NUTRITION 2019
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JUNE 8 - 11, 2019 | BALTIMORE, MARYLAND

The big picture: what nutrients are most limiting and where.

June 10, 2019

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Executive Director Micronutrient Forum

Micronutrient FORUM

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Disclosure

- The Micronutrient Forum has received financial support from:
  - The Bill & Melinda Gates Foundation
  - USAID
  - Sight & Life
  - HarvestPlus
  - Global Alliance for Improved Nutrition (GAIN)

- No other conflicts of interest to disclose

We lack key evidence for tackling micronutrient deficiency

It's often cited that

> *"Over 2 billion people worldwide suffer from a chronic deficiency of micronutrients, a condition known as hidden hunger".*
> (World Health Organisation, 2006)

Yet we don't know the state of micronutrient deficiencies in nutritionally vulnerable populations, such as children under five years of age, women and adolescent girls

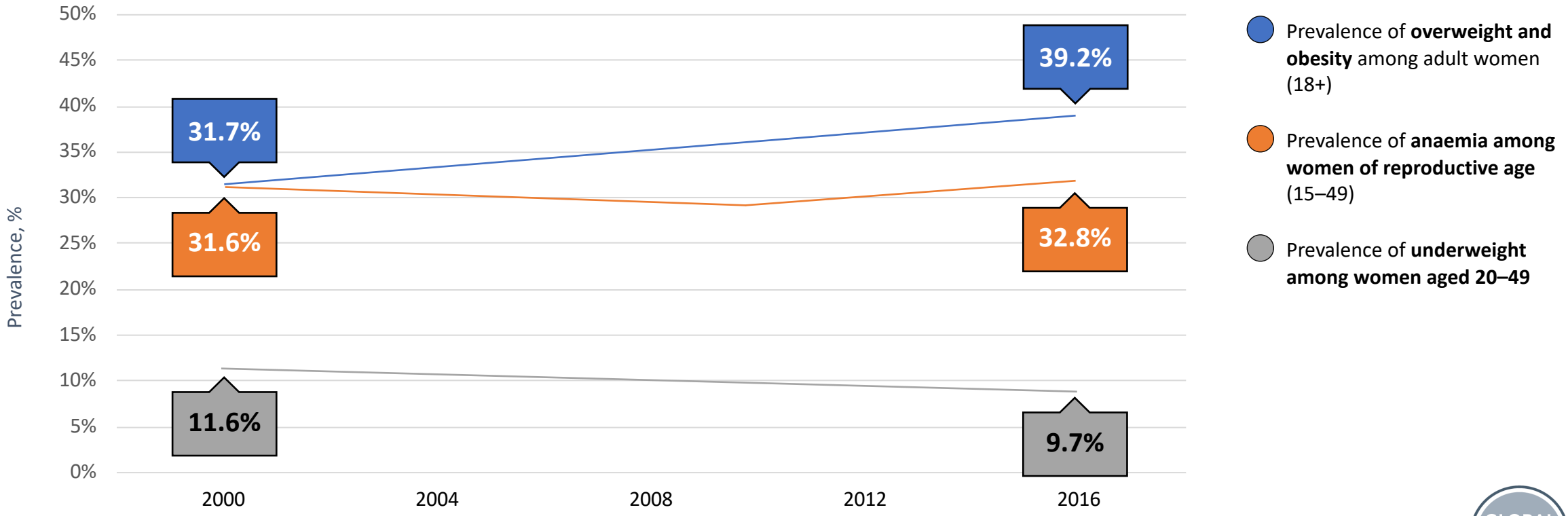
More and better data on malnutrition is being collected, collated and analysed….

- Global Dietary Database
- Global Burden of Disease study
- FAO/WHO GIFT
- Gallup Diet Quality Worldwide project,
- International Dietary Data Expansion (INDDEX) Project

- Intake at the Center for Dietary Assessment at FHI 360
- IANDA project
- Fill the Nutrient Gap tool
- INFORMAS
- Range of initiatives for adolescents, bringing in their voices e.g. TALENT, CO-CREATE

Rates of anaemia and women underweight have barely changed

Global prevalence of anemia, overweight (including obesity) and underweight in women, 2000–2016

