Distribution of Malnutrition in India; Effects of Socio-Economic Characteristics and Economic Development on Being Underweight and Overweight

I. Introduction and Rationale

Malnutrition refers to undernutrition, overnutrition, and nutrient deficiency. The prevalence and distribution of malnutrition in a society have implications for public health outcomes and policy formulation. Body Mass Index (BMI), calculated as weight (kg)/height^2(m), provides an indication of nutritional status. In adults, the normal BMI range is 18.5 – 24.9. A BMI of less than 18.5 is considered as underweight, 25-29.9 is overweight, and 30 or above is classified as obese. Low BMI is an indicator of Chronic Energy Deficiency, which negatively affects physical work capacity, productivity, and maternal outcomes, and is associated with increased risk of morbidity and mortality (Shetty and James 1994). Overweight and obesity are risk factors for cardiovascular disease, type 2 diabetes, several cancers, and renal, hepatic and respiratory related mortality (Haslam and James, 2005, Whitlock et al., 2009)

In the past fifty years, there have been huge shifts in the global distribution of malnutrition. In high and middle income countries, food security is no longer a major concern, while the health and economic costs of overweight and obesity have risen alarmingly (World Health Organization and Food and Agricultural Organization 2003; Popkin and Gordon-Larsen 2004; Popkin 2009). However, in many low income countries, child and adult under-nutrition continue to be a major health concern, contributing to both morbidity and mortality (Gragnolati, Shekar et al. 2005; Subramanian and Smith 2006). At the same time, increasing urbanization, and changes in diet and lifestyle brought on by globalization and economic development are associated with rising overnutrition and associated chronic diseases (Caballero 2001; Miranda, Kinra et al. 2008). As per capita income increases, the burden of overweight starts shifting from high income towards low income groups. Apart from average income, the distribution of wealth appears to play a role in prevalence of malnutrition. In high income countries where obesity is a greater public health concern than undernutrition, income inequality is associated with greater prevalence of overweight and obesity (Pickett, Kelly et al. 2005). In low income countries, however, there has been limited analysis of the effects of income inequality on malnutrition.

This paper builds on existing understandings of under and overweight, examining representative national data from the third round of the National Family Health Survey 2005-6 (NFHS-3) to assess the correlates of under and overnutrition amongst adult women and men in India. In particular, the paper focuses on a range of indicators of economic inequality.

India is undergoing a process of rapid economic growth, urbanization, and demographic change which to a certain extent is being reflected in changes in nutritional status and the distribution of malnutrition (Griffiths and Bentley 2001; Shetty 2002; Vaz, Yusuf et al. 2005). While the prevalence of undernutrition in children and adults remains high (Gragnolati, Shekar et al. 2005; Subramanian and Smith 2006; Deaton and Dreze 2008), overweight and obesity have also risen rapidly in the past decade, from 11% of ever-married women in 1998-9 to 15% in 2005-6 (IIPS and Macro International 2007). Previous analyses of under and overweight in India using data from 1998-9 have found individual socioeconomic status to be an important predictor of BMI (Griffiths and Bentley 2001); at the same time, state-level economic development increases risk for overweight, while income inequality appears to increase the risk for both under and overweight (Subramanian, Kawachi et al. 2007).

II. Economic Inequality

The notion that the distribution of income in society, as measured by the variance of income or Gini coefficient, may have a relationship with health has been debated in the literature (Deaton 2003; Wilkinson 2005). The mechanisms by which inequality in income may affect individual health are potentially many; models of redistributive politics predict that if a myopic median voter is making choices in allocation of public goods in more unequal societies then the level of health care and education available to society at large well be more sub-optimal for people at the extremes of the income distribution the more unequal the initial distribution of income is (Alesina and Rodrik 1994; Persson and Tabellini 1994). It has also been argued that the quality of social relations (such as levels of trust and violence) are better in more egalitarian societies. Given that low social status and poor social relations are a strong determinant of poor health, less egalitarian societies are more likely to see poorer health (Subramanian and Kawachi 2004; Wilkinson 2005). Indeed, there is an empirically well documented negative relationship between income inequality and mortality (Wilkinson 1998).

