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Childhood under-nutrition and SES gradient in India – myth or reality

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Abstract: The paper tries to explore whether SES gradient exists in childhood under-nutrition in India since, in spite of sound economic growth and poverty reduction, the under-nutrition prevalence is not declining so much. The paper uses different secondary data sources to analyze the issue. It uses data for fifteen major Indian states and looks at the pattern of under-nutrition, poverty and pattern of influence of SES and other poverty syndrome factors over one and half decade. It also explores whether the value of the gradient varies due to contribution of different levels – household and community and finally it decomposes the inequity in nutritional achievement to find the pattern of SES contribution over one and half decade. Based on these analyses, it concentrates on one major state where contribution of SES and spatial inequity seems to be higher. It is visible that SES gradient is very much present in under-nutrition and works through the pathway of higher intra-household inequity in several child and mother specific factors. Over time contribution of SES has increased and intra-household inequity has increased. So it suggests bottom up strategies in policy development is to be strengthened through e-governance techniques and institutional integration to ensure universal access to public goods and services.

Keyword: Under-Nutrition, Children, Socioeconomic Status

1. Introduction

Link between economic status and under-nutrition has long been established in literature (Deolalikar 2004, Svedberg 2000, Navaneetham and Jose 2005, Hong and Mishra, 2006, Svedberg 2008). There exists two-way causality between economic status and under-nutrition as poor people are more undernourished and under-nutrition reduces production of human capital and in long run reduces work capacity and earning (Dasgupta and Roy 1986).

In Asian countries like Bangladesh, India, range of Latin American and sub-Saharan African countries living standard and children's nutritional status are interrelated (Poel *et al*. 2008, Zere and McIntyre 2003, Fotso 2006, Hong and Mishra 2006, Smith and Haddad 2000, Pongou *et al*. 2006, Larrea and Freire 2002, Taguri *et al*. 2008, Giashuddin *et al.* 2005). But in countries like Mexico, Ecuador, Cambodia any relation between economic status and under-nutrition is absent (Hong *et al*. 2006). Economic status, healthcare and regional characteristics are few determinants of under-nutrition in Ghana (Poel *et al*. 2007). In some developing countries, income growth improves nutrition outcomes but the trickle-down effect is slow, long and indirect (Shekar and Lee 2006).

Socioeconomic status is one correlate which influences the decision making of the household related to children's share of food in the family as well as health seeking at household level (Tipping and Segall 1996, Linnermayr *et al*. 2008). One study finding shows that a child from richest quintile is twice as likely to be taken to a suitable provider compared to a poor child when suffering from diarrhoea or pneumonia (Gwatkin *et al*. 2000). Such adherences are strongly associated with socioeconomic status of the households found in rural Sudan also (Wagstaff 2003). Another study on Tanzania shows that, poorer children are significantly less likely to receive antibiotics when they suffer from pneumonia (Schellenberg *et al*. 2003).

Therefore, economic status via household's behavior influences intra-household food allocation, preventive and curative care seeking which can improve child's health and nutritional status. These literatures also measured the impact of determinants and different economists recommended several policy directions to reduce their impacts and protect children from those impacts.

It was long been argued in a study of the World Bank that

poverty reduction strategy process will be strengthened if nutrition is emphasized (Shekar and Lee 2006). Then poverty reduction will be accelerated as improved nutrition will improve future human capital development (ibid.). Since, poor are more undernourished; therefore if nutritional interventions would target those groups then it will reduce the prevalence of undernourishment and will break the vicious circle of under-nutrition and poverty (ibid.). Thus poverty reduction along with nutritional interventions will improve the health and well being of the poor (Setboonsarng 2005, Shekar and Lee 2006).

Despite such innovative thinking, it is prominent that, the problem of undernourishment and childhood under-nutrition is still a considerable problem in Asian countries. Notwithstanding, lower incidence of poverty, South Asia shows higher prevalence of undernourished children in the world (Navaneetham and Jose 2005). In South Asia, 40 percent population is under lower poverty line as defined by the World Bank compared to 46.3 percent in Sub Saharan Africa whereas, incidence of under-nutrition is higher in South Asia compared to Sub Saharan Africa (Moderate to severe stunting in South Asia is 44.8 percent compared to 32.8 percent in Sub Saharan Africa) (Navaneetham and Jose 2005, Svedberg 2000). One study has projected that India will take until 2023 to achieve the MDGs under the best of circumstances (Shekar and Lee 2006). In India currently 26 percent population is below poverty line but 38 percent child population is undernourished (NHDR 2001, NFHS 2006). Despite a number of poverty eradication programmes and nutritional interventions in India, under-nutrition rate is so high (Gragnolati *et al.* 2005).

Not only the economic status, poverty syndrome factors at individual, household and community level play important role in determining child's nutritional status (Navaneetham and Jose 2005). As for example, child nutrition is influenced by urbanization (Navaneetham and Jose 2005, Fotso 2006). Demographic factor related to household like household size is another determinant of under-nutrition (Navaneetham and Jose 2005, Taguri *et al*. 2008, Mamobolo *et al*. 2005).

Frequency of childhood illness also depends on whether the feeding practice is not proper (Wagstaff 2003). From the very first hour of birth to five months of age exclusive breastfeeding protects child on or after suffering from infectious diseases and under-nutrition (WHO 2001). From six months onwards only breast milk could not be able to provide sufficient nutrition and energy to combat with diseases but frequent, consistent complementary feeding with proper feeding approach is required with breastfeeding (Wagstaff 2003). Improper start of complementary feeding has different negative consequences (ibid.). Per capita food availability, food security in the household is another underlying determinant affecting the dietary intake of children in the household (Smith and Haddad 2000, Yambiand Kavishe1999, Garcia M.1994, Onis *et al.* 2000). In India, it has been felt long ago that to bring food security Public Distribution System (PDS) is needed (Swaminathan 2001). Given the equitable intra-household food allocation, poorer household will benefit from efficient food distribution through PDS than food production due to rising role of market in agriculture (Swaminathan 2001). A significant shock to the children at their age of less than three has discernable impacts ten years later in terms of height achievement. This perpetuates inequality in future (Zere and McIntyre 2003).

Household's environment is determined by his access to public goods e.g. drinking water, toilet and sanitation facility etc., which have influence on child's nutritional status in a family (Svedberg 2000, Monteiro *et al*. 2009, Onis *et al.* 2000, Linnermayr *et al*. 2008, Taguri *et al*. 2008, Navaneetham and Jose 2005, Yambi and Kavishe 1999, Hong and Mishra 2006) which is one community and household level determinant. Place of defecation, hand washing after that or before cooking, safe drinking water influences the occurrence of diarrhea and other infectious diseases (Wagstaff 2003). Water and sanitation acts as underlying determinant because it impacts proximate determinants like feeding of the child (Wagstaff 2003, Linnemayr *et al*. 2008). Indoor Air Pollution is formed from use of coal or biomass fuels (wood, animal dung etc.) for cooking or heating without proper ventilation and increases the risk of pneumonia among children and birth of low birth weight babies (Wagstaff 2003).

Preventive activities like antenatal visits, health worker's advice about mother and child's nutrition are community level characteristics that improve mother's nutritional status, reduce the probability of low birth weight babies and promote proper feeding practice of mother and children (Wagstaff 2003). Studies have shown that less healthcare uptake as indicated by incomplete immunization worsens impacts of under-nutrition, and also found to be the significant risk factor for stunting (Taguri *et al*. 2008).

Care during illness is household level underlying determinant (Haddad *et al*. 1995, Martorell *et al*.1984). Delayed or improper care seeking worsens the scenario. Poor or delayed care seeking is found as the cause of 70 percent of child deaths (Wagstaff 2003). Knowledge about the symptoms and danger signs of severe illness influences the decision of taking to a right provider.

Financial barrier of the poor low income is one household level obstacle, which not only means less resource to combat health shock but also the economic impact of seeking treatment (Russell 2004). Poor people's monthly consumption is highly responsive to health seeking. Single hospital utilization in Vietnam in 1998 cost the 22 percent of annual non-food consumption expenditure for the poorest quintile (Wagstaff and Doorslaer 2000). Poorest people in India curtail 60 percent of food consumption when utilize hospital care (Kanjilal *et al*. 2007).

