative merits and demerits of the both the indicators, see, Mishra and Dilip (2008).

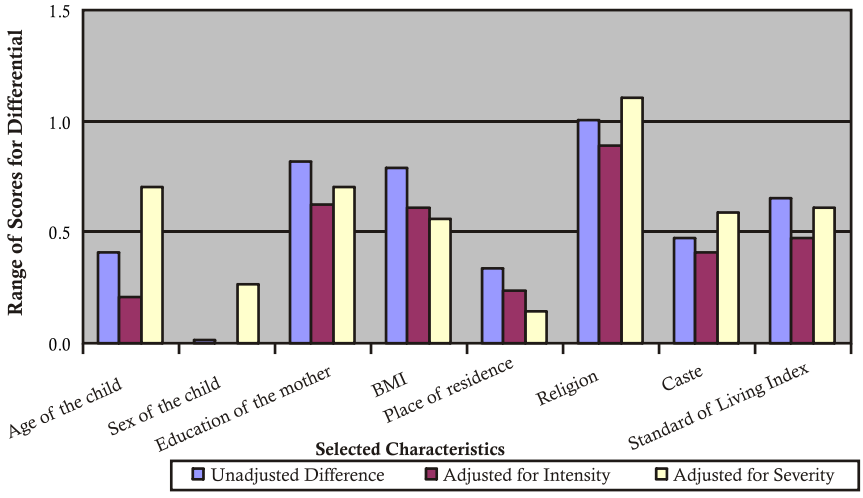
From Table 2 it is evident that at the aggregate all India level there is a small decline of 1.5 percentage point in prevalence of underweight among children of 0-35 months between 1998-99 and 2005-06. However, the intensity and severity levels have gone up by 0.10 percentage points and 0.19 percentage points respectively during the same period. The intensity of underweight is found to be the lowest among children aged below 8 months during both the periods and highest among children aged 18 months and above during both the periods. It is also interesting to note that the intensity is low in younger age groups whereas the severity of underweight is highest among children of age below 5 months. The female children, despite having marginally lower prevalence than their male counterparts in both the rounds, show higher intensity in NFHS-2 and higher severity than their male counterparts in NFHS-2 and NFHS-3. Children of uneducated mothers, children of undernourished mothers, children from rural households and children from low household-standard-of living-index have the highest prevalence, intensity and severity for underweight vis-à-vis their counterparts in other groups for respective characteristics. In terms of social group identity, children from tribal households have the highest prevalence level and the highest intensity vis-à-vis other social groups. However, the severity of underweight is found to be the highest among children from scheduled caste (SC) households during NFHS-2 and children from ST households during NFHS-3.

Table 2 and Graphs 2 and 3 present the pattern of intensification in differential across categories within characteristic groups. The method of computing the differentials is already elaborated in the discussion on Graph 1. It is observed that the distance between groups for any given characteristics become pronounce after adjustment, for all the selected characteristics, with some exceptions (especially for severity for characteristics like BMI of the mother and place of residence). From the graphs one can observe the pronounced differentials for intensity and severity (adjusted differentials) vis-à-vis the prevalence level (unadjusted differential) are not robust as in case of Graph 1 (except for severity for age of the child for the rounds, religion and caste for NFHS-3). One reason could be as the age of the child increases the intensity and severity of underweight also increases along with the age. This proposition needs further introspection. However, this could possibly be due to cumulative nature of nutritional deprivation.

Graph 2
Differential across Characteristics for Underweight among Children of Age 0-35 Months in India: 1998-99



Graph 3
Differential across Characteristics for Underweight among Children of Age 0-35 in India: 2005-06



6. Conclusion

This exercise cautions on the assessments made on prevalence of outcomes defined by dichotomous criterion which remains blind to the distribution of the phenomenon on either side of the dichotomy. The proposed adjustment to account for intensity and severity not only revises the level of the phenomenon, but also refines the depiction of differentials. Such a refinement seems to pronounce differentials otherwise remaining concealed when computed without distributional adjustment of the phenomenon. The intensity and severity adjusted inter-group difference will be more meaningful for prioritizing the intervention for the most vulnerable group. It might sensitize policy planners regarding the intensity and inequality of the phenomenon beyond its mere level. Given that relatively lesser deprivations are accompanied with greater intensity and inequality, it will merit more focused attention. Further, sensitization to intensity and inequality will influence prioritization beyond the levels of deprivation. Manifestations of differentials will no longer be conditioned only by the levels of deprivation rather than its intensity and inequality.

References

Blossner, Monika and Mercedes de Onis (2005), 'Malnutrition: Quantifying the Health Impact at National and Local Levels', *WHO Environmental Burden of Disease Series, No. 12,* Geneva, World Health Organization. Available at http://www.who.int/quantifying_ehimpacts/publications/MalnutritionEBD12.pdf. Accessed June 9, 2011.

Chakraborty, A. (2001), 'Concept and Measurement of Group Inequality', *Working Paper No. 315*, Centre for Development Studies, Thiruvananthapuram, pp. 1-34.

Foster, J., J. Greer, and E. Thorbecke (1984), 'A Class of Decomposable Poverty Measures', *Econometrica*, Vol. 52, No.3, pp. 761-766.

Government of India (2009), *Millennium Development Goals: India Country Report Mid-Term Statistical Appraisal*, New Delhi, Central Statistical Organisation, Ministry of Statistics and Programme Implementation. Available at http://indiaenvironmentportal.org.in/files/MDGGOIreport_0.pdf. Accessed June 9, 2011.

International Food Policy Research Institute (2010), *2010 Global Hunger Index - The Challenge of the Hunger: Focus on the Crisis of Child Undernutrition*, IFPRI, Washington D.C. Available at http://www.ifpri.org/sites/default/files/publications/ghi10.pdf. Accessed June 9, 2011.

International Institute for Population Sciences (IIPS) and ORC Macro (2000), *National Family Health Survey-2*, Mumbai.

International Institute for Population Sciences (IIPS) and ORC Macro (2007), *National Family Health Survey-3*, Mumbai.

Mishra, U.S. and T.R. Dilip (2008), 'Reflections on Wealth Quintile Distribution and Health Outcomes', *Economic and Political Weekly*, Vol. 43, No. 8, pp. 77-82.

Mishra, U.S. and Rudra Narayan Mishra (2009), 'On Comparison of Nutritional Deprivation: An Illustration Using Foster Greer Thorbecke Criterion', *Applied Economics Letters*, Vol. 16, Issue 10, pp. 1021-1024.

Subramanian, S. (2005), 'Fraction versus Whole Numbers: On Head Count Comparisons of Poverty across Variable Populations', *Economic and Political Weekly*, Vol. 40, No. 43, pp. 4625-4628.

United Nations (2010), *The Millennium Development Goals Report 2010,* New York, UN. Available at http://www.un.org/millenniumgoals/pdf/MDG%20Report%202010%20En%20r15%20-low%20res%2020100615%20-.pdf. Accessed June 9, 2011.

World Health Organization (1995), 'Physical Status: The Use and Interpretation of Anthropometry: Report of a WHO Expert Committee', *Technical Report Series No. 854*, Geneva, WHO.

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