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Revealing the Prevalence of “Hidden Hunger”

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On behalf of USAID Advancing Nutrition and the Global Micronutrient Deficiencies Research Group

Conflict of Interest Disclosure

I have no conflict of interest to report in relation to this presentation.

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Credit: Liam Wright/ICRISAT

Approach

- First comprehensive global analysis of prevalence of any deficiency using multiple micronutrient biomarkers within individuals: Data on 22 countries from 2003–2019
- Focused on preschool-aged children and women of reproductive age (15–49 years) due to data availability
- Estimated prevalence of single deficiencies for iron, zinc, folate (prioritized red-blood-cell folate if dataset also included serum folate), vitamin A, vitamin B_{12}, and vitamin D
- Estimated combined prevalence of deficiency in one to three micronutrients for preschool-aged children (iron, zinc, vitamin A) and women (iron, zinc, folate)
- Used thresholds for deficiency with established consensus in the field
- Biomarker values adjusted for inflammation using the latest evidence (BRINDA recommendations)

Biomarkers, Cutoffs, and Inflammation

	Biomarker	Definition of deficiency	Population	Adjust for inflammation?
Vitamin B_{12}	Serum B_{12}	<150 pmol/L	All	No
Folate*	Red blood cell folate	<340 nmol/L	All	No
Folate*	Serum folate	<10 nmol/L	All	No
Vitamin A†	Serum retinol	<0·7 µmol/L	All	Preschool-aged children only
Vitamin A†	Retinol-binding protein	<0·7 µmol/L	All	Preschool-aged children only
Zinc‡	Serum zinc	<9·9 µmol/L	Children younger than 10 years (morning, non-fasting)	Yes, provided conditions are met
Zinc‡	Serum zinc	<8·7 µmol/L	Children younger than 10 years (afternoon, non-fasting)	Yes, provided conditions are met
Zinc‡	Serum zinc	<10·7 µmol/L	Girls and women aged 10 years or older (morning, fasting)	No
Zinc‡	Serum zinc	<10·1 µmol/L	Girls and women aged 10 years or older (morning, non-fasting)	No
Zinc‡	Serum zinc	<9·0 µmol/L	Girls and women aged 10 years or older (afternoon, non-fasting)	No
Iron	Serum ferritin	<12·0 µg/L	Children younger than 5 years	Yes
Iron	Serum ferritin	<15·0 µg/L	Individuals aged 5 years or older	Yes
Vitamin D	Serum 25-hydroxyvitamin D	<25·0 nmol/L	All	No

References for definitions of deficiency and adjustments for inflammation are available in the appendix (p 12). *When both red blood cell folate and serum folate were included in a dataset, red blood cell folate data were used. Folate thresholds were adjusted for survey assay (appendix pp 19–22). †When both serum retinol and retinol-binding protein were included in a dataset, serum retinol was used, provided that it was available for the full biological measurement sample. If serum retinol was only available for a subsample, retinol-binding protein data were used. ‡For surveys with blood collection throughout the day or if the blood collection protocol was not reported, the average of the morning non-fasting and afternoon non-fasting cutoffs was used (ie, <9·3 µmol/L for children and <9·55 µmol/L for women). Specific thresholds used for each dataset are listed in the appendix (pp 19–22).

Table 1: **Definition of deficiency and adjustment for inflammation for each included biomarker**

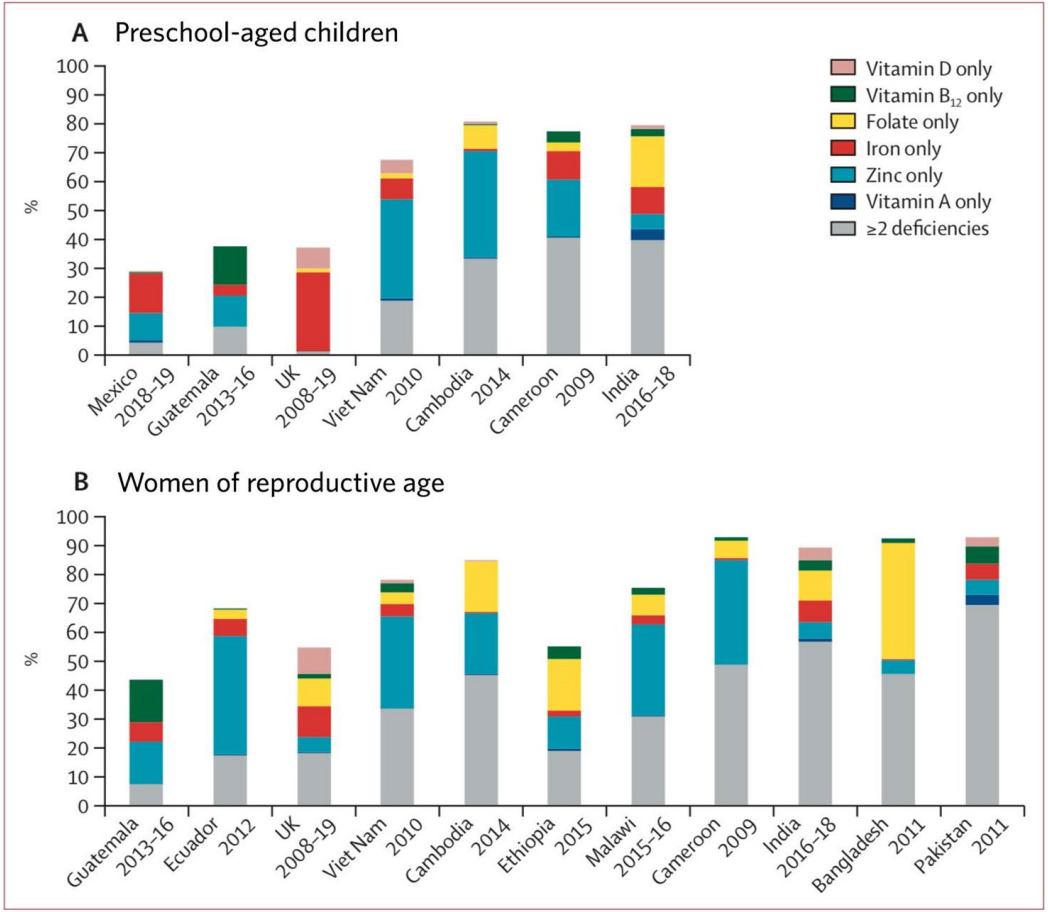
(Stevens et al. 2022, e1592)

