Malnutrition and Child Mortality in Sub-Saharan Africa:
A Growing Gap?

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Background

There is substantial research examining the relationship between child malnutrition and mortality in the developing world. An early piece established that malnutrition contributed to approximately 55 percent of all deaths of children aged 1-4 (Puffer and Serrano, 1973). Since then, other studies have analyzed data on both health indicators to quantify this relationship associating poor nutritional status with higher child mortality (Chen, Chowdhury and Huffman, 1980; Pelletier and Frongillo, 1993; Smedman et al. 1987 for example). This relationship is consistent across diverse world populations and takes into account the role of both severe malnutrition as well as mild to moderate malnutrition on child mortality (de Onis, 2000; Pelletier 1994; Pelletier 1994b; Trowbridge and Sommer, 1981). Although there may be differences in magnitude across regions, socio-economic conditions or scenarios of differing policies, the general direction of this relationship has been well established (Pelletier and Frongillo, 2003). Research also indicates that malnutrition multiplies the number of deaths caused by infectious diseases rather than following an additive model. It is not a cause of death on its own but magnifies the role of infectious diseases in causing mortality, its role proportional to the severity of malnutrition. Although children's exposure to diseases and infection may be similar in a particular context, malnutrition can enhance the rates of mortality among that group. This implies that malnutrition has its biggest impacts on populations with already high mortality levels (Pelletier, Frongillo and Habicht, 1993; Pelletier, 1994; Pelletier, 1994b).

Trends in Malnutrition and Child Mortality in sub-Saharan Africa

Research shows that although child malnutrition as measured by stunting has generally declined globally, progress has been uneven across regions. Despite this decline, malnutrition continues to remain a major public health problem particularly in sub-Saharan Africa. A WHO study shows that 26% of those children under 5 years who were stunted lived in Africa. In fact, the rates of stunting in much of sub-Saharan Africa and South-central Asia are rising (de Onis et al., 2000).

A preliminary analysis of data from the Demographic and Health Surveys (DHS) on indicators of malnutrition in combination with under-five mortality show disturbing patterns. As Figure 1 indicates, in the past twenty years, indicators of malnutrition are found to decline only in countries in Eastern Africa. In fact, in countries in the Sahel and in Southern Africa, they are found to increase over time. On the other hand, child mortality has generally declined in sub-Saharan countries except in the West-central region where it is somewhat stagnant.

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Figure 1 about here

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Using Demographic and Health Surveys (DHS) data from the past two decades, this paper builds on recent analyses by de Onis and colleagues (2000), and Pelletier and Frongillo (2003) to explain the divergent trends over time in these two indicators in sub-Saharan Africa. It explains why malnourished children seem to have a greater chance for survival. The analysis also contributes to the existing research by attempting to better explain the mechanisms by which malnutrition works towards increasing child mortality thus having important policy implications. Given that malnutrition exacerbates the effect of infectious diseases on children's health (Pelletier 1994; Pelletier 1994b), we examine the mechanisms by which factors such as environmental conditions, food security and health systems performance operate in influencing child mortality.

This research calls for the need for the health community to focus on decreasing malnutrition and consequently morbidity as goals themselves, as also the means by which child mortality could be reduced even further. Furthermore, determining the mechanisms by which these relationships operate is also useful in devising appropriate intervention strategies.

Data and Methodology
Data
For this analysis, we use DHS data from 25 countries in sub-Saharan Africa between the years 1986 and 2006. The countries include Burkina Faso, Chad, Mali, Niger, and Senegal in the Sahel; Benin, Cameroon, Cote d'Ivoire, Ghana, Guinea, Nigeria, and Togo in the West-Central region; Ethiopia, Eritrea, Kenya, Rwanda, Tanzania, and Uganda in Eastern Africa; and, Madagascar, Malawi, Mozambique, Namibia, South Africa, Zambia and Zimbabwe in the southern region. Countries with at least 2 data points, one of which is after the years 2000 are included[1]. 16 of these countries have data from 3 time points. Data from the UNICEF sponsored Multiple Indicator Cluster Surveys (MICS) for the above mentioned countries will also be included by adding additional time points to strengthen the analysis.