Healthcare provision at community level means a lot of issues- geographical accessibility, availability of human resource, organizational and technical quality, relevance and timeliness of services. Distance to and time to reach health facility has significant impact on service use and health status outcome and poor people usually found to travel more to get a healthcare service and also face difficulty in transportation

(Wagstaff 2003). Utilization of services is higher in households where healthcare services are well equipped with machinery, drug stock and properly staffed and it was also found that facilities serving the poor are not well staffed nor well stocked (Wagstaff 2003). Poor usually becomes a victim of worse organizational quality while they go to public facilities and suffer from long waiting or rude behavior (Wagstaff 2003). Poor people visit hospitals, which are of inferior organizational quality, and quality of case management of childhood illness is frequently very low (WHO 1998).

Child's nutritional intake, intra household food allocation, health care seeking of children depend upon one crucial household level factor - mother's education, her knowledge, awareness, and also decision-making power (Svedberg 2000, Onis *et al.* 2000, Chakrabarty 2004, Navaneetham and Jose 2005, Linnermayr *et al*. 2008, Svedberg 2008, Aturupane *et al*. 2006, Pongou *et al*. 2006, Taguri *et al*. 2008). Child's under-nutrition decreases with increase in mother's education, as educated mothers are more likely to follow better feeding practice, more likely to avail preventive and curative healthcare services and childcare (Wagstaff 2003, Linnermayr *et al*. 2008). Across country and within country inequality in maternal education is substantial particularly in South Asia and western and central Africa. Parental poverty and low educational attainment are adversely associated with the survival of children as found in few other studies on under-nutrition (Montgomery and Hewett 2005, Victora *et al*. 2003).

Maternal nutritional status is significant household level influencing factor for child's growth retardation found in many studies (Chakrabarty 2004, Morales *et al*. 2004, Mani 2007, Black *et al*. 2008). Women who were undernourished as children are likely to give birth to low birth weight babies (Setboonsarng 2005, Navaneetham and Jose 2005). South Asia is the worst in this respect (Poel *et al*. 2008). Low birth weight is one of the main causes of higher prevalence of under-nutrition as girls and women are less well cared (1/3 of Indian babies, ½ of Bangladeshi babies are born low birth weight) (Navaneetham and Jose 2005). It reflects gender dimension also. Again low birth weight predicts poorer health in early childhood but also predicts sufferings of chronic degenerative diseases (especially the risk of high glucose concentrations, blood pressure, and harmful lipid profiles, mental illness increases) in adulthood (Navaneetham and Jose 2005, Victora *et al*. 2008). Child and maternal health outcomes largely affected in poor communities by negative attitude of their families towards mother's autonomy, their good health outcomes and in this manner affects time and energy mothers devote for childcare and health seeking (Svedberg 2008).

As we see, different studies tried to understand whether the influencing factors are clustered in different levels like state, community, household, and individual. Alderman (2006) has considered few underlying influencing factors from individual level (child), mother, household and community level (presence of NGO and public health facility but not the utilization of those facilities due to data limitation).

One study on 12 developing countries to measure how far income change can reduce under-nutrition found that countries with higher per capita income have less under-nutrition. They estimated the short term, medium term and long term impact of income change on the prevalence of under-nutrition and found that estimates of income effects are more sensitive to treatment of unobserved community factors compared to controls for household's access to public good. (Linnemayr *et al*. 2008).

Under relative poverty approach a number of studies addressed the spatial (rural urban) inequalities in under-nutrition prevalence to find inequality at community level and they used mainly logistic regression techniques to find the correlates of inequality as well as determinants at urban and rural level.

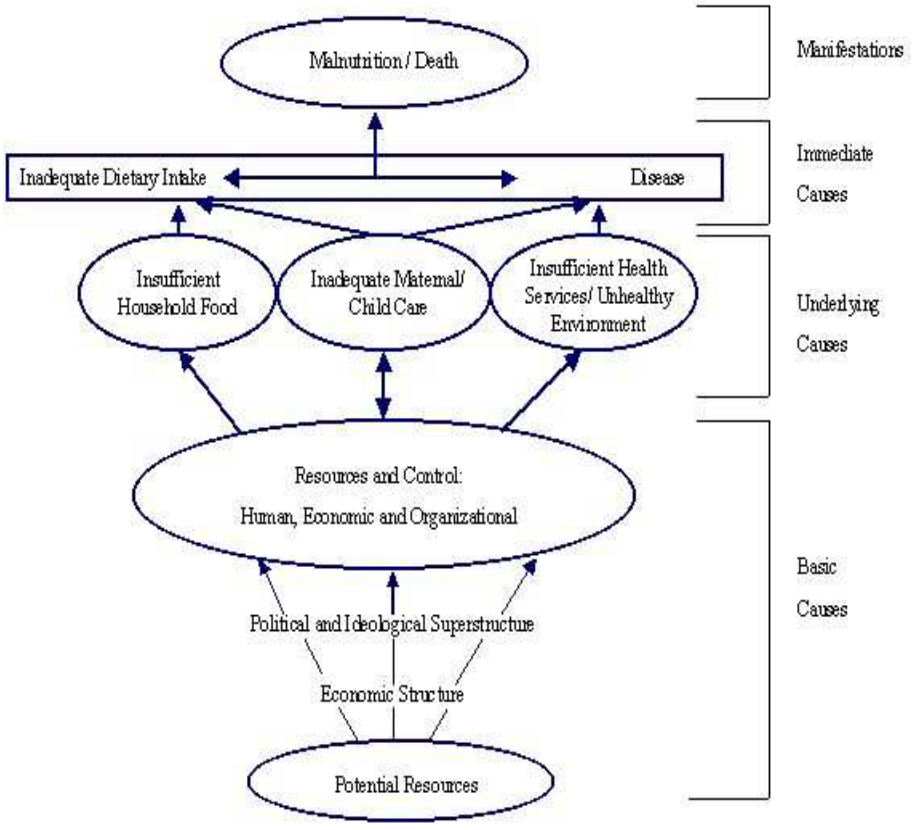
On average, child health conditions are better in urban areas than in rural counterparts in developing countries (Poel *et al*. 2007, Ruel *et al*. 1998, Menon *et al*. 2000, Fotso and Kuate-Defo 2006). Understanding the nature and the causes of rural urban disparities are essential to understand the impact of rapid urbanization taking place in the developing world in order to target resources appropriately to raise population health (Poel *et al*. 2007). As it is observed from different studies, the locus of poverty and under-nutrition is shifting from rural area to urban area (Ruel and Garrett 1999, Garrett 2000). Poel (2007) found that urban poor has higher level of stunting than rural poor in some developing countries. In Sub-Saharan African countries, rural-urban differential in under-nutrition is narrowing in some of them due to increase in urban percentage and widening in some because of sharp decline in urban under-nutrition (Fotso 2006). In a study in different cities of Africa, Asia and Latin America spatial clustering of childhood under-nutrition and its covariates across cities has been found (Morris 2000). In a study of nutritional status of children under the age of five in Mozambique, Garrett (1999) and Ruel (1999) found that it is the levels of critical influencing factors and not their nature are responsible for rural-urban differential in under-nutrition and food insecurity. Another study also concludes the same (Smith *et al*. 2005).

