

Child Undernutrition in India - An Inter-State Analysis

SYNOPSIS

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BASUDHA MUKHOPADHYAY

Department of Economics
Jadavpur University
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Background and Motivation -

One of the continued concerns in the development discourses of the present times is the coexistence of affluences with deprivations. There are several dimensions of such asymmetries and one such dimension is the coexistence of nutritional deprivation or undernutrition with the success in development seen through growth, prosperity, technological and social progress etc. in many parts of the world. While there are debates with respect to the appropriateness or otherwise of the choice of indicators of undernutrition in a developing economy, and those of development outcomes, the coexistence of such deprivations with affluences on a large scale, tends to question the relevance and authenticity of the process of economic development in the global economy. This is however, not to deny that the incidence of undernutrition has diminished over time and space, but like the incidence of child labour in different part of the globe, the prevalence of undernutrition poses serious questions on the functioning of developing economies. In particular, the question often asked is why even food surplus developing economies fail to steer clear the deficiency of food intake in the aggregate that undernutrition usually connotes. Is it a problem of distribution or of entitlement failure or something else? Also related is to identify the cluster or the group for which the incidence of undernutrition shows high or significant proportion among the population in developing economies.

Malnutrition is defined as a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain natural bodily capacities such as growth, pregnancy, lactation, learning abilities, physical work as well as resisting and recovering from diseases (World Food Program, 2008). Malnutrition refers to both under-nutrition and over-nutrition (obesity/overweight). The phenomenon of malnutrition refers to ‘an abnormal physiological condition caused by inadequate, excessive or imbalanced intake in

macronutrients: carbohydrates, protein, fats- and micronutrients’, whereas under-nutrition is condition where the body does not have adequate amounts of one or more nutrients and usually reflects as outcomes of the various anthropometric indicators of human body. For the purposes of the present dissertation, we focus on the problem of under-nutrition.

Children are that group of population who are at greatest nutritional risk. Both the rate of morbidity and mortality of children are affected by undernutrition. This is because children are incapable to cope with nutritional deficiencies than adults (Senauer and Gracia, 1991). Researchers and development planners across the world are of the opinion that nutrition is the cornerstone of socio-economic development of the country. To quote UNICEF(2007), Nutrition “is something that can drive economic growth, because children who are well nourished have been shown to have much higher income potential as adults” .

Major Issues

The India Health Report (2015) says that though India has shown significant improvements in agricultural productivity, household income and child survival, yet the rates of child under-nutrition is among the highest in the world.

According to the state-wide data on undernutrition presented by the Indian Council of Medical Research (ICMR), Public Health Foundation of India (PHFI) and National Institute of Nutrition (NIN), in 2017, undernutrition is the predominant risk factor for death in children younger than five in every state of India, accounting for 68.2 per cent of the total under-5 deaths, translating into 706,000 deaths (due to malnutrition).

The prevalence of child stunting in India in 2017 was 39.3 per cent, child wasting 15.7 per cent, child underweight 32.7 per cent, anaemia in children 59.7 per cent, anaemia in women 15–49 years of age 54.4 per cent, exclusive breastfeeding 53.3 per cent and overweight child 11.5 per cent. According to the findings, if the trends estimated up to 2017 for the indicators in the National Nutrition Mission 2022 continue in India, there would be 9.6 per cent excess prevalence for stunting, 4.8 per cent for child underweight, 11.7 per cent for anaemia in children, and 13.8 per cent for anaemia in women relative to the 2022 targets.

The NITI Aayog has released the National Nutrition strategy in September, 2017 which aims to reduce all forms of under-nutrition by 2030 as enumerated in the Sustainable development goals. It will enable a decentralized approach to promote greater flexibility in decision making at the state, district and national levels.

The present dissertation is titled ‘Child Undernutrition in India –An Interstate Analysis’. It tries to provide various informations related to child undernutrition in the context of India and its major states. The incidence of under-nutrition among under five children is high and there exist considerable interstate variations in nutrition and health related variables. Some of these variable are directly related to diversity of nutritional intakes, food habits, climatic factors, social and cultural factors as well as macroeconomic variables like per capita income, annual growth rate of NSDP, and a host of household, social and contextual factors and health care practices across the states in India. One needs to understand the connection between such state level indicators and variables reflecting nutritional outcomes and the processes involved. Therefore, the study is placed in the context of development of the Indian economy, and tries to obtain directions for fresh policy interventions to achieve the target of lower incidence of undernutrition among children in different states of our country.