Key Variables
The key dependent variable used is the under-five mortality rate in a country per 1,000 live births in the last 5 years before the survey. This indicator measures the impact of neonatal care and the role of infectious diseases. Although a high proportion of infant deaths occurs in the first month and is not related to the infant's nutritional experience, this measure is chosen because it is the most important indicator used in policy analyses in relation to nutritional status. Two anthropometric measures of moderate and severe malnutrition are used, namely stunting and underweight, for children 0-3 years of age. Stunting is measured as the percentage of children in a country whose height for age is 2 standard deviations below the reference median. Underweight is measured as the percentage of children in a country whose weight for age is 2 standard deviations below the reference median. These anthropometric indicators are chosen because they are known to be sensitive over the entire spectrum of malnutrition as compared to other biochemical and clinical indicators (de Onis, 2000; Gomez et al., 1956). Two sets of analyses will be conducted, one for each indicator of malnutrition.

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[1] An exception is Togo for which the most recent data point was in 1998.

The trend analysis will examine the relationship between the indicators of malnutrition and under-five mortality in each of the four different sub-regions in Sub-Saharan Africa, namely the Eastern, Southern, West-Central and Sahelian regions.

Statistical Method

Based on research indicating that the relationship between malnutrition and child mortality cannot be attributed to a simple additive model, we use an exponential regression model weighted by the number of live births aged 0-4 to indicate that mortality is an exponential function of malnutrition within a given population (Pelletier, Frongillo and Habicht, 1993).
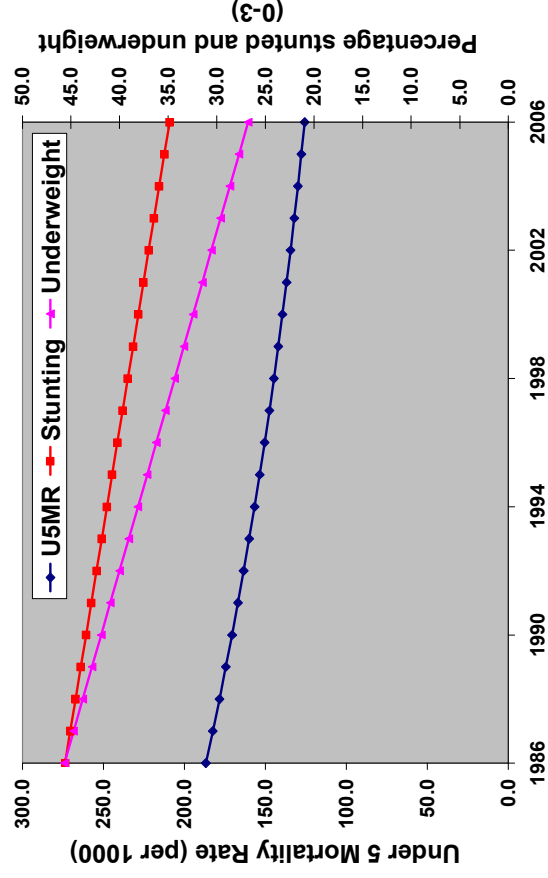
The regression models for each country will control for the year, sub-region, socio-economic characteristics such as urban residence, gender, mother's education beyond the primary education level; and GDP per capita from the World Development Indicators as a measure of economic growth. Other variables that act as moderators in the relationship between malnutrition and child mortality are included as interaction variables in the model. These include environmental factors such as access to water and sanitation; food security as measured by caloric intake; and a measure of health sector performance based on use of oral rehydration, measles immunization coverage and use of Vitamin A supplements.
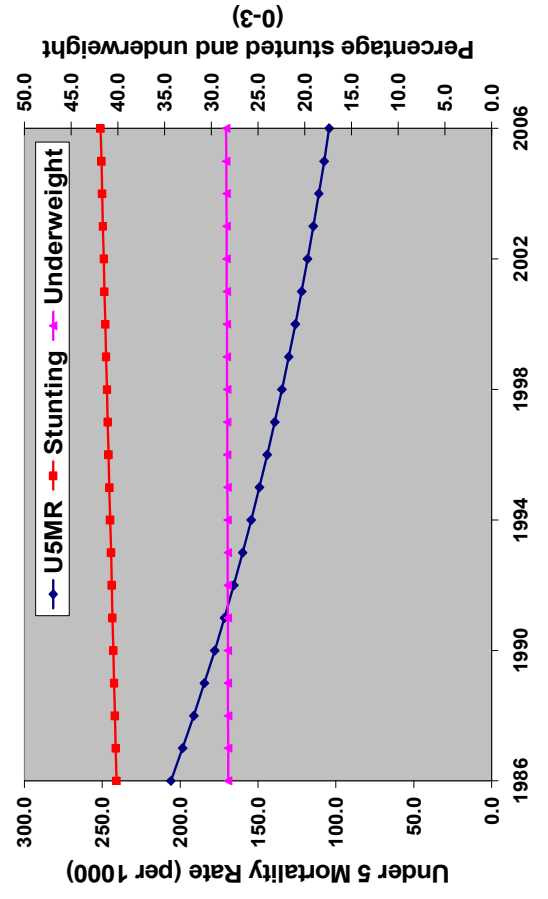
References:

Chen, L. C., Chowdhury , A. K. M. A., and S. L. Huffman. 1981. The use of anthropometry for nutritional surveillance in mortality control programs. *American Journal of Clinical Nutrition*. 34: 2596-2599.

de Onis, M. 2000. Measuring nutritional status in relation to mortality. *Bulletin of the World Health Organization* 78(10): 1271-1274.

de Onis, M. Frongillo, E.A. Jr., and M. Blössner. 2000. Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980. *Bulletin of the World Health Organization.* 78(10):1222-1233.

Gomez F. et al. 1956. Mortality in second and third degree malnutrition. *Journal of Tropical Pediatrics*. 2:77-83.

Pelletier, D. L. 1994. The relationship between child anthropometry and mortality in developing countries: Implications for policy, programs and future research.. *The Journal of Nutrition*. 124 (10) Supplement. 2047S-2081S.

Pelletier, D. L. 1994b. The Potentiating Effects of Malnutrition on Child Mortality: Epidemiologic Evidence and Policy Implications. *Nutrition Reviews*. 52, No. 12: 409-415.

Pelletier, D.L. and E.A. Frongillo. 2003. Changes in Child Survival Are Strongly Associated with Changes in Malnutrition in Developing Countries. *Journal of Nutrition* 133:107-119.

Pelletier D. L., Frongillo E. A. Jr., and J.P. Habicht. 1993. Epidemiologic evidence for a potentiating effect of malnutrition on child mortality. *American Journal of Public Health*. 83:1130-1133

Pelletier D. L., Frongillo E. A. Jr, Schroeder D. G., and J.P. Habicht. 1995. The effects of malnutrition on child mortality in developing countries. *Bulletin of the World Health Organization*.73:443-448.

Smedman, L., G. Sterky, L. Mellander, and S. Wall. 1987. Anthropometry and subsequent mortality in groups of children aged 6–59 months in Guinea-Bissau. *American Journal of Clinical Nutrition* 46(2): 369–73.

Trowbridge F. L, and A. Sommer. 1981. Nutritional anthropometry and mortality risk. *American Journal of Clinical Nutrition*. Nov. 34(11):2591–2592.

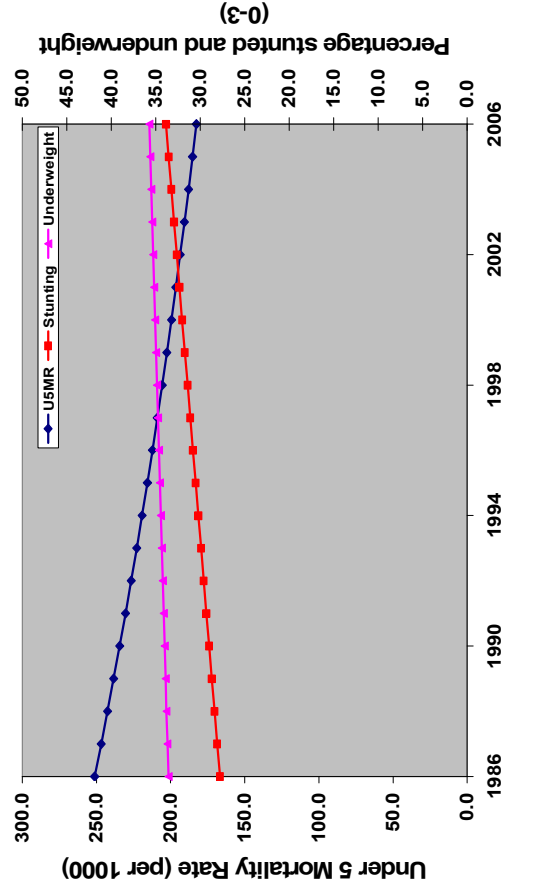Figure 1: Trends in Malnutrition in Sub-Saharan Africa by Region (Weighted), 1986-2006