The above mentioned studies investigated different correlates of rural-urban differential in under-nutrition. Household wealth is found as strong determinant of rural-urban disparity (Poel *et al*. 2007). Greater dependence on cash income, employment in informal sector, and greater exposure to environmental contamination are major causes in addition to the previous one (Ruel *et al*. 1999). Most common causes of under-nutrition are poor feeding practice, less utilization of nutrients due to infections and parasites, inadequate food and health security, poor environmental conditions, and lack of proper child care practice (Ghosh and Shah 2004). In one study, Ruel (2000) found that in Latin America, rural children are worse off in terms of growth and dietary diversity than their urban counterpart and exclusive breastfeeding up to six months and continuation of it along with complementary feeding beyond 4-6 months are key concerns of urban area. Though breastfeeding rates are lower

in urban areas, dietary patterns are better in urban areas as urban mothers are more likely to start complementary feeding in timely fashion (Ruel and Menon 2002). In Sub-Saharan Africa and South Asia, under-nutrition largely is a material dimension of poverty including water and sanitation, access to food and healthcare and income is the most crucial factor along with mother's education and maternal nutritional status in alleviating child under-nutrition which has strong and significant community level variance (Fotso and Firestone 2008, Fotso 2006, Harttgen and Misselhorn 2006). In Poel's (2007) study, controlling of socio-demographic characteristics reduces rural-urban risk ratio by 22 percent implying that demographic characteristics also has significant influence on the economic gradient of rural-urban differential in under-nutrition (Poel *et al*. 2007). In Sub-Saharan Africa, after controlling of economic status, the rural-urban gap disappears implying that focus is needed for urban poor children (Fotso 2006). Identification of factors affecting the health of urban poor and programs that target them is very urgent in phase of urbanization (poel *et al*. 2007, Ruel *et al*. 1999). Besides, efforts to alleviate the most critical socioeconomic constraints specific to the different environment should continue to be prioritized (Smith *et al*. 2005).

Despite recent achievement in economic progress in India (World Bank 2003), the fruit of development has failed to secure a better nutritional status of children in the country (Rajaram *et. al*. 2007, Shiva Kumar 2007, Pathak & Singh 2009, Svedberg 2006). India presents a typical scenario of South-Asia, fitting the adage of 'Asian Enigma' (Ramalingaswami *et. al*. 1996); where progress in childhood under-nutrition seems to have sunken into an apparent under-nutrition trap, lagging far behind the other Asian countries characterized by similar levels of economic development (Gragnolati *et al*. 2005, UNICEF 1990, Svedberg 2007, Claeson *et. al*. 2000).

In light of above depiction of findings of previous literatures as well as analysis of literatures, now we should look into the Indian scenario. Exhibiting a sluggish declining trend over the past decade and a half, the recent estimate from the National Family Health Survey -3 (NFHS-3) the unique source for tracking the status of child under-nutrition in India (Mishra & Rutherford 2000) indicates about 38 percent are moderately to severely stunted (short for age) (IIPS 2007). The decline in prevalence however becomes unimpressive with the average levels marked by wide inequality in childhood under-nutrition across the states and various socioeconomic groups (Rajaram *et. al*. 2007, Shiva Kumar 2007, Bawdekar & Ladusingh 2008, Pathak & Singh 2009). Growing evidence suggests (Pathak & Singh 2009) that in India the gap in prevalence of another measure of under-nutrition i.e. underweight among rich and poor children is increasing over the years with wide regional differentials. From this specific context, the work is an attempt to study the pattern of the nutritional status for Indian children in last few decades.



Source: UNICEF 1990

Figure 1. *The Conceptual Framework.*

Socioeconomic differences in morbidity and mortality rates across the world have received its due attention in the recent years (Wagstaff 2000a, Brockerhoff & Hewett 2000, Gilson & McIntyre 2001). Such differentials in health status in-fact are found pervasive across nations' cross-cutting stages of development as mentioned above (Mohanty and Pathak 2009, Poel *et al.* 2008, Houweling *et al.* 2007, Lawn *et al.* 2006, Carr 2004, Gwatkin *et al.* 2004, Oomann *et al*. 2003, Zere and McIntyre 2003, Wagstaff 2002, Wagstaff 2000b, Gwatkin *et al.* 2007, Smith & Haddad 2000). As studies have identified poverty as the chief determinant of under-nutrition in developing countries that perpetuates into intergenerational under-nutrition and prevents social improvement and equity (Larrea & Kawachi 2005, Hong *et al.* 2006). Nutritional status of under-five children in particular is often considered as one of the most important indicator of a household's living standard and also an important determinant of child survival (Thomas *et al*. 1990). The deterministic studies in India while exploring the impact of covariates on degree of childhood under-nutrition come up with an important nexus shared between household socioeconomic status (ICMR 1972, Rao & Rao 1994, Rajaram *et al*. 2003, Rao *et al*. 2004, Bamji, 2003, Bharati 2008, Pal 1999, Zere & McIntyre 2003, Rajaram *et al*. 2007, Arnold *et al*. 2004, Radhakrishna & Ravi 2004). The two-way causality of poverty and under-nutrition seems to pose a very significant pretext for under-nutrition in India like other developing nations, where poverty and economic insecurity due to constrained access to economic resources permeate undernourishment among the children (Behrman & Deolalikar 1988, World Development Report 1993, Strauss & Thomas 1998, World Health Report 1999, Ruger & Kim 2006, Gragnolati et. al. 2005). Thus, economic deprivation and inequality constitute the focal point of discussion while studying under-nutrition and deserves suitable analytical treatment to examine its interplay with other dimensions of under-nutrition and to prioritize appropriate programme intervention. Such attempt to the best of my knowledge is still awaited, using recent nationwide survey data. The present work will try to fill up the existing gap with respect to India.

Hypothesis: The hypothesis of the paper is,

The association between poverty and chronic under-nutrition is weak in India in last one and half decade

1.1. Research Questions

1. What is the pattern of income poverty, and chronic under-nutrition (the prevalence) in fifteen major states in last one and half decade in India?
2. How far the socioeconomic gradient truly exists?

1.2. The Theoretical Framework

The theoretical model is based on Grossman's (1972) demand for health concept. Economists derived nutrition demand function from household's utility function. Here the theoretical model is the contextualized version of Smith and Haddad (2000). The household behaves as if maximizing a welfare function, *W*, made up of the utility functions of its members (*Ui*), indexed *i*= 1, ..., *n*. The household members include a care giver who is assumed to be the mother (indexed *i*= *M*), *D* other adults (indexed *i*= 1, ...,*D*), and *J* children (indexed *i*= 1, ..., *J*). The welfare function takes the form:

$$W\ (U_M, U^1_{ad}, \ldots\ldots, U^D_{ad}, U^1_{ch}, \ldots., U^J_{ch}; \beta) \text{ and } \beta = (\beta M, \beta^1_{ad}, \ldots, \beta^D_{ad}) \quad (1)$$

where the βs represent each adult household member's "status." Such status affects the relative weight placed on members' preferences in overall household decision-making, or their decision-making power. The utility functions take the form:

$$U^i = U\ (N, F, X_0, T_L)\ i=1, \ldots\ldots, n \quad (2)$$

$$i=1+D+J$$

where *N, F, Xo* and T_L are 1 X *N* vectors of the nutritional status, food and non-food consumption, and leisure time of each household member.

Nutritional status is viewed as a household provisioning process with inputs of food, non-food commodities and services, and care. The nutrition provisioning function for child *i* is as follows:

$$N^i_{ch} = N\ (F^i, C^i, X^i_N, \delta_{HENV}, \delta_{FOOD}, \delta_{MEDU}, \delta_{HEXP}, ES, \varphi^i) \quad i=1, \ldots\ldots..J \quad (3)$$

Where F^i is the food received by the *i*th child and C^i is the care received by the i^{th} child, X^i_N represents non-food commodities and services purchased for care giving purposes, such as health services. The variable δ_{HENV} represents the health environment, that is, the availability of safe water, sanitation, in the household's community.

The variable δ_{FOOD} represents the availability of food in the community. Finally, the variable δ_{MEDU} represents the mother's educational status which influences her knowledge, attitudes, beliefs and practice regarding child care. The child's care, C^i, is itself treated as a child-specific, household- provisioned service depends on mother's decision-making process in care giving which is assumed to be governed by her education level (assumed to be contemporaneously exogenous). The term φ^i indicates the physiological endowment of the child (his or her innate healthiness), cultural factors affecting caring practices; the mother's own nutritional status embodying the status of her physical and mental health, Household members' income constraint is reflected in their economic status.