To highlight the major departures of the present dissertation from the earlier studies, it is important to note, firstly, that the present dissertation attempts to place the problem of child undernutrition in the context of development of the Indian economy and explain inter-state diversity in the pattern of child undernutrition in the Indian states.

Secondly, this dissertation recognises the fact that need for appropriate combinations of socio-demographic factors with health care practices, maternal resources for childcare and household resources, supported by community and government, the potential risks associated with high under-nutritional outcomes of children and mothers, in analysing the factors underlying child undernutrition among the Indian states.

Thirdly, this dissertation is an attempt to use large unit level comparable data from NFHS 3 and NFHS 4 in identification of determinants of child undernutrition in Indian states, role of dietary diversity and mothers' health conditions and many of the behavioral results estimated would constitute an advancement from the existing literature and so on.

Finally, the dissertation makes an attempt to link the state level macroeconomic indicators like economic growth or GDP with the nutritional deprivation of children using panel data econometrics and this constitute a departure from the literature on existing studies.

It is expected that the present study shall fill up the void in the existing literature by combining economic and demographic factors with health care practices, maternal resources for childcare and household resources, supported by community and government, the potential risks associated with high under-nutritional outcomes of children, and so on. It must be understood that the design, implementation and monitoring of effective health promotion interventions depend on the availability of high quality public health surveillance data to illuminate the epidemiological situation and help trace trends over time in health, risk factors and protective factors. In this regard, there remain vital knowledge gaps about child health in India that must be filled. Among these gaps, the trends of child health in various states in India and within social segments in the country are yet to be explored. This is important to help guide better national and local health promotion policy-making and practice. Further, while home care is understood to be of vital importance to child health, too little is yet known about how childcare practices influence (are associated with) child health.

The objectives of the present dissertation are the following:

- 1) To understand the extent of inter-state differences in child undernutrition for selected states in India.
- 2) To examine the position of different states in comparison to the nation as a whole with regard to various child undernutrition parameters.
- 3) To study the interplay of various socio-demographic variables and the status of child undernutrition in India using controls at individual, maternal, household and community characteristics.

- 4) To understand the position of different states of India with respect to its under-nutrition status on the basis of the determinants of Minimum Acceptable Diet.
- 5) To explore the relationships of Minimum acceptable diet to childhood under-nutrition parameters for different states in India, when control variables related to maternal, child and household characteristics are accounted for.
- 6) To examine the link between economic growth and nutritional outcomes of the few selected states in India.

We address the first two questions on the extent of inter-state differences in different parameters towards child undernutrition and the associated position of individual states in comparison to the nation as a whole, in Chapter IV.

The third question on the interplay of various socio-demographic variables with the status of different child undernutrition parameters has been dealt with in Chapter V.

The fourth and the fifth question on the position of different states of India with respect to the determinants of Minimum Acceptable Diet and its association with child undernutrition parameters is undertaken in Chapter VI.

The sixth objective on the link between economic growth and nutritional outcomes in selected states in India has been briefed in Chapter VII.

Data Source and Methodology

The main source of data used in the present dissertation to estimate the extent of child undernutrition in Indian states is the National Family Health Survey (NFHS), 1,2,3,4 conducted at intervals. These are health surveys conducted by the International Institute for Population Studies (IIPS), Mumbai, under the guidance of the Ministry of Health and Family Welfare (MoHFW), Government of India.

Since the surveys have grown in size and scope over successive rounds, it is important to locate comparable survey data when making overtime comparisons, so we find it reasonable

to focus on NFHS-3 AND NFHS-4 for temporal comparisons among Indian states. The study is based on data from both the published reports and data extracted from the unit-level raw data sets.

The thesis used three standard indicators of physical growth. These three indicators are expressed as standard deviation units (z-scores) from the median of the International reference population (WHO 2006).

The three indicators are:

Height-for-age or Stunting: It is an indicator of chronic undernutrition, as it allows information regarding linear growth retardation of children. Children with the height-for-age z-score < -2 SD (Standard Deviation) from the median of the International reference population are regarded as short for their age (Stunted). Children are stunted when they are deprived of receiving adequate nutrients over a long period of time. Stunting is also an effect of chronic or repeated illness, and is not affected by improper recent dietary intake.

Weight-for-height (Wasting): It is an indicator of acute malnutrition. It occurs when the child is unable to receive inadequate nutrition during the time period immediately preceding the survey. Wasting is also an effect of recent episode of illness experienced by the child. If weight-for-height z-score < -2 SD from the median of the International Reference population, a child is said to be thin for his/her height or wasted.