To capture income inequality, we use state level Gini coefficients based on household expenditure calculated by the Planning Commission. Another measure of economic inequality is derived from the household's ownership of assets. We do this by exploiting the wealth index that is available with the NFHS dataset. The wealth index is constructed as a score variable created from doing a factor analysis on several asset ownership variables that are a part of the original survey instrument. While wealth and income are correlated, they capture different economic effects in that wealth is a stock variable representing the currently accumulated value of past income, while income is a flow variable capturing income flows in the last financial year. Denninger and Olinto (2000) were among the first to point out that while the theoretical

literature linking distributional concerns and economic growth were based on asset inequality, empirical tests of this prediction used only income inequality. When placing both income inequality and asset in their growth regressions, they found that asset inequality with regard to land (which is also a part of the construction of our wealth index) has a negative effect, while income inequality has a positive sign. In this paper, we are able to investigate the independent impact of income and wealth (asset) inequality on being under and overweight.

III. Data and Methods

NFHS - 3 is the third in a series of large, nationally representative sample surveys of households that has been designed to collect information on fertility, infant and child mortality, the practice of family planning, maternal and child health, reproductive health, nutrition, anemia, utilization and quality of health and family planning services. The first two surveys (1990-91 and 1998-99) collected detailed information on women in the 15-49 age group. The most recent survey additionally included men in 15-54 age group. NFHS -3 provides detailed individual, household and community level characteristics that provide height and weight information as well as a BMI variable that we use to create our key independent variables. These are two dichotomous variables: one for under nutrition (BMI < 18.5), and another for overnutrition, when BMI > 24.99. We restrict the sample in two ways to construct our analysis sample: 1) we only include men and women in the 19-49 age group. We excluded adolescents (18 and under), as it is not straightforward to classify over and underweight through BMI in this age group. We excluded men over 50, as we wanted to have men and women in the same age group in the analysis; and, 2) we exclude currently pregnant women and women who have been pregnant in the last three months as this affects their body composition. Thus, our analysis sample consists of 101,600 women and 62,013 men in the 19 to 49 age group.

We pair the individual-level data with macro-level variables including the state- level per capita income, state-level Gini coefficients, and the specific composition of the agricultural sector in state GSDP. For the asset inequality measures we use the NFHS data to construct two classes of inequality measures; the *wealth- quintile* inequality and the *neighborhood* inequality measures. The wealth-quintile inequality for a household is calculated as the standard deviation in wealth in the quintile where the household falls within the state. The *neighborhood* measure of wealth inequality is similar to the wealth quintile inequality except that instead of quintiles we measure inequality within different neighborhood aggregations (the state, rural-urban, and the primary sampling unit (PSU) from which the sample households were drawn). Similarly, for the State Urban-Rural measure we define the neighborhood to be the urban or rural area in the state that the

household is, and for the State PSU measure we define the neighborhood to be the primary sampling unit from which the household was drawn.

We use the logistic regression framework to examine the determinants of being under and overweight. In the overweight models, the dependent variable takes a value of 1 for BMI of greater than 25.3 and 0 otherwise. In the underweight models, a BMI of less than 18.5 is categorized as 1 and 0 for all other values.

IV. Preliminary Results

Our preliminary analysis suggests that economic inequality matters for both under and overweight, but the effects across the various measures of inequality are not similar. People living in states with higher income inequality, as captured by the Gini co-efficient, are more likely to be overweight. However, surprisingly, they are also less likely to be underweight – thus, income inequality seems to predict higher BMI for the whole population. However, when we look at our alternative wealth (asset) inequality measures, we find a negative relationship between inequality and the likelihood of being overweight *i.e.,* higher levels of wealth inequality reduce the likelihood of being overweight. Looking at the wealth quintile inequality measure we find that the effect is approximately 3.5 - 6% when it is significant. This result is robust even when we disaggregate by the rural-urban level of geographic wealth inequality as well as for the PSU level wealth inequality. Our findings are largely the same when we disaggregate by men and women. Similar to the overall models, household income and income inequality are both positive and significant. Wealth-quintile inequality has modest effects as compared to income inequality, though it is significant only for men.

Overall, women seem to have a small, but higher likelihood of being both over and underweight than men. A larger household size has a negative, but small effect on being overweight. This seems probable as it implies resource sharing within the household. Our models indicate that with increasing age, the likelihood of being overweight is linearly increasing in comparison to the reference group, 18-19 years of age. If we disaggregate by gender, we see that the likelihood of being overweight is higher for women at all ages. From age 30 onwards, they are twice as likely as men to be overweight. Increasing household wealth has a positive effect on BMI for both men and women; it increases risk of being overweight as well as decreasing their risk of being underweight. Somewhat surprisingly, the state per capita income was not significantly associated with BMI.

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