The maximization of (1) subject to (2), (3) leads to a reduced- form equation for the i^{th} child's nutritional status in any given year. Therefore this paper will analyze how far socioeconomic status is responsible for suboptimal availability and/or utilization of factor bundle in the reduced form equation over one and half decade in India.

2. Data and Methods

To explore the first research question, data on incidence of income poverty has been collected from Handbook of Statistics on Indian Economy from Reserve Bank of India. Data on material deprivation of the households in form of SLI index are available in National Family Health Survey datasets to investigate the link between SES and under-nutrition.

Data on stunting or chronic under-nutrition is available from NFHS-1 (1992-93), NFHS-2 (1998-99) and NFHS-3 (2005-06). NFHS-1, NFHS-2, NFHS-3 are designed to provide estimates of important maternal and child health indicators including nutritional status for young children (under five years for NFHS-3), following standard anthropometric components. The NFHS surveys were conducted by International Institute of Population Sciences following stratified sampling technique (IIPS 2007). The analysis took the children population under the age of three to make comparison among NFHS-1, NFHS-2 and NFHS-3 i.e. the data from three time points. Since there exists data limitation in the sense that NFHS-1 covered children under the age of four and NFHS-2 covered children under the age of three. So in this work, when the comparisons of three time points are made, children under the age of three are taken. Of the total children for whom NFHS I, NFHS II and NFHS III has similar information, a subset of 48,640 children are considered; those who are under the age of three and whose height-for-age z-score (HAZ) is available within the range of -6 to +6 standard deviation from the WHO-NCHS reference population for fifteen major states. I will do the analysis in two phases – first, I will see the socioeconomic gradient in India in three time points and then for one state from four state groups based on the result of one previous work by Kanjilal *et al*. (2010). In that work fifteen major states were clubbed in four groups based on the NSDP, state prevalence of chronic under-nutrition (stunting) and state level concentration index values indicating inequity in nutritional status in those states for the year 2005-06. According to such categorization, four groups are: 1) High Prevalent High Inequity (HPHI) state : Orissa, 2) High Prevalent Moderate Inequity (HPMI) state: Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat, 3) High Prevalent Low Inequity (HPLI) state: Rajasthan, Uttar Pradesh, Madhya Pradesh, Bihar, Assam, and 4) Moderate Prevalent High Inequity (MPHI) state: Haryana, Punjab, West Bengal, Maharashtra, Kerala. Since among all such state groups, we found West Bengal has the highest spatial inequity, I consider detail analysis for this state in this regard.

The first objective is investigating the patterns of chronic under-nutrition in three time points (1992-93, 1998-99 and 2005-06), and the patterns of poverty at nearest time periods. The measurement of percentage of children chronically undernourished and concentration index of chronic under-nutrition in Indian states are made in all India scenario. The pattern of income poverty has also been analyzed.

The work uses height for age (stunting) as the key outcome variable, which is an indicator of chronic nutritional status capable of reflecting long-term deprivation of food (WHO working group 1986) following the established practice of anthropometric measures of malnutrition. The measure is expressed in the form of z-scores standard deviation (SD) from the median of the 2006 WHO International Reference Population.

The objective of calculating socioeconomic inequity in nutritional status is catered through the measurement of concentration index as in previous section. To do the cluster wise analysis of exploring the factors influencing stunting and socioeconomic gradient in three time points I used multilevel modeling technique as explained in previous section. And next to find the magnitude of contribution of different factors in inequity in nutritional status I used the technique of concentration index decomposition following O'Donnell *et al*. (2008).

In this section, multilevel models are based on observations 14312 (NFHS I), 17447 (NFHS II), 16881 (NFHS III) approximately for each time points from households distributed in fifteen major states and 1053 for West Bengal in 2005-06 i.e. the present time point to get an in depth idea of present scenario. Inclusion of separate levels for children and mothers were considered not necessary since 1:1 relationship is there with households.

The widely used standard tool that examines the magnitude of economic inequality in any health outcome, i.e. Concentration Index (CI) (O'Donnell *et al.* 2008) is employed to study the extent of inequity in chronic child under-nutrition across the states of India. The tool has been universally used by the economists to measure the degree of inequality in various health system indicators, such as health outcome, health care utilization and financing. The value of CI ranges between -1 to +1, hence, if there is no economic differential the value returns zero. A negative value implies that the relevant health variable is *concentrated* among the poor or disadvantaged people while the opposite is true for its positive values, when poorest are assigned the lowest value of the wealth-index. A zero CI implies a state of horizontal equity, which is defined as *equal treatment for equal needs* (Wagstaff *et al.* 2003). CI values calculated for stunting help us find the possible concentration among rich and poor children below three years of age during three time points.

2.1. Multi-Level Regression

Due to the stratified nature of data in NFHS (IIPS 2007), the children are naturally nested into mothers, mothers are nested into households, households are into Primary Sampling Units (PSUs) and PSUs into states. Hence keeping in view this hierarchically clustered nature, the section uses multi-level regression model to estimate parameter for nutritional status among children to avoid the likely under-estimation of parameters from a single level model (Griffith *et. al*. 2002). Since here, siblings are expected to share certain common characteristics of the mother and the household (mother's education and household economic status for e.g.) and children from a particular community or village have in common

community level factors such as availability of health facilities and outcomes, it can be reasonably asserted that unobserved heterogeneity in the outcome variable is also correlated at the cluster levels (Bingenheimer and Raudenbush 2004, Marini and Gragnolati 2006). This amounts to an estimation problem employing conventional OLS estimators, which gives efficient estimates only when the community level covariates and the household level covariates are uncorrelated with the individual and maternal covariates.

Researchers have adopted fixed effect models to estimate nutrition models and control for unobservable variables at the cluster level, which leads to the difficulty that if the fixed effect is differenced away, then the effect of those variables that do not vary in a cluster will be lost in the estimation process (Marini and Gragnolati 2006). Allowing the contextual effects in this analysis of the impact of household economic status on child under-nutrition, alternative multilevel models are adopted.

Broadly, two types of multilevel models are tested following the practice in contemporary literature; the variance components (or random intercept) models and the random coefficients (or random slopes) models. As in above, STATA routines for hierarchical linear models using maximum likelihood estimators for linear mixed models were used for both model forms.

The variance-components model correct for the problem of correlated observations in a cluster, by introducing a random effect at each cluster. In other words, subjects within the same cluster are allowed to have a shared random intercept. Since, in rare cases information on more than one child from a single household was reported in NFHS, I consider two clusters, i.e., community and household. Thus, I have,

$$z_{ij} = \beta' x_{ij} + \delta_i + \mu_{ij}$$

where z_{ij} is the HAZ score for the child(ren) from the j^{th} household in the i^{th} community. β is a vector of regression coefficients corresponding to the effects of fixed covariates x_{ij}, which are the observed characteristics of the child, the household and the community. Where, 'i' is a random community effect denoting the deviation of community i's mean z-score from the grand mean, 'j' is a random household effect that represents deviation of household ij's mean z-score from the i^{th} community mean. The error terms δ_i and μ_{ij} are assumed to be normally distributed with zero mean and variances σ^2_c and $\sigma^{2,}_h$ respectively. As per the arguments above, these terms are non-zero and estimated by variance components models. To the extent that the greater homogeneity of within-cluster observations is not explained by the observed covariates, σ^2_c, and $\sigma^{2,}_h$ will be larger (Gragnolati 1999).

To evaluate the appropriateness of the multilevel models, I test whether the variances of the random part are different from zero over households and communities. The resulting estimates from the models can be used to assess the Intra Class Correlation (ICC) i.e., the extent to which child under-nutrition is correlated within households and communities, before and after I have accounted for the observed effects of covariates x_{ij}. A significantly different ICC from zero suggests appropriateness of random effect models (Marini and Gragnolati 2006). The ICC coefficient describes the proportion of variation that is attributable to the higher level source of variation. The correlations between the anthropometric outcomes of children in the same community and in the same family are represented by the formulae:

$$\rho c = \sigma^2 c / (\sigma^2 c + \sigma^2 h + \sigma^2 \text{residual}) \text{ for community level}$$

$$\rho h = \sigma^2 h / (\sigma^2 c + \sigma^2 h + \sigma^2 \text{residual}) \text{ for household level}$$

Following this, the total variability in the individual HAZ scores can be divided into its two components; variance in children's nutritional status among households within communities, and variance among communities. By including covariates at each level, the variance components models allow to examine the extent to which observed differences in the anthropometric scores are attributable to factors operating at each level. Thus, the variance components model described above introduces a random intercept at each level or cluster assuming a constant effect of each of the covariates (on the outcome) across the clusters.

