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Abstract

Malnutrition is pervasive in both low- and middle-income countries. Yet, there is a scarcity of food consumption data collected at the individual level to describe diets, determine the prevalence of inadequate nutrient consumption in populations, and to shed light on how diets contribute to the malnutrition burden. In the absence of nationally representative individual-level food consumption surveys, particularly in low- and middle-income countries, many researchers are using food data collected in household consumption and expenditure surveys (HCES) as a second-best option to make inferences on the food and nutrient consumption of populations.

To assess the prevalence of nutrient inadequacy (PoNI) in a population, it is necessary to have information on the distribution of usual consumption. To that aim, dietary surveys usually collect repeated observations on individual food consumption over short-term reference periods (usually, 24 hours). To estimate usual consumption, data must thus be treated to remove within-person variation (i.e. to adjust for excess day-to-day variability). This is achieved with statistical methods such as the one developed by the National Cancer Institute of the United States (NCI method) (US National Cancer Institute, 2021), which also removes some of the measurement errors.

Household-level food consumption data, on the other hand, are collected with longer reference periods (one week to one month). Daily per capita consumption values, obtained as an average over the number of days in the reference period and the number of people that partakes the households' food, are interpreted as direct estimates of usual consumption. However, estimating the distribution of usual consumption in the population presents a challenge due to presence of various types of measurement errors. Not treating the data to remove excess variation due to measurement errors can induce biases when estimating the prevalence of inadequate consumption.

The aim of this study is two-fold: i) to present an approach for adjusting nutrient consumption data from HCES for excess variability due to measurement error; and ii) to present a method for using those data for estimating the PoNI. Both are inspired from elements of the Food and Agriculture Organization of the United Nations (FAO) methodology to compute the prevalence of undernourishment (PoU).

We demonstrate the effectiveness of the approach for adjusting HCES consumption data for excess variability and estimating the distribution of usual consumption levels by comparing estimates of coefficients of variation (CVs) from the 2015 Bangladesh Integrated Household Survey before and after adjustment. Further, using the same survey, we estimate the prevalence of inadequacy for eight micronutrients (vitamins A, B1, B2, B6, B12 and C, and calcium and zinc) based on the adjusted, household-level, food consumption data and contrast them with estimates obtained from food consumption data at the individual level, collected from the same households through two household-level 24-hour recalls, adjusted to control for day-to-day variability using the NCI method), a standard approach for this type of analysis. We find that the CVs obtained from adjusted household-level data are very similar or only slightly higher than those estimated using individual-level data, with differences that vary depending on the nutrient, ranging from 0.5 percentage point for vitamin A (CV = 36.6 percent against 37.1 percent, with the two methods respectively) to 16.7 percentage points for vitamin B12 (53.0 percent against 36.3 percent). This confirms that our proposed method to treat household-level food consumption data achieves the desired result in terms of controlling excess variability. However, the PoNI for the eight

micronutrients estimated using the adjusted household-level data are always lower than the corresponding estimates obtained from individual-level data. For two micronutrients (calcium and vitamin A), for which we find very high PoNI, the differences are minimal, but for the other six micronutrients, the differences in estimated PoNI range from 14.6 percentage points to 41.6 percentage points, depending on the nutrient considered. Given the closeness of the estimated coefficient of variation, the main reason for the lower PoNI is the invariably higher value for the *average* consumption level obtained from household-level data, compared to that obtained from the individual-level data.

Overall, our results show that (a) estimates of average nutrient consumption based on data collected using modules typically included in HCES are higher than those obtained from food consumption data collected at individual-level; (b) failing to adjust food consumption data from HCES for excess variability would generate biased estimates of PoNI; and (c) when estimating the PoNI with the FAO methodology, for non-episodically consumed nutrients, a reliable CV parameter can be obtained from HCES data. From these, we conclude that the exclusive use of HCES data to estimate the PoNI is indeed a promising avenue to obtain assessment when no large-scale dietary surveys are available. Given the growing importance of food consumed away from home, efforts should be made to increase the reliability of food consumption data collected in HCES, especially with respect to the ability to correctly represent food consumed away from home.

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