Weight-for-age(Underweight): It is a composite indicator of chronic as well as acute undernutrition which takes into consideration both height-for-age as well as weight-for-height. Children with z-score < -2 SD from the median of the reference population are classified as underweight with respect to the International WHO Reference Population.

Methodology

This thesis is an empirical study on Child Undernutrition in different states in India using mathematical and statistical tools. Here, we have outlined the main data base and different mathematical and statistical methods used in the present dissertation. The discussions have

been guided by the objectives of the dissertation and the context in which these methods have been used.

In order to understand the extent of inter-state differences in child undernutrition for selected states in India, in chapter 4 the z-score is calculated. We then calculated, UN, defined as the percentage of children under five years of age who are stunted, wasted and underweight in NFHS-3 and NFHS 4 in order to examine the position of different states in comparison to the nation as a whole with regard to various child undernutrition parameters. Here, we calculated the relative measure $RUN_{STATE} = 100 * (UN_{STATE} / UN_{NATION})$. The state relatives RUN is the degree of undernourishment among children in the state compared to the national average between the two rounds of NFHS Surveys (NFHS-3 and NFHS-4). Again, there is a growing literature that there is a possibility of overlapping between the three child undernutrition indicators. Hence, following Svedberg's method, the Composite Index of Anthropometric Indicators are also calculated for all the states and thereafter ranked.

As child undernutrition is internationally recognized as an important public health indicator for monitoring nutritional status and health in populations, therefore the devastating results of undernutrition, as seen from the pattern of child undernutrition disparity among the states of our country, in different rounds of NFHSs calls for an identification of those states where more progress is required. This might give an insight for policy implementation working for the betterment of child health situation in our country. Here, the percentage of different conventional parameters of undernutrition is taken from the four rounds of NFHS published reports, in order to maintain the parity across all the four rounds. Hence, in chapter 4, we also tried to pick out those states, which have progressed topmost and those which discharged an awful performance within and across the four rounds of NFHSs. Then we calculated the range between these states and also tried to understand whether there had been any decline in the range as well as national average across the various rounds of NFHSs for all the three conventional parameters of child undernutrition.

Next, to study the interplay of various socio-demographic variables and the status of child undernutrition in India we used controls at individual, maternal, household and community

characteristics in Chapter 5. We tested variance component or random intercept model where we introduced the model covariates in various stages. The usefulness of the variance component model is that it corrects the problem of correlated observations in the cluster, by introducing random effect at each cluster. We then assessed the Intra-Class correlation (ICC), to test whether the variances of the random part of the model are different from zero over the two clusters, households and communities.

In chapter 6, an analytical method is used for exploring the relationship between Minimum Acceptable Diet and child under-nutritional parameters controlling for other covariates. For that we calculated, percentage of children fed with breastmilk, milk or milk products, percentage of children receiving minimum dietary diversity, percentage of children receiving Minimum Meal frequency and lastly percentage of children fed with Minimum Acceptable Diet. These values are calculated for height-for-age, weight-for-height and weight-for-age and the various determinants of complementary feeding practices, for NFHS-3 and NFHS-4.

In order to understand the impact of minimum acceptable diet on child undernutrition we considered the agro-climatic regions separately for NFHS-3 and NFHS-4 respectively, following the recommendations of The Indian Council of Agricultural Research (ICAR.). We then used multilevel logistic regression model.

In chapter 7, we have used state level variables like per capita NSDP (economic growth), female literacy and mother's anaemia and their impact on state-level child undernutrition of few selected states in India. We have used per capita net state domestic product, as a measure of a state's economic development. These data are obtained from Reserve Bank of India, for the years 1998, 2005 and 2014 and measured in 2005 base prices.

In this chapter we considered panel data regression, using the following regression equation We used both the Fixed and Random Effect Model, followed by Hausman Test to check the existence of any inconsistency in the estimation of regression coefficients.

Outline of the Chapters and Empirical Findings

The dissertation has been organized into the following eight chapters, and we present below the major findings for each chapter.

Chapter 1: Introduction

This chapter gives the background and motivation behind taking up this research-topic and briefly introduces the objectives, key research issues, likely contribution of the study and the limitations of the study.

Chapter 2: Methodology

This chapter mainly discusses about the data sources and the mathematical and statistical tools used to support the study.

Chapter 3: Survey of Literature

This chapter sets forth a comprehensive survey of literature on child undernutrition and its various associated problems. It discusses the major studies carried out by researchers in different parts of the world and in India. The chapter also highlights how the present study can add to the existing knowledge on child undernutrition problem in India and its states.