Stevens, G.A, T. Beal, M.N.N. Mbuya, H. Luo, L.M. Neufeld, on behalf of the Global Micronutrient Deficiencies Research Group. 2022. "Micronutrient Deficiencies among Preschool-Aged Children and Women of Reproductive Age Worldwide: A Pooled Analysis of Individual-Level Data from Population-Representative Surveys." *Lancet Global Health.* 10(11): E1590–E1599. doi.org/10.1016/S2214-109X(22)00367-9

Models to Estimate Global and Regional Prevalence

- Used a Bayesian hierarchical logistic regression model to estimate prevalence of one or more deficiencies globally and for seven regions
- Hierarchical structure allowed the estimate for each region to be informed by data from the region and by data from other regions, particularly in regions where data were sparse or inconsistent
- Included the sociodemographic index as a time-varying, country-level covariate in the model to borrow strength from countries of similar development level

Prevalence of Single or Two or More Micronutrient Deficiencies



(Stevens et al. 2022, e1594)

Combined Prevalence of Deficiencies in One or More of Three Core Micronutrients

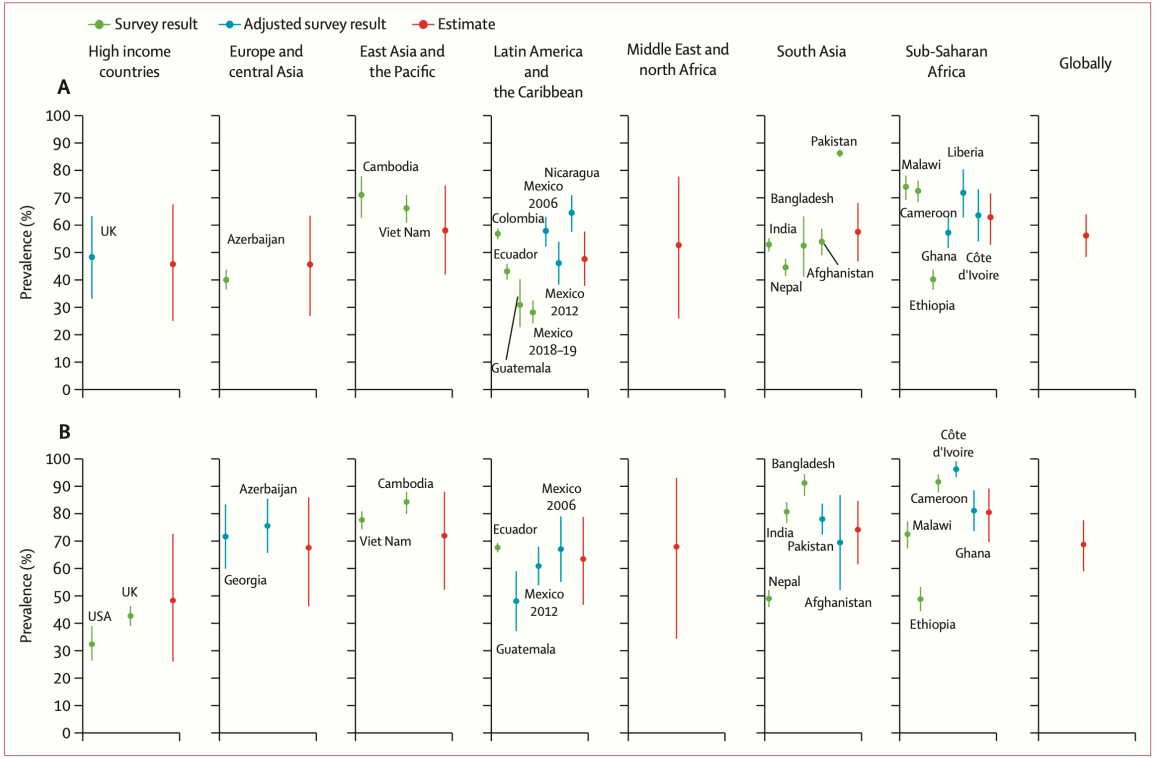
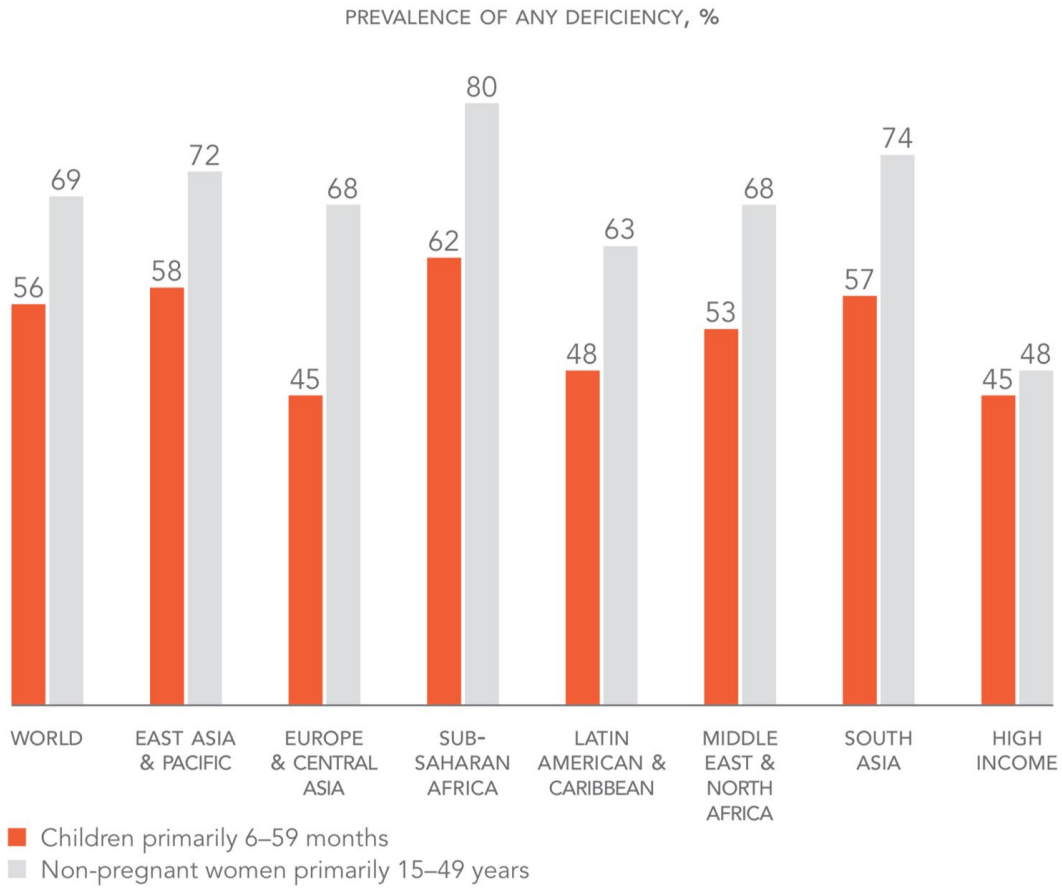


Figure 2: **Estimated prevalence of three core micronutrient deficiencies (2003–19) in preschool-aged children 6–59 months (A) and women aged 15–49 years (B)**

Combined Prevalence of Deficiencies in One or More of Three Core Micronutrients



Key Insights

- 1 in 2 children and 2 in 3 women worldwide are affected by micronutrient deficiencies
- 9 in 10 children in Pakistan and 8 in 10 in India and Cambodia are deficient in at least one micronutrient