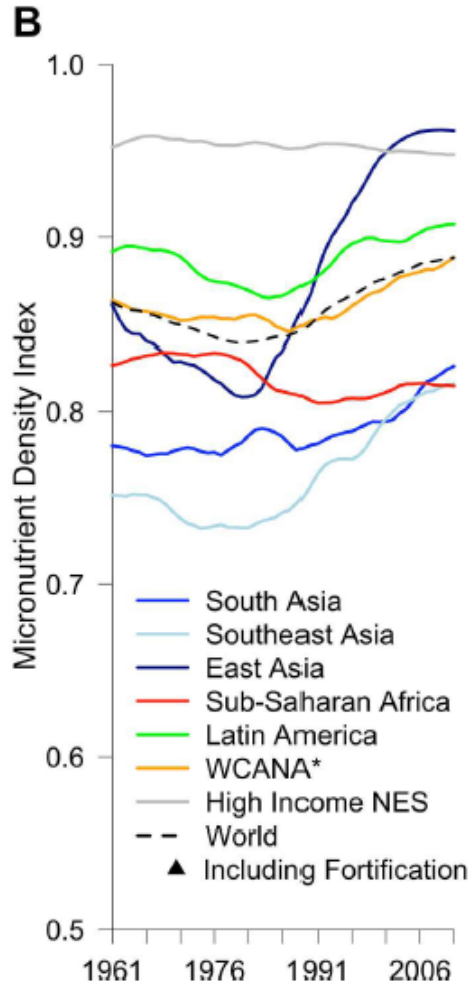


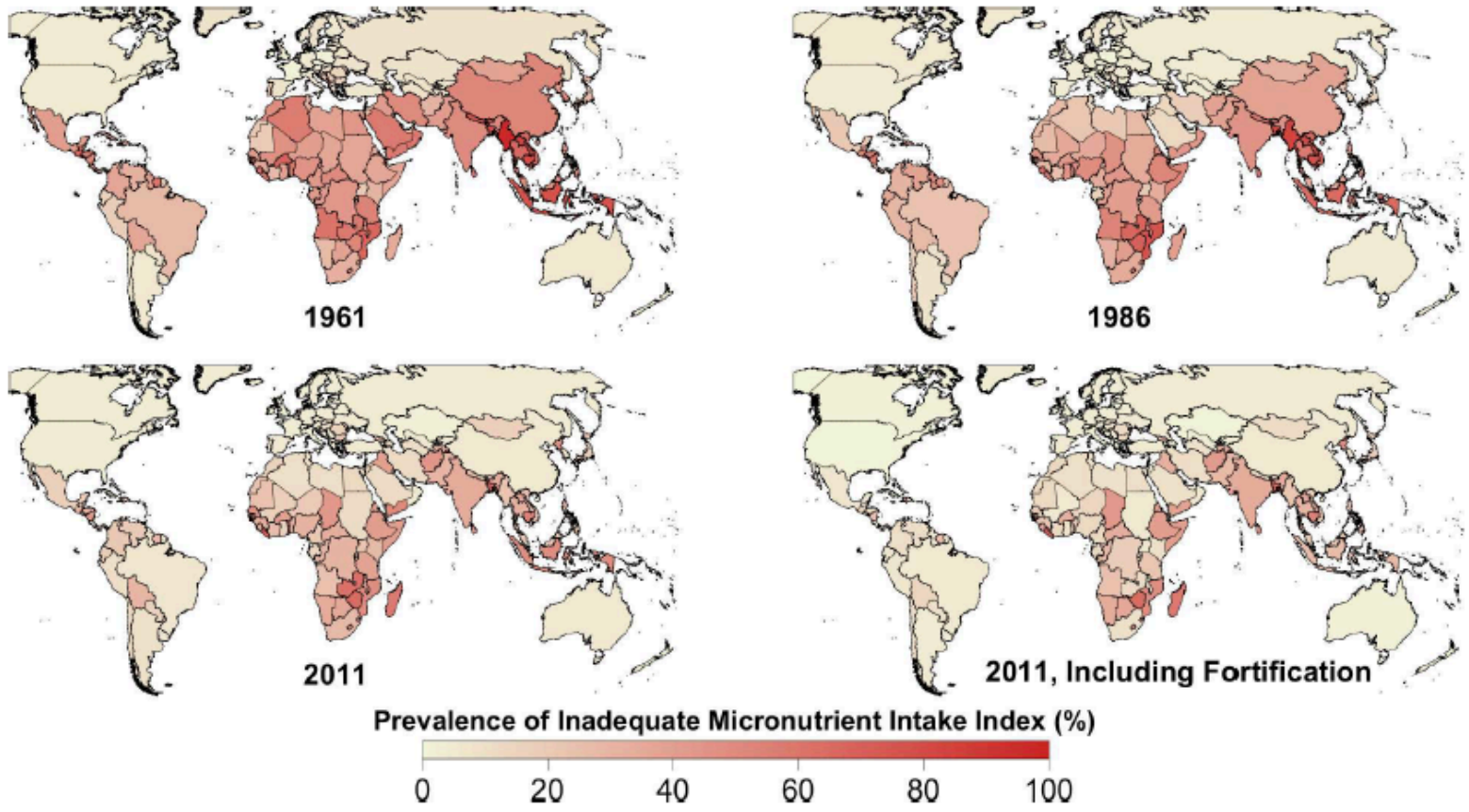
Food Balance sheets have been used to estimate global trends in dietary micronutrient supplies and estimated prevalence of inadequate intakes

- Prevalence of inadequate intake was estimated for every year from the distribution of availability of each micronutrient in the food supply and population-weighted Estimated Average Requirements (EAR) using the EAR cut-point method.
- Bioavailability of iron, zinc and calcium was taken into account by calculating % bioavailability based on ratio of the micronutrient and inhibitors and enhancers of absorption in the food supply.
- Estimates of the amount of fortified micronutrients in the food supply based on national fortification policies (in 2011 only).
- **Prevalence of Inadequate Micronutrient Intake Index**: the average inadequate intake for 14 micronutrients, equally weighed.
- **Micronutrient Density Index**: average micronutrient density of the food supply based on 14 micronutrients.

Beal T, Massiot E, Arsenault JE, Smith MR, Hijmans RJ (2017) Global trends in dietary micronutrient supplies and estimated prevalence of inadequate intakes. PLoS ONE 12(4): e0175554.