If additionally, I consider the effect of certain covariates to vary across the clusters (for e.g, differential impact of household economic status or mother's education across households and/or communities), I need to introduce a random effect for the slopes as well, leading to a random coefficients model. Under these assumptions, the covariance of the disturbances, and therefore the total variance at each level depend on the values of the predictors (Gragnolati 1999).

The analysis is presented in the form of five models, apart from the conventional OLS model without considering the cluster random effects, primarily as a comparison: Model Null is the null model, where the variable containing HAZ z scores is the dependent variable with no covariates included; while in the later models along with poorest and richest household asset quintile, other covariates are introduced in a phased manner. Such as, Model Kids introduces child specific predictors (being purely individual attributes); Model Moms introduces the mother-specific covariates. Model Full is the full model with all the model covariates at respective levels. These models are three-level random intercept models with the two clusters: community, and households. In Model Random Slope, a random coefficient for economic status at the household level is introduced. After trying initially with each of the wealth quintile dummies, the work however settled for the random coefficient in the form of a continuous variable, provided in the NFHS data as wealth factor score. Results are reported in Table 3. The covariates included as controls in analytical models, with the primary aim of isolating the effect of economic status on chronic child under-nutrition are described below. In the multilevel framework most of these variables can be classified as individual-specific, household-specific or community-specific covariates.

2.2. Decomposition

Concentration index is decomposed into the contribution of each factor to asset and living standard related inequality

in nutritional status where each contribution is a product of the sensitivity of stunting with respect to that factor and the degree of asset and living standard related inequality in that factor. STATA Version 11 is used for all the analyses.

2.3. Explanatory Variable

2.3.1. Household Standard of Living as the Proxy for Household Economic Status

Following the standard approach of assessing economic status of the household (Gwatkin *et. al*. 2007), the work uses household assets, and different other living standard indicators provided commonly by the NFHS I, II and III to prepare the index. I prepared the household standard of living index based on different household characteristics and ownership of household assets using additive method following NFHS II valuation of assets and household characteristics. The items are type of house, toilet facility, drinking water, main fuel for cooking, ownership of agricultural land, irrigated land, livestock, has electricity or not, ownership of durables like tractor, thresher, water pump, bullock cart, sewing machine, fan, radio, refrigerator, television , motorcycle, car, bicycle, clock/watch. Then the household SLI is divided into three equal groups based on the scores.

2.3.2. Explanatory Variables Used as Controls

Other determinants of childhood under-nutrition are chosen based on the conceptual framework in the literature (UNICEF 1990; Smith and Haddad 2000; Gragnolati *et al.* 2005; Svedberg 2007, Kanjilal *et al*. 2010). Certain individual characteristics of child are considered as the proximate influencing factors of chronic under-nutrition. These predisposing factors include child's characteristics similar to other studies, such as, child's age in months in four categories (0-5, 6-11, 12-23, 24-35 months), sex of the child (female, male), birth order (first, second, third or more) , size of child at birth (large, average, small) as a proxy of birth weight (Som *et. al*. 2007), recommended feeding practice; denoted by exclusive breast feeding for infants below six months of age, introduction of complementary feeding along with or without breast milk at six months of age. In view of information provided by NFHS on child feeding, a child who eats any complementary food starting from 6 months of age irrespective of its breast feeding status is considered for latter feeding practice variable.

The controls on mother's characteristics include; education (illiterate, primary, secondary, higher), (Linnemayr *et. al*. 2008), employment status (employed or not) and place of birth for the child (child delivered at home or institution). On the household level, controls are included for household religion and ethnicity (Hindu and other minorities are two categories for religion, general and backward caste are two categories for ethnicity) since a large number of earlier studies found a significant linkage between scheduled tribe/scheduled caste households and childhood under-nutrition (Bawdekar and Ladusingh 2008, Rajaram *et. al*. 2007). Community characteristic is regarded as the distant covariate of child under-nutrition in the model. This is believed to capture the heterogeneity through rural-urban place of residence keeping in mind the variation in childhood mortality and morbidity across rural and urban area.

3. Results

3.1. Pattern of stunting

Table 1 depicts pattern of stunting in three time points in fifteen major states in India. According to MDG 1, the target of halving under-nutrition within 2015 is not easy to reach. Prevalence of stunting is highest in Bihar and lowest in Kerala in 1992-93. In 1992-93, none of the states is showing below 30 percent prevalence. Maximum level is 60 percent. Three out of five children under the age of three are stunted in Bihar, Madhya Pradesh and Uttar Pradesh in that period. In Bihar and Madhya Pradesh shows a reduction in the prevalence only by 2 to 3 percentage in next six to seven years. But, it shows a reduction by 8 percent in another five to six years. In Uttar Pradesh, Maharashtra, and Punjab the prevalence does not show change during nineties. It depicts change by eight to twelve percentage points in these states in next five years except in Maharashtra. In Maharashtra, the change is very slow like in Orissa, Gujarat, and Kerala. But status of undernourishment in Kerala is not comparable with the same in other three states as percentage of stunted below -2 Standard Deviation is already very low in Kerala as the health service delivery is more developed compared to other states. In Karnataka and Rajasthan prevalence is more or less 40 percent and there is approximately no change in last ten years.

Table 1. *Percentage of children under the age of three stunted in India by states (% below-2SD).*

States	1992-93	1998-99	2005-06
Bihar	60.3	57.6	49.5
Madhya Pradesh	60	56.4	48
Uttar Pradesh	60	60.3	51.9
West Bengal	56.7	50.1	41.8
Assam	56.5	53.7	41.4
Orissa	50.8	49.1	43.9
Haryana	50.5	55.4	43.2
Gujarat	50.1	51.8	49.1
Karnataka	47.5	42	42.3
Maharashtra	47	47	43.9
Rajasthan	45.5	59	40.1
Punjab	45.2	45.2	34.6
Andhra Pradesh	40.8	47.1	38.3
Tamil Nadu	40.8	35	31.1
Kerala	32.8	27.8	26.5

Source: Three NFHS rounds

High-prevalent states remain within first four high-prevalent states and less-prevalent states remain within last three low-prevalent states over the fifteen-year period. West Bengal, Assam are comparatively in a better condition than before. It is to be noted that these states show considerable amount of fall in stunting in the fifteen-year period. Whereas, Orissa, Gujarat, Maharashtra became worse which show slow or no progress.

Other states show very little alteration in ranking.

Table 2 exhibits the concentration index values for stunting in fifteen major states for children under the age of three in India in three time points. It is clear that concentration of under-nutrition is higher among poor in all the states in all the time points. Over time, inequality in nutritional status between the rich and the poor is increasing. In Haryana, Orissa, and Punjab inequality shows an increase in first decade of the millennium compared to previous years. Rank of Kerala, Andhra Pradesh, Assam shows drastic change between early and late nineties with respect to concentration of undernourishment. The situation becomes better with time. However, Assam shows increase in inequality after that period. High-prevalent states have lower extent of concentration.

Concentration of stunting is higher among states with low prevalence of 30-40 percent and high prevalence of 50 to 60 percent during early nineties. During 2005-06, data shows that higher the prevalence, lower is the concentration.

Table 2. *Concentration Index of stunted children under the age of three in Indian states and their t statistics.*

States	1992-93	t statistic	1998-99	t statistic	2005-06	t statistic
Andhra Pradesh	-0.121	-1.56	-0.084	-1.35	-0.147	-3.18
Assam	-0.091	-1.06	-0.025	-5.51	-0.117	-2.66
Bihar	-0.040	-1.78	-0.046	-1.22	-0.069	-1.50
Gujarat	-0.060	-4.69	-0.116	-1.58	-0.119	-2.88
Haryana	-0.050	-2.75	-0.078	-2.58	-0.155	-3.02
Karnataka	-0.088	-1.54	-0.111	-1.46	-0.128	-2.38
Kerala	-0.143	-3.25	-0.099	-2.16	-0.128	-1.57
Madhya Pradesh	-0.035	-1.64	-0.068	-1.38	-0.047	-1.37
Maharashtra	-0.088	-4.30	-0.117	-2.20	-0.145	-2.96
Orissa	-0.047	-1.53	-0.091	-1.43	-0.198	-2.78
Punjab	-0.047	-2.31	-0.110	-5.81	-0.233	-3.77
Rajasthan	0.000	0.05	-0.060	-1.38	-0.115	-2.65
Tamil Nadu	-0.121	-1.68	-0.132	-1.48	-0.138	-2.19
Uttar Pradesh	-0.035	-1.64	-0.061	-1.28	-0.115	-2.51
West Bengal	-0.048	-1.72	-0.141	-1.87	-0.138	-2.30

Source: Three NFHS rounds

In Kerala, Tamil Nadu, and Punjab the magnitude of stunting is lower but inequality in nutritional status among the poor and the rich is increasing with time. High-prevalent states like Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh inequality is lower. Other states are showing medium level of prevalence as well as medium level of inequality.

Table 3. *The t values for testing the significance of differences in mean values of stunting in fifteen major states in India.*

Rural	Difference between second and first time point	Difference between third and second time point	Urban	Difference between second and first time point	Difference between third and second time point
Bihar	0.699	0.001	Uttar Pradesh	0.042	0.002
Uttar Pradesh	0.580	0.003	Madhya Pradesh	0.211	0.003
Madhya Pradesh	0.620	0.006	Bihar	0.354	0.004
West Bengal	0.591	0.012	Gujarat	0.435	0.009
Assam	0.482	0.025	West Bengal	0.501	0.013
Orissa	0.378	0.051	Haryana	0.957	0.014
Maharashtra	0.328	0.074	Rajasthan	0.977	0.029
Haryana	0.303	0.099	Karnataka	0.833	0.041
Gujarat	0.459	0.193	Assam	0.885	0.057
Karnataka	0.604	0.235	Orissa	0.762	0.089
Punjab	0.453	0.201	Punjab	0.874	0.160
Rajasthan	0.506	0.374	Maharashtra	0.920	0.236
Andhra Pradesh	0.936	0.765	Tamil Nadu	0.986	0.285
Tamil Nadu	0.246	0.842	Andhra Pradesh	0.655	0.331
Kerala	0.584	0.628	Kerala	0.734	0.592

Source: Three NFHS rounds

The above table shows that (Table 3) in rural India, change in average level of stunting in second time point is significant for the states i.e. the difference between the means are significant. Whereas the differences in mean values of stunting from second to third time point is not significant for majority of states – Bihar, Uttar Pradesh, Madhya Pradesh, Gujarat, West Bengal, Assam, Orissa, Rajasthan, Karnataka, Maharashtra and Haryana. In urban Uttar Pradesh fall in average values are not significant in both the times – from 1992 to 1999 and from 1999 to 2005.

3.2. Pattern of Poverty

There is a long debate on poverty status of India during nineties (Deaton and Dreze 2002). There is continuous income poverty decline in some states as well as India as a

whole as the table below depicts (Table 4). It is found in literature that the increase in per capita consumption expenditure in the reference period is modest with decline in this poverty headcount. There is considerable poverty headcount decline between 1993-94 and 1999-2000 period. The all India headcount ratio declines from 36 percent to 26 percent during this period.

In the statewise analysis in the Table (Table 4) below, the basic pattern of modest income poverty decline between 1983-84 and 1999-2000 is visible, the pattern at the all-India level, also holds good at the level of major individual states in most cases. Except Haryana, all the states show a continuous decline in poverty headcount in last three decades. If spatial disaggregation is done, rural poverty shows an increase in some states like Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra and Rajasthan in 2000-2001 periods. However rural parts of some states - Bihar, Madhya Pradesh, Uttar Pradesh, Assam, and Orissa - have consistently higher levels of poverty incidence. In relation to urban India, poverty shows an increase in Andhra Pradesh, Bihar, Gujarat, Karnataka, Tamil Nadu and Uttar Pradesh. Urban poverty is generally higher in Gujarat, Karnataka and Madhya Pradesh.

The main exception is Assam, where it is evident that income poverty shows stagnation in both rural and urban areas. In Orissa, there is very little decline in the second period, and Bihar now has the highest level of rural income poverty among all Indian states.

Table 4. *Pattern of poverty incidence in three time points in states in all India, rural and urban.*

States	Percentage of population below poverty line			Percentage of population below poverty line - Rural			Percentage of population below poverty line - Urban		
	1983-84	1993-94	1999-00	1983-84	1993-94	1999-00	1983-84	1993-94	1999-00
Andhra Pradesh	28.91	22.19	15.77	26.53	15.92	11.05	36.3	38.33	26.63
Assam	40.47	40.86	33.47	42.6	45.01	40.04	21.73	7.73	7.47
Bihar	62.22	54.96	36.09	64.37	58.21	44.3	47.33	34.5	32.91
Gujarat	32.79	24.21	14.07	29.8	22.18	13.17	39.14	27.89	15.59
Haryana	21.37	25.05	8.74	20.56	28.02	8.27	24.15	16.38	9.99
Karnataka	38.24	33.16	20.04	36.33	29.88	17.38	42.82	40.14	25.25
Kerala	40.42	25.43	12.72	39.03	25.76	9.38	45.68	24.55	20.27
Madhya Pradesh	49.78	42.52	37.43	48.9	40.64	37.06	53.06	48.38	38.44
Maharashtra	43.44	36.86	25.02	45.23	37.93	23.72	40.26	35.15	26.81
Orissa	65.29	48.56	47.15	67.53	49.72	48.01	49.15	41.64	42.83
Punjab	16.18	11.77	6.16	13.2	11.95	6.35	23.79	11.35	5.75
Rajasthan	34.46	27.41	15.28	33.5	26.46	13.74	37.94	30.49	19.85
Tamil Nadu	51.66	35.03	21.12	53.99	32.48	20.55	46.96	39.77	22.11
Uttar Pradesh	47.07	40.85	31.15	46.45	42.28	31.22	49.82	35.39	30.89
West Bengal	54.85	35.66	27.02	63.05	40.8	31.85	32.32	22.41	14.86

Source: National Human Development Report 2001

Decline in poverty incidence is different for different Indian states. In early nineties period, two southern states-Andhra Pradesh, Tamil Nadu, and three northern states - Haryana, Punjab, Uttar Pradesh experiences decline in poverty headcount. Other states show increase in proportion of population below poverty line. In late nineties and early millennium, all the major states experience decline in poverty headcount.

3.3. Pattern of Influence of SES Gradient on under-Nutrition within Clusters in Three Time Points

It is evident from table 5 that, children with lower living standard are more undernourished which is prominent even after controlling for other factors. Therefore poorer children of older age, sex being male, of higher birth order, smaller size, who was not started complementary feeding at 6th month of age, whose mothers are illiterate or less educated, employed, have less contact with health services, belong to backward class and live in rural area are more undernourished. Over time, marginal impact of medium and higher SLI compared to lower SLI shows an increase may be due to similar pattern of changes with respect to child's age, number of children, child's complementary feeding practice, mother's employment, gender and social position. But spatial inequity, inequity with respect to mother's education and health seeking shows decline for stunting prevalence. Pattern of marginal impact shows linear change for children of medium SLI, backward social group or exclusively breastfed children. Non-linear movement is visible for children belonging to higher SLI, different age group, male children, smaller size children, complementary feeding practice, mother's education, employment status, contact with health service and location of residence.

Therefore the null hypothesis is rejected and it is evident that over the decades SES gradient is prominent even after controlling for other proximate and underlying determinants of under-nutrition of children under the age of five. However, it is also true that marginal changes in SES gradient took place through the pathway of in those poverty syndrome factors.