Chapter 4: Patterns of Child Under-Nutrition in Indian States

In this chapter we tried to understand whether India made any progress in reducing under-nutrition among under five children in the last two decades. Since the different states of India are at different levels of economic and social development, we felt that it would be of considerable interest to carry out a detailed analysis of inter-state differences in child under-nutrition in India. An attempt has been made in this chapter to understand the extent of inter-state differences in child under-nutrition.

The chapter begins with the portray of the nutritional status of under five children in Indian states as are revealed through NFHS 1 and NFHS 2 Surveys, with ranking of the states. Quite obviously it was seen that some states have fared better than others in terms of the three indicators of child undernutrition. But in NFHS-1 Survey it was found that in certain states

only the weights were recorded, because the boards for measuring heights were not available. In NFHS-2, such deficiencies in scale were rectified, but the target sample group was under 3 years in some states and under 4 years in some other states. Therefore, we focussed on NFHS-3 and NFHS-4 for the purpose of comparing all the states in India because the data in these two rounds are strictly comparable in terms of statistical significance and correctness in the choice of the sample households. as mentioned earlier. In the first stage, we calculate the z-score of all the three We use the three anthropometric indicators of child under-nutrition indicators of undernutrition, namely, stunting, wasting and under weight, and then calculated UN, defined as the percentage of children under five years of age who are stunted, wasted and underweight in NFHS-3 and NFHS 4.

A comparison between the two NFHS report brings out a myriad picture of the position of different states of our country. It can be seen that the z-scores have improved for all the states of our country from NFHS 3 to NFHS 4. When we compare the positions of the states in the two NFHS it can be seen that some states have improved their position considerably from NFHS 3 to NFHS 4. In terms of change in z-scores over a period of ten years from NFHS 3 to NFHS 4, it can be observed that while some states have taken strides to improve their position, others have been lagging behind.

In order to have a better view of the extent of child under-nutrition over time we calculated the RUN. We observe that though certain states have recorded their improvement in reducing the prevalence on child undernutrition their contribution to the overall reduction of the country's child undernutrition problem is not that impressive.

We then used the compatible data from NFHS 3 and NFHS 4 for children of less than 5 years old to estimate the z-scores of CIAF- a combined measure suggested by Svedberg (2000) - for the 29 states of India to gauge the pattern of inter-state variations in under five child undernutrition. We found that overall the incidence of child undernutrition is higher through CIAF compared to three separate indicators in both NFHS 3 and NFHS 4.

As child undernutrition is internationally recognized as an important public health indicator for monitoring nutritional status and health in populations, therefore there is a need to identify those states where more progress is required. Here, the percentage of different conventional parameters of undernutrition is taken from the four rounds of NFHS published reports, in order to maintain the parity across all the four rounds. We calculated the range between the states and also tried to understand whether there had been any decline in the range as well as national average across the various rounds of NFHSs for all the three conventional parameters of child undernutrition. It was found that the HAZ and WAZ percentage has declined over time. The national percentage for these indicators, namely stunting and underweight have also shown certain percentage reduction. But the percentage of WHZ has remained stagnant not only over time, but also the national average. Hence, it could be concluded that India is yet to take the control of acute undernutrition problem of children under five years of age.

The natural question to ask is what causes or influences such huge asymmetry in child undernutrition in Indian states? We need to look beyond the indicators and search for the socio-demographic variables that possibly influence such huge magnitude as well as variations across the states in India. We undertake such tasks in chapter 5 below.

Chapter 5: Influence of Socio Demographic Factors on Child Undernutrition in India

It was observed in the previous chapter that there is a decline in the prevalence of undernutrition from NFHS 3 to NFHS 4 in India as a whole as also in certain states of the country. But this decline looks unimpressive when we into the wide inequality in child undernutrition status across the various states and also the socio-demographic groups. There are evidences in literature, which shows the extent and type of under nutrition differ sharply due to variation of socio-demographic factors, levels of literacy, climate, religion and cultural beliefs.

The social and demographic determinants of child undernutrition are the factors that characterize the environment which influences the lifelong development and health outcome

of a child. These determinants act at different levels of influence of child nutritional status and interact with one another.

The present chapter is an attempt to study the interplay of socio-demographic variables and the status of child undernutrition in India using controls for various traditional and accepted predictors of undernutrition at individual, maternal, household and community characteristics. The conceptual framework of the study is based on the econometric methodology of different forms for analyzing determinants of undernutrition operating at community, household, maternal and child level covariates.

