"'Stuffed and Starved': Unraveling the Dual Burden Paradox of Childhood Obesity and Undernutrition in India"

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*Extended Abstract submitted for consideration to (1) **Section 309** (Overweight and Obesity in Children and Youth) and (2) **Section 301** (Family Resources and Child Health and Well-Being) of the annual meeting of the Population Association of America, Washington DC, March 31 – April 2, 2011.

ABSTRACT

Childhood obesity has dramatically increased during the past two decades and is a major health problem in both developed and developing countries. A key feature of nutrition and epidemiological transition in India, a population giant, is the existence of two extremes: underweight and overweight, also often called the "dual burden" of malnutrition, which can be found at both the population and household level. Using data from the 2005 India Human Development Survey (IDHS) and stepwise multilevel models that incorporate individual-, household-, and district-level determinants, this study will examine trends and individual-level as well as contextual determinants of the "dual burden" across various parts of India and their variation by gender, income, and region. Does the "dual burden" vary from locale to locale and hence, needs to be contextualized, or is it consistent across all settings? I conclude the paper by discussing data limitations, relevant policy issues, and future research.

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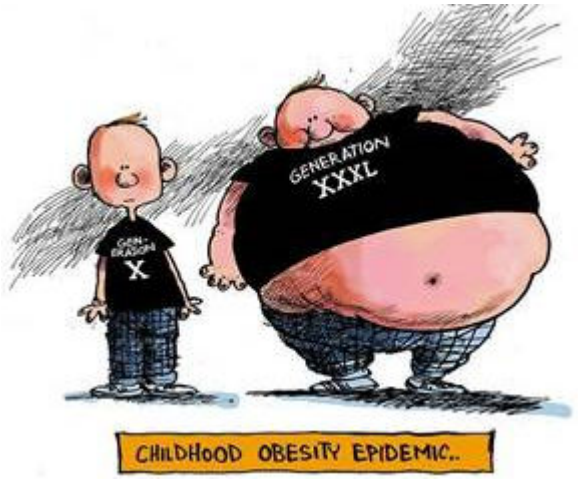
Introduction

Childhood obesity has dramatically increased during the past two decades and is a major health problem in both developed and developing countries (Khan, 2006; Popkin, 2001). While levels of physical activity have decreased and influential marketing strategies and mass media have shifted diets to include more fats and sugars, the globalization of food markets have also made available larger quantities of low-cost, high-calorie foods and the adoption of Western diets and lifestyles (Caballero, 2005). This is particularly the case in India, a population giant, which has experienced a nutrition and epidemiological transition as it prospers, urbanizes, transitions, and becomes an integral part of the global economy. A key feature of this transition is the existence of two extremes: underweight and overweight, also often called the "dual burden" of malnutrition, which can be found at both the population and household level (Popkin 2002). However, although childhood obesity is of concern to public health program and policy-makers, the issue has remained relatively unaddressed by the Indian government whose primary focus of research and spending is malnutrition that afflicts more than 47 percent of all children.



This paper will address an important gap in the demographic health literature by examining the prevalence and micro-macro factors of the "dual burden" among children in India. Such an analysis is especially relevant in light of the fact that both undernutrition and obesity are linked with a range of adverse health conditions. While the underweight are

susceptible to childhood growth problems and compromised mental development, obesity is associated with such diseases as hypertension, type-2 diabetes, certain forms of cancer, and metabolic syndrome. Importantly, child and adolescent obesity is a strong predictor of adult obesity, and the risk of obesity among children increases if even one of the parents is overweight or obese. Using data from the India Human Development Survey and stepwise multilevel models that incorporate individual-, household-, and district-level determinants, this study will address the following questions:

1. What are the trends in the dual burden—childhood undernutrition and obesity—across various parts of India? How do these trends vary by gender, income, and region?
2. What are some individual-level as well as contextual factors predictors of the dual burden of malnutrition?
3. Does the "dual burden" vary from locale to locale and hence, need to be contextualized, or is it consistent across all settings?

In subsequent sections, I will provide a brief overview of the Indian context, theoretical framework, hypotheses, data, and methodology. Based on their BMI, the dependent variable has five categories: obese, overweight, normal weight, underweight and severe underweight. Model 1 estimates the effect of district-level factors on child weight. In Model 2, various district-level controls are introduced to investigate if the relationship observed in Model 1 remains consistent and robust. Model 3 includes all the compositional (individual and household) as well as contextual levels to evaluate (1) the robustness of the contextual effect (by controlling for compositional factors), and (2) the extent to which compositional factors at the individual-level explain changes, if any, in the observed relationship. I then conclude the paper by discussing data limitations, relevant policy issues, and future research.

