

**Measuring food and nutrition security based on health outcomes, not food availability**

A.J. Stein

*International Food Policy Research Institute, USA*

**Introduction:** The links between food security, nutrition and public health—and thereby economic development—receive increasing attention. At the same time the use of the proportion of hungry people as key indicator for food and nutrition insecurity (FNI) is being questioned because of its reliance on mere food availability data. This begs the question which alternative metrics can capture the complex nature of the factors that contribute to malnutrition to explain FNI trends and monitor the progress on international development goals.

Here data on actual health outcomes of malnutrition are used to quantify the consequences of FNI by country and to illustrate the development of the burden of undernutrition—undernourishment and micronutrient deficiencies—since 1990. This trend is compared to the progress in the fight against hunger as measured by the Food and Agriculture Organization (FAO), which is also one indicator for the achievement of the United Nation's Millennium Development Goals, and shortcomings of this approach are discussed.

To illustrate the magnitude of the remaining problem of FNI, and to quantify the economic implications of human capital development that is compromised by FNI and related poor health, especially in children, the economic cost of the burden of undernutrition is projected. Finally, the need for more interdisciplinary collaboration in the overlapping fields of agriculture, nutrition, health and development is set forth, and the importance of frequent updating and timely sharing of data is highlighted.

**Methods:** To calculate the burden of malnutrition for each country worldwide, the latest World Health Organization (WHO) data on “disability-adjusted life years” (DALYs), disaggregated by country and health outcome, is used. Following a previously developed and published methodology, the burden of undernutrition is derived from data on protein-energy malnutrition, iodine deficiency, vitamin A deficiency, iron deficiency anaemia, maternal conditions, measles, diarrhoeal diseases, and lower respiratory infections, and the results are updated to 2011 figures using World Bank population data.

To show the development of the burden of undernutrition since 1990 and to match it with FAO data on the proportion of hungry people, spatially more aggregate but temporally disaggregated DALYs estimates from the Institute for Health Metrics and Evaluation (IHME) are used to compute a comprehensive burden of undernutrition based on data on protein-energy malnutrition, health risks of underweight in children, iodine deficiency, vitamin A deficiency and related risks, iron deficiency anaemia and related risks, as well as the health risks of zinc deficiency.

Following examples from the published literature, the implications for economic growth—which result from the loss of human capital due to poor health—are projected using World Bank data on gross national income. The food security framework (availability, access, utilisation)—expanded to include dietary needs as well as the outcomes of FNI (chronic and hidden hunger)—is used to discuss the diverging results of the different measures of food security (Figure 1).

**Results:** The share of micronutrient malnutrition in the overall burden of undernutrition (which includes “classic” undernourishment) is about two thirds, i.e. using food availability (and the dietary energy it can provide) as proxy for food security does not capture the full extent of FNI. The data also shows that while the burden of undernutrition in poor countries can represent a share of 7-8% of the overall burden of disease, in rich countries this share is less than 1%, i.e. FNI clearly is a problem of developing countries.

However, if the DALYs burden of undernutrition is followed over time, the calculations show that the burden in 2010 was only half as big as 1990, i.e. according to this measure the international goal of reducing hunger by half has already been achieved—which contrasts with the trend seen in the proportion of undernourished people as measured by the FAO. Moreover, progress on the reduction of undernourishment was actually faster than on micronutrient malnutrition (Figure 2).

Nevertheless, if DALYs are converted into monetary terms, undernutrition causes an annual loss of 0.8-1.9 trillion international dollars—depending on whether estimates are based on WHO or the more comprehensive

IHME data. This is about 1.0-2.4% of current world income and it shows that even if hunger has been halved compared to 1990, this is no reason for complacency.