- 9 in 10 women in Bangladesh, Cameroon, Côte d'Ivoire, India, and Pakistan are deficient in at least one micronutrient
- 1 in 2 women in the UK and 1 in 3 in the US are deficient in at least one micronutrient—iron deficiency alone in prevalent in 1 in 5 women in both countries
- 372 million (95% UI 319-425) preschool-aged children and 1.2 billion (95% UI 1.0-1.4) women were affected by one or more micronutrient deficiencies worldwide

Recommendations

- The pattern of micronutrient deficiencies varies across countries and regions, and it is therefore essential to characterize each condition locally, including subnationally.
- Our estimates should be considered a new starting point for global monitoring of micronutrient deficiencies. We encourage periodical reassessment building on the approach we used, as additional and more comprehensive data becomes available.
- The primary limitation of our analysis was the scarcity of population-based biomarker data to assess micronutrient status. We hope this analysis motivates addressing the data gaps and spurs commitment to global monitoring to track progress and address this public health burden.

Recommendations

- Biomarkers and laboratory methods differed by data source, which might have affected their accuracy and compatibility. Efforts to improve analytical capabilities in the micronutrient area are necessary.
- High prevalence of at least one deficiency estimated in high-income countries diverges from estimates of inadequacy in the food supply. Future studies should combine biomarker testing with dietary adequacy.

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