Data and Methodology

Analytical multilevel strategy

Until recently, higher neighborhood-, community-, or even district-level effects were not incorporated in studies pertaining to child obesity (Sastry, 1996; Desai & Alva, 1998). This could be due to problems in transporting these effects into individual-level models as well as choosing the appropriate units *and* levels of analysis (Raudenbusch & Bryk, 2002). However, even when such effects are included in single-level equations, the results can be misleading due to aggregation bias, misestimated standard errors, and heterogeneity of regression (Raudenbusch & Bryk, 2002). Hierarchical linear modeling (HLM), which permits simultaneous estimation of full micro-level and macro-level models, helps correct these methodological problems. By using maximum likelihood statistical estimation, it provides relevant tools for modeling *within* and *between* social phenomena, thus allowing for the direct representation of the influence of higher-level factors on structural relations within areas. Finally, HLM adjusts for correlation errors among individuals (or children, in this analysis) within the same geographical areas and uses the appropriate degrees of freedom for higher-level hypotheses, making it an ideal technique to answer the questions posed here.

Data

This analysis utilizes two levels of data at the individual and community level from the India Human Development Survey (IHDS) carried out by the University of Maryland, College Park, in conjunction with the National Council of Applied Economic Research (NCAER). It is a nationally representative, multi-topic survey of 41,554 households in 1503 villages and 971 urban neighborhoods across India with extensive household- as well as village-level information such as household possessions and living standards, education and past/current labor force participation, intra-household relationships, women's empowerment,

reproduction, maternal and child health, birth history, and other relevant demographic variables, several of which are used as controls in this study. The IDHS is particularly useful because it provides extensive anthropometric records on children born in the three years preceding the survey; one health investigator on each survey team carefully measured the height and weight of eligible women, children below 5, and children between the ages of 6 - 11. Overall, the dataset represents 99% of India's population residing in 26 states.

Dependent variables used in study

The dependent variable in the analysis is BMI-for-age z scores (BAZ) as standard deviations (SD) relative to the 2007 reference median created from the child weight, height, and age data. The following BAZ cut-offs are used to generate the following five categories:

- severe underweight (< -3 SD)
- underweight (< -2 SD)
- normal weight (-2 SD to + 1 SD)
- overweight (> +1 SD)
- obesity (> +2 SD)

Extreme BAZ values (< -5 SD and > +5 SD) are excluded as outliers. The analysis is restricted to children between the ages of 6-11 years.

Compositional individual-level variables

Several individual-level variables are included in the analysis. The child-level variables are as follows:

1. **Sex of child**: female, male (reference)
2. **Child's age**: a continuous measure in months
3. **Birth order of child**: one (reference), two, three, four or higher

4. **Diet Diversity**: 2-5 (reference), 6, 7, and 8-11 groups, measured as number of unique food groups (out of 111) the child had access to in the previous 30 days serves as a useful tool for measuring diet quality and the "access" dimension of food security.
5. **Meals per day:** categorized as 2-4 (reference group) and 5-7 times per day.
6. **In school or not**: categorized as 0 for no and 1 for yes. Children not in school may be involved in activities such as domestic chores, paid or unpaid work, looking after other children in the household and at leisure or play are included as physical activity.
7. **Child is BCG immunized**: coded as 0 for no, 1 for yes, used as a proxy measure for health services utilization.

Maternal and paternal variables include:

8. **Maternal age**: categorized as 24-30 (reference group), 31-35, 36-40 and ≥41 years.
9. **Maternal education**: categorized as none (reference group), primary, secondary, matriculation and higher.
10. **Paternal education**: categorized the same as maternal education.

Household-level variables include:

11. **Wealth index quintiles**: categorized into 5 groups with 1 being the poorest (reference group) and 5 the wealthiest. The index is a composite score of consumer durables, housing quality, and access to services and is considered to be a more accurate reflection of socio-economic status in developing countries.
12. **Exposure to mass media:** anyone reading newspapers, watching TV, or listening to radio
13. **Involvement in various network**: categorized as anyone in the household involved in 1-2 (reference group), 3-5, and 6-11 local organizations.
14. **Household size**: categorized as 1-4 (reference group), 5-6, and ≥7 people.

15. **Ethnic group of household**: categorized as Scheduled caste/Scheduled tribe (reference group), Backward caste, and Other caste.
16. **Religion**: Hindu (reference), Muslim, and Other

Structural-level explanatory variables

District-level or structural variables in the analysis include:

17. **Location**: coded as 1 for urban, 2 for rural.
18. **Access to health care services**: coded as 0 for no, 1 for yes. A potential drawback of this variable is the lack of information about the actual *quality* of these health centers and the facilities provided by them.
19. **Overall wealth index** serves as a proxy for the socioeconomic status of the district and averages the proportion of houses in the district with higher quality roofing, wall, and floor materials, toilets (flush/others), electricity, water (piped water/others), and clean cooking fuels. A quadratic transformation of wealth is also introduced in the analysis to test for nonlinearity.

Conclusion

The impending double burden of malnutrition and the emerging problem of child obesity must be addressed through extensive research and carefully targeted intervention programs. This paper is an important contribution and will help inform policymakers in transitional countries such as India to by identifying key indicators and risk groups.