Figure 1: Food security and human capital development

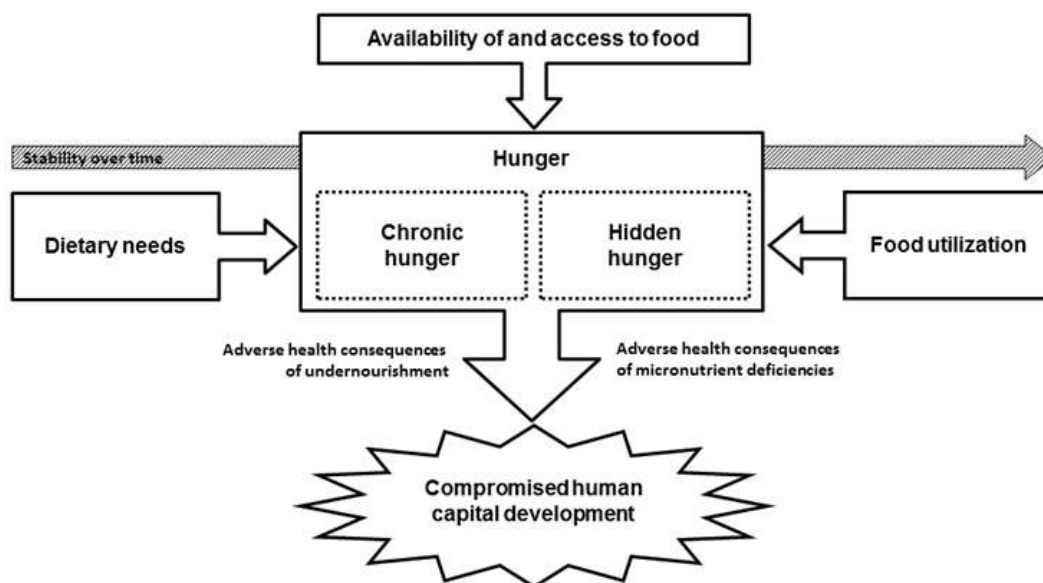
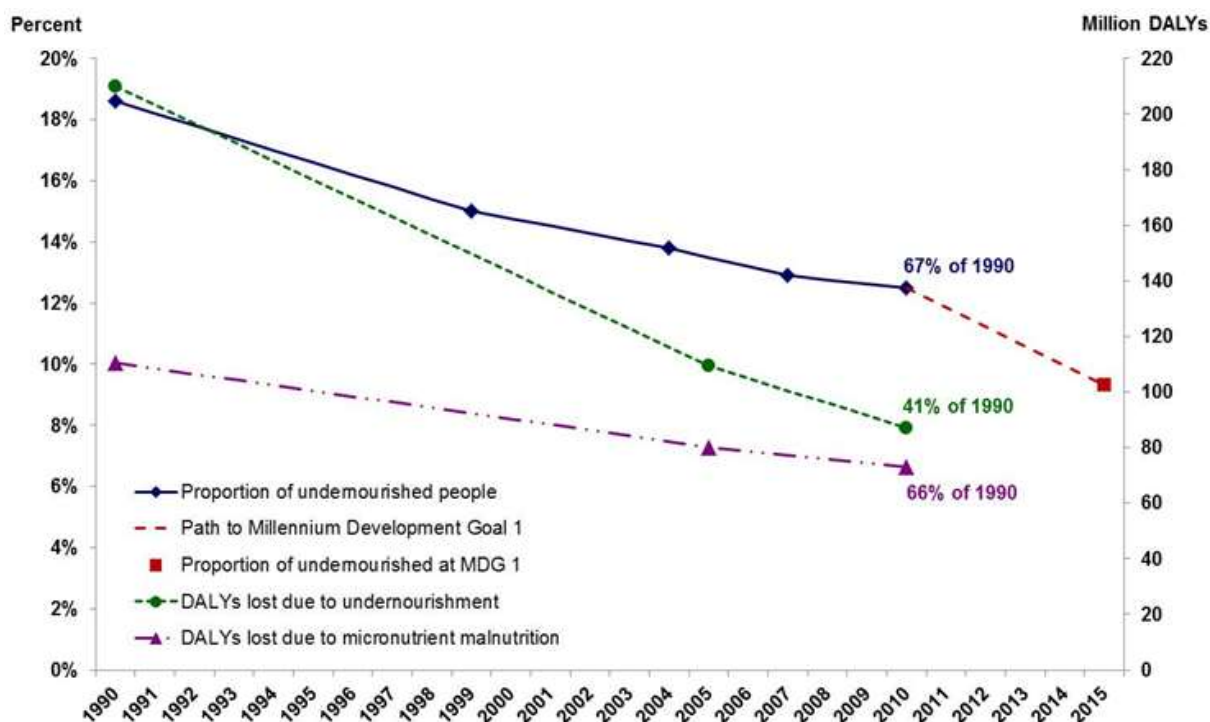


Figure 2: Trends in global hunger based on different measures, 1990-2010



**Discussion:** While food availability—the basis of the FAO’s calculation of the number of hungry people—is a determinant of food security, it is but one factor (Figure 1). To the extent that (i) increasing mechanisation, motorisation, and the spread of information and communication technologies in many parts of the world reduced people’s dietary needs, (ii) better storage and pest control, improved food preservation techniques, and expanding food retail chains reduced food waste, (iii) nutrition education, improved infant feeding practices, access to clean water, lower parasite infestation, better overall health statuses, and dietary changes improved utilization of the food people consume, and (iv) the depth of undernourishment decreased but remained below the given threshold, this indicator can be misleading.

DALYs measure the outcome of all these factors combined and they are sensitive to gradual changes in the severity of undernutrition, therefore offering a more comprehensive picture of FNI. Because they quantify the health losses due to impaired cognitive and physical development, they also link malnutrition and human capital development, thus giving a better indication of foregone human and economic benefits. Experts working on the nexus of agriculture, nutrition, health and development need to be aware of outcomes-based indicators, such as DALYs, which better reflect the complex nature of the factors producing malnutrition.

To facilitate future work and more detailed analyses, such health data needs to be updated more frequently and more attention should be paid to nutritional aspects. Likewise, available data needs to be made accessible to researchers and policy-makers to improve the setting and monitoring of development targets and to better understand the factors that drive nutritional security—while progress on food security may be greater than thought, the remaining burden of malnutrition is still unacceptably high.

**Keywords:** Food security, Malnutrition, Measurement, Public health