Table 5. *Random intercept model with PSU and household level variation in mean z score showing economic gradient in three time points (Only the full models are shown).*

	NFHS I	NFHS II	NFHS III
Low Standard of Living (Ref.)			
Medium Standard of Living	0.063*	0.060**	0.116***
High Standard of living	0.320***	0.307***	0.401***
0-5 months (Ref.)			
6-11 months	-0.556***	-0.476***	-0.522***
12-23 months	-1.236***	-1.355***	-1.425***
24-35 months	-1.648***	-1.703***	-1.502***
Male child (Ref.)			
Sex of the child (Female)	0.174***	0.061**	0.114***
1st Birth Order (Ref.)			
2nd Birth Order	0.009	-0.031	-0.044
3rd and more	-0.075**	-0.094***	-0.094***
Size of the child - Large (Ref.)			
Average	-0.313***	-0.238***	-0.067**
Small	-0.517***	-0.541***	-0.341***
Not Exclusively breastfed children (0-5 months) (Ref.)			
Exclusively breastfed children (0-5 months)	-0.016	0.146**	0.186**
Children not introduced complementary feeding at 6th month (Ref.)			
Children with any complementary feeding at 6th month	-0.037	-0.005	0.279***
Respondent is illiterate (Ref.)			
Educated up to Primary	0.150***	0.194***	0.082**
Educated up to Secondary	0.353***	0.400***	0.252***
Has higher education	0.589***	0.652***	0.621***
Respondent is unemployed (Ref.)			
Respondent is employed	-0.043	0.011	-0.110***
Child delivered at home (Ref.)			
Child delivered at institution	0.212***	0.278***	0.200***
Child belong to minorities (Ref.)			
Hindu	0.021	-0.004	0.038
General (Ref.)			
Backward caste	-0.014	-0.110***	-0.147***
Lives in urban area (Ref.)			
Lives in rural area	0.008	-0.174***	-0.035
Intercept	-1.137***	-0.871	-1.092
Number of observations	14216	17094	16366
Wald chi2	2395.470	4293.570	3308.03
P>chi2	0.0000	0.0000	0.0000
Log likelihood	-27375.971	-32249.414	-30651.795

Significance level: * p<.1; ** p<.05; *** p<.01

3.4. Variance Components i.e. Pattern of Influence of SES Gradient between Clusters

Table 6 represents variance components results. In almost all the major states, heterogeneity among children controlling for child, mother and household characteristics are more between households rather than between two communities since community level variation is lower than household level variations. However, controlling for child, maternal, household and community characteristics, the higher household level variation reconfirms that a child from richer family possesses different nutritional status than a child from a poor household which has increased over time from 1992-93 to 2005-06. However maximum household level heterogeneity in socioeconomic impact on stunting is visible in MPHI states even after controlling child, mother and household level characteristics.

Table 6. *Percentage variance contribution of community and household level in total variance in four models in 1992-93, 1998-99 and 2005-06 in India and HPHI, HPMI, HPLI and MPHI states in 2005-06.*

% contribution of two levels in total variance		Model Null	Model Kid	Model Mother	Model Household
NFHS I	PSU	0.65	0.50	0.48	0.48
	Household	0.35	0.50	0.52	0.52
NFHS II	PSU	0.11	0.07	0.07	0.08
	Household	0.89	0.93	0.93	0.92
NFHS III	PSU	0.31	0.20	0.17	0.18
	Household	0.69	0.80	0.83	0.82
HPHI	PSU	0.39	0.30	0.35	0.34
	Household	0.61	0.70	0.65	0.66
HPMI	PSU	0.25	0.22	0.18	0.18
	Household	0.75	0.78	0.82	0.82
HPLI	PSU	0.39	0.2	0.19	0.21
	Household	0.61	0.8	0.81	0.79
MPHI	PSU	0.10	0.07	0.06	0.06
	Household	0.90	0.93	0.94	0.94

3.5. West Bengal Scenario

Among different state groups, Medium Prevalent High Inequity (MPHI) states show higher intra-household heterogeneity that contributes to inequity in under-nutrition. Among different MPHI states, West Bengal shows higher spatial difference in inequity as well as over time the contribution of SLI and spatial characteristics have increased in this state and intra-household heterogeneity has increased the most from 1999 to 2006.

Table 7. *Decomposition of CI values for India and West Bengal for major factors in the second and third time point.*

	Socioeconomic status		Mother's education		Health service uptake		Location - Rural -urban	
	NFHS2	NFHS3	NFHS2	NFHS3	NFHS2	NFHS3	NFHS2	NFHS3
India	0.32	0.49	0.39	0.28	0.13	0.14	0.14	-0.00
West Bengal – MPHI	0.21	0.68	0.38	0.08	0.07	0.16	-1.34	0.03

Table 8. *Comparison of household level contribution to the total variance influencing the stunting level in West Bengal.*

	NFHS2	NFHS3
West Bengal - MPHI	0.60	0.67

In West Bengal as a whole, it is evident that stunting prevalence is higher among children belonging to lower standard of living and among them who are older, smaller at birth, who are not exclusively breastfed, whose mothers are illiterate. In urban and rural counterparts also the children with same attribute are more stunted. The only difference is

that intra-household heterogeneity measured by variance contribution of household level is much higher in urban area compared to rural are (Figure 2).

Table 9. *Random intercept model with PSU and household level variation in mean z score showing economic gradient in three time points (Only the full models are shown) for West Bengal as a whole, Urban and Rural.*

	West Bengal	West Bengal Urban	West Bengal Rural
Medium Standard of Living	0.14	0.42	0.04
High Standard of living	0.75***	0.83**	0.71***
6-11 months	-0.21	0.23	-0.38
12-23 months	-0.80***	-0.76**	-0.82***
24-35 months	-0.82***	-0.24	-1.06***
Sex of the child (Female)	0.05	-0.05	0.12
2nd Birth Order	0.07	-0.04	0.16
3rd and more	-0.20	-0.61***	0.05
Average	-0.02	0.15	-0.09
Small	-0.35***	-0.39*	-0.34**
Exclusively breastfed children (0-5 months)	0.55*	1.30**	0.36
Children with any complementary feeding at 6th month	0.04	0.29	0.02
Educated up to Primary	-0.11	-0.47*	0.05
Educated up to Secondary	0.00	-0.07	0.03
Has higher education	0.74**	0.61	0.03
Respondent is employed	-0.09	0.11	-0.15
Child delivered at institution	0.16	0.16	0.19
Hindu	-0.05	-0.12	0.01
Backward caste	0.14	0.10	0.16
Lives in rural area	-0.08		
Intercept	-1.15***	-1.50*	-1.31***
Statistics			
N	902	351	551
Chi2	190.66	101.92	88.64
Prob>chi2	0.0000	0.0000	0.0000

Significance level: * p<.1; ** p<.05; *** p<.01

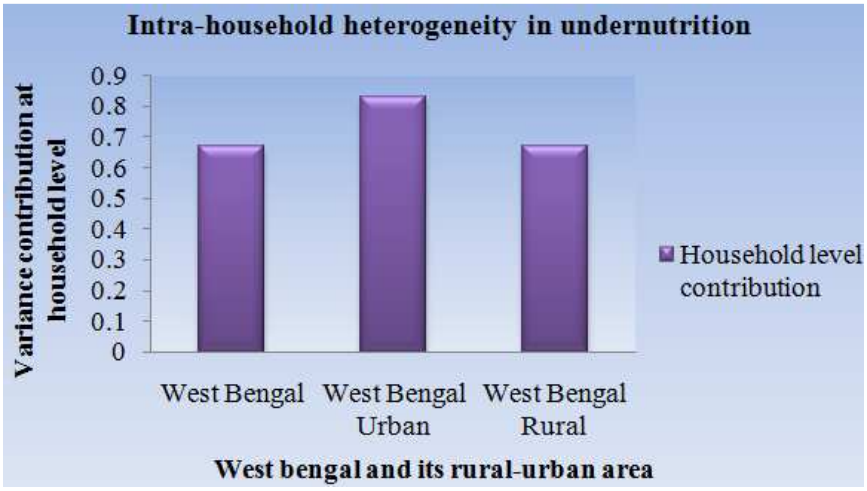


Figure 2. *Intra-household heterogeneity in under-nutrition in West Bengal in 2005-06.*

4. Discussion

This paper tries to see whether the SES gradient exists in India over one and half decades and the present situation in a high inequity state. The results of the paper show significant increase in inequity in nutritional status among children under the age of three in few major Indian states in this period whereas the change in prevalence are not significant. Decline in stunting prevalence is higher in richer families implying widening of inequity among poor and rich. It shows a non-linear pattern of change in household level heterogeneity related to SES gradient with steep increase in strength in first five years and then a little arrest in next five years though the degree of strength is much higher in 2005-06 compared to 1992-93. Household level inequity is highest in MPHI states compared to other state groups.