In this chapter, we have considered rural- urban place of residence (RU) as an explanatory variable in the study. The other explanatory variables are child's age in months (CA), sex of the child (CS), birth order (CB), size of the child at birth (CSz), complete doses of immunization (CI) and recommended feeding practice denoted by exclusive breastfeeding for infants below six months of age (CBf). Apart from the child level covariates, we have also considered the mother level controls. These includes : education of mothers in terms of number of years of education (ME), mother's body mass index(MBmi) (BMI base = 18.5), mother's status of anemia(MAn), mother's availing Mother and Child Protection Card (MC), place of birth of the child (MIn), mother's decision making power in terms of autonomy for taking medical help(MAu).

The household level factors that are considered, except for rural-urban differences (RU), controls are included for ethnicity of the household(HEn), i.e., whether they belong to scheduled casters and scheduled tribe households, either the household has the piped water facility(HPw), and whether the household owns a house of its own(HOh). The last two factors are used as an indicator of the nature of asset the household has. Since the community characteristic is regarded a distant covariate of child undernutrition in the model, hence the percapita NSDP and different states are considered in each of the models as controls or as fixed effects of the multilevel model. Initially, the z-score is calculated and then we have considered the regression equation.

It is important to note that the household level observations are not always independent, as children belonging to a particular household often share common characteristics in the process of their growth. It is also seen that children from the households in the rural areas of all the states in our country have higher prevalence of worst nutritional status. That suggests that children belonging to households in the urban areas show better nutritional status. These findings are supportive of the earlier studies based on NFHS data. Such association is consistent across the different variance component models applied in this study. This reaffirms the fact that better nutritional status is enjoyed by the children living in urban parts of the country having favorable socio-demographic background. This also emphasizes that the differences in the availability of resources to the families in urban and rural parts of the country act as an important determinant to child undernutrition. Hence, we can infer that the prevailing socio-demographic status is an important determinant of the level of nutritional achievement among children of our country. If we look forward to the betterment of such socio-demographic condition, then it is expected to improve nutritional growth of the children through better nutritional intake.

Among the states, Haryana, Punjab, Himachal Pradesh, Chattisgarh and Odisha show a positive association with the nutrition score. It can be also observed that states of Uttarkhand, Madhya Pradesh, Bihar, Uttar Pradesh, Arunachal Pradesh, Mizoram and Gujarat negatively impact the nutritional score for children in our country. The results of OLS are also more or less consistent with the results of the other models where the covariates are introduced in phased manner.

Chapter 6: Dietary Pattern and Child Undernutrition in India

For the sake of child's optimal growth, health and development, adequate nutrition from the period in the mother's womb to two years of age is essential. There is a universal consensus on the importance of breastfeeding and complementary feeding as an important determinant of child nutrition. The upsurge in the recognition of minimum acceptable diet as an important element in healthy nutrition calls for more research in this area. Minimum acceptable diet is anticipated to contribute to good child health of a child. But, for many children from poorer households this minimum is not achieved.

Most of the existing studies have estimated the association of food consumption pattern and child undernutrition. The present study in Chapter VI differs from earlier studies as it takes into consideration the association between Minimum acceptable diet and child undernutrition controlling for other covariates at different levels.

It was found that the Minimum acceptable Diet is influenced by many factors such as agro-climatic conditions, and other possible socio-demographic factors. Selected socio-demographic indicators are included in the analysis.

The percentages of the parameters of complementary feeding practices were first obtained for the different states. The parameters includes, percentage of children fed with breastmilk, milk or milk products, percentage of children receiving minimum dietary diversity, percentage of children receiving Minimum Meal frequency and lastly percentage of children fed with Minimum Acceptable Diet.

It has been observed that the percentage of children receiving minimum acceptable diet is quite unappealing as this percentage varies by very less amount between states with different percentages of undernutrition parameters. India lags behind other countries in the world in maintaining the standards of Minimum acceptable diet for children.

Multilevel logistic regression analysis was also performed with individuals and households within the community, and community within the states. The agro-climatic regions are classified separately for NFHS-3 and NFHS-4. The analysis is presented in five models.

It was found that compared with the West Coast Plain, other agro-climatic regions had higher risk of child stunting and underweight. It was found that Upper Gangetic Plain and Western Dry Region showed more prevalence of undernutrition. This is because the state of Uttar Pradesh and Rajasthan are the states where there is more concentration of people living below the poverty line. The economic condition of the household may be a crucial factor for determining Minimum Acceptable Diet. This is because high-income households may have followed all the nutrient requirements for Minimum Acceptable Diet while the poor spending

mostly on basic requirements. It was found that after the introduction of household level factors the agro-climatic regions lost their significance.