Inequity related to child's age, sex, number of children in a family, size of the child at birth as a proxy of birth weight, introduction of complementary feeding in timely manner, and mother's care giving knowledge, attitudes and practices are common in major states as determinants of stunting. Inequity in relation to mother's employment status is one significant

influencing factor in HPMI (Gujarat, Andhra Pradesh, Karnataka, and Tamil Nadu) and HPLI states (Uttar Pradesh, Madhya Pradesh, Rajasthan, Bihar and Assam). In the above major states and MPHI states (Punjab, Haryana, West Bengal, Maharashtra, and Kerala) contact with health service is significantly influencing the nutritional status of children. One study confirms that if mother's contact with health service is better, then there is probability of reduction in stunting in HPMI and HPLI states (Brennan *et al*. 2004). These results will be explained in detail in the light of different earlier works on developing countries in general and India in particular.

Incorporation of child's characteristics, mother's characteristics reduces the impact of socioeconomic status. Thus SLI works through these factors. Therefore where the reason is age or mother's education, basically, illiterate mothers belong to poor families and thus it is SLI which is the main influencing factor as found in previous work (Kanjilal *et al*. 2010). As for example, in Orissa mother's education is a strong confounder so health seeking is not visibly significant here (Kesterton *et al*. 2010). In Orissa near about 60 percent children are delivered at home according to NFHS III (IIPS 2007). Thus mothers' less utilization of health facility may be one cause of poor childcare as evident in other developing countries (Sakisaka *et al*. 2010). Another point is weaning period children are more undernourished significantly in 2005-06. Complementary feeding practice is significant in 2005-06 in HPMI and HPLI states and controlling it reduces the direct marginal impact of socioeconomic status as poor children of weaning period do late and/or improper start of semi-solid or solid food (Padmadas *et al*. 2002, Anoop *et al*. 2004). Thus socioeconomic factor is the main player here which works through child's age, feeding practice and mother's education which is also in line with other previous studies (Hong *et al*. 2006, Svedberg 2008).

In West Bengal, household's social status is a significant influencing factor. Here, social inequity is confounding the impact of economic inequity. In West Bengal, not only poor population of general community is stunted but significant percentage of backward caste child population living in different pockets is also undernourished (Maiti *et al.* 2012).

Major findings related to West Bengal are, household level heterogeneity in relation to socioeconomic gradient of stunting is highest even after controlling for several child, mother and household factor related inequity. Economic and social status of household are strong influencing factors contributing to inequity as poor and tribal people seek less care from qualified provider governed by their traditional culture, resource scarce environment and livelihood insecurity visible among tribal population (ibid.). Another point deserves mention that urban children are more undernourished than rural children in the model which requires further research on intra-urban disparity in West Bengal.

Thus it is clear that observing the importance of access barriers to healthcare seeking related health interventions have improved mother's knowledge and health seeking but the trickle-down effect is low or though the policies have been pro-poor, execution is ineffective due to poor monitoring. If we look back to history of health interventions to reduce inequity in health - propelled by several structural inequities after globalization and structural adjustment programmes, such interventions remain insufficient and less successful (Gopalan *et al*. 2011). But from this study it is clear that policies on health equity, which follows a holistic approach to achieve inclusive growth (growth along with socioeconomic development) and expected to accelerate the pace to achieve Millennium Development Goals is not either properly designed or implemented as also reviewed in other previous study (ibid.).

Therefore whether policy process in India has followed equity approach to bring integrated health sector reform following Alma Ata Declaration to United Nations Millennium declaration is needed to be explored more. To investigate the same, several previous research works and policy documents studied the policy determinatives with whole health policy process (Walt *et al*. 2008, Gopalan *et al*. 2011). The literatures concentrated on looking at how far social determinants of health are included comprehensively, whether participatory policy processes are included or not, if included then to what extent, how far evidences on health inequity among vulnerable groups are generated and used, how much the policy was oriented to bring equitable, timely, acceptable and affordable healthcare services for vulnerable groups (ibid.). But such analysis is required at more micro level with special focus on poor and marginalized population.

It is clear from my study that vulnerable population in terms of social status (backward caste), economic status (poor children) and location of residence (rural area) are not targeted properly using health equity lens as found in few earlier works on India and other developing country context (Mahal *et al*. 2001; Steinhardt *et al*. 2009; Sinha *et al*. 2009). Though under such approach, health seeking behaviour and awareness about childcare is targeted to some extent, still the poor children are in worse situation due to several poverty syndrome factors – poor living environment, less health seeking, lack of knowledge, traditional culture and higher opportunity cost like other developing countries as well as results from studies on India (Smith & Haddad 2000, Svedberg 2000, 2006, 2008, Larrea & Freire 2002, Zere & McIntyre 2003, Deolalikar 2004, Navaneetham & Jose 2005, Hong & Mishra 2006, Hong *et al*. 2006, Fotso 2006, Pongou *et al*. 2006, Poel *et al*. 2008, Taguri *et al*. 2008, Kanjilal *et al*. 2010). Thus poverty syndrome is a major hindrance to achieve health equity (Peters *et al*. 2008, Steinhardt *et al*. 2009). Therefore, the fundamental remedy is optimal allocation of physical, financial, and managerial resources to ensure universal coverage with effective child-centric service delivery, strong monitoring and periodic evaluation through effective governance (Braveman 2006, Gopalan *et al*. 2011).

One intervention can be use of health information technology to improve the monitoring of the Government at all levels – from grassroot frontline workers to central ministry. This can improve the service delivery through increasing the efficacy of governance with respect to

nutrition service delivery system in India. Integrated Child Development Service in India is not successful to eradicate inequity in nutritional status even it is pro-poor and pro-marginalised. One major reason is, data collected at ground level by anganwadi workers in ICDS centers do not reach at central level where policy decisions are taken care of. Because at each level of hierarchy, data is aggregated for the next level official and gradually the individual level information remain hidden in aggregated averages. If through the help of information technology, the ground level individual specific data can be entered into a system which will be visible up to central level then it will be easy for policy makers to build strategies depending on the ground level situation. They can easily decide on which pocket needs special attention with what specific intervention like which state pocket needs more awareness generating counseling sessions, which one needs more supply of food and / or medicines, more human resource etc. Therefore through e-governance method the inclusive growth can be accelerated.

The overarching requirement is integration of all the major departments like agriculture, public health, nutrition, water and sanitation to provide handholding support to each other and identify area specific micro level needs through research and evaluation for taking further steps.

5. Conclusion

Thus it is evident from the above findings that multifaceted poverty is responsible for inequity in health seeking, differences in mother's knowledge, and practice regarding childcare. Such differential characteristics vary mostly between poor and rich households within communities. It is also evident that increased childcare with timely following of child feeding and universal health coverage for poor and backward social groups with proper family planning and maternal care will help to reduce the prevalence. First thousand days of life should be priority for policy makers. So bottom up strategies in policy development is to be strengthened through e-governance techniques and institutional integration to ensure universal access to public goods and services. A common platform to approach health equity is to be built up to integrate departments, programmes, civil society organizations, researchers and ultimately vulnerable communities to accelerate the pace of inclusive growth and development.

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