The multi level analysis found that Minimum Acceptable diet significantly affects the child undernutrition status. It was also observed that people living in rural areas have a higher prevalence of undernutrition as compared to their urban counterpart. This highlights the fact that as children in rural areas belong to lower socio-economic classes, they are more nutritionally deprived. Our study also suggests that that households with regular income have significantly associations with the reduction of child undernutrition parameters. Per capita Net State Domestic Product (NSDP) is also significantly associated with the reduction of the incidence of child undernutrition.

Chapter 7: Economic Growth and Child Undernutrition in India

In chapter 7, we have tried to examine the relationship between child undernutrition and economic growth with other selected macro-level variable. The aim of this chapter has been to study the inter-relationship between the indicators of child undernutrition in our country at the state level with the macroeconomic aggregates likes the per capita NSDP or the rate of growth the states' NSDP over time, controlling for important social factors like mothers' anaemia or their levels of education as measured by the mothers' literacy. We have used per capita net state domestic product, as a measure of a state's economic development. We used Panel Data regression analysis in this chapter.

From the analysis of this chapter it is clear that there is a negative relationship of Economic growth, measured by percentage change in per capita net state domestic product, with all the different child undernutrition parameters, namely, stunting, wasting, undernutrition and CIAF in the Fixed Effect Model. It is also observed in this model, that there is also a negative association of female literacy with the mentioned child undernutrition measures. That shows that as Economic Growth and state female literacy increases, the incidence of child undernutrition falls. But there are differences when we consider the relationship between mother's anaemia and child undernutrition variables. It can be observed that while, there is a positive association with stunting and CIAF, implying that as mother's anaemia level falls,

the rate of child stunting and CIAF at the state level, too, falls, there is practically no impact of mother's anaemia with child wasting and undernutrition parameters in case of Fixed Effect model.

Likewise, when we considered the Random Effect Model, the results that were observed are almost the same. This implies that Economic Growth and state Female literacy have a significant association and impact in the reduction of all the child undernutrition parameters in the different states of our country. But mother's anaemia has a positive relationship with stunting and CIAF, implies that children from anaemic mothers have a greater risk of being stunted and also the risk of composite anthropometric failure. This also implies that the long-term dietary pattern of mothers from their adolescence affects their childbearing phase of life, and which in turn increases the possibility of long term undernutrition of the child. However, it is also observed that mother's anaemia has no impact on state level child acute undernutrition and child underweight.

Now, when we consider only per capita NSDP in place of percentage change in per capita NSDP, it can be observed that per capita NSDP significantly affects the rate of child stunting, underweight and CIAF. But it is insignificant in case of wasting. The obvious implication that more educated mothers can significantly influence the overall health of her children. Here too, it can be seen that Mother's anaemia level at the state level has no impact on the health of the children of the state.

In all the cases, it can be observed that for the Fixed Effect Model, the Durbin-Watson statistic fell in the 'inconclusive zone' when compared with the theoretical Durwin-Watson values. On the other hand, in Random Effects Model, the problem of autocorrelation is absent, as the computed Durwin-Watson statistic is greater than theoretical Durwin-Watson values. Again, the Random Effects Model gets accepted on the basis of Hausman test as computed Chi-square (χ^2) value is statistically insignificant. Thus in all the cases we prefer the Random Effects Model in the context of panel data regression.

Chapter 8: Conclusion

The dissertation made a reasonable attempt to understand the inter-state variations in child undernutrition in India. Several observations emerge from the findings of the dissertation. The states which have fared better overtime from NFHS-3 to NFHS-4, are the states of Kerala. Tamil Nadu, Himachal Pradesh and Haryana. Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan, Jharkhand showed maximum percentage of stunted children in the country. The percentage of stunted children in Gujarat, Maharashtra and Assam is also high in both the NFHSs. There has been an increase in the prevalence of child wasting from NFHS 3 to NFHS 4 in the states of Maharashtra, Gujarat, Uttar Pradesh, Andhra Pradesh and Delhi. Jharkhand, Karnataka and Chhattisgarh also show a huge percentage of wasted children.

This final chapter concludes the dissertation by summarizing the major findings from four core chapters, trying to make a critical assessment of the empirical results and discussing the limitations of the study, few policy implications and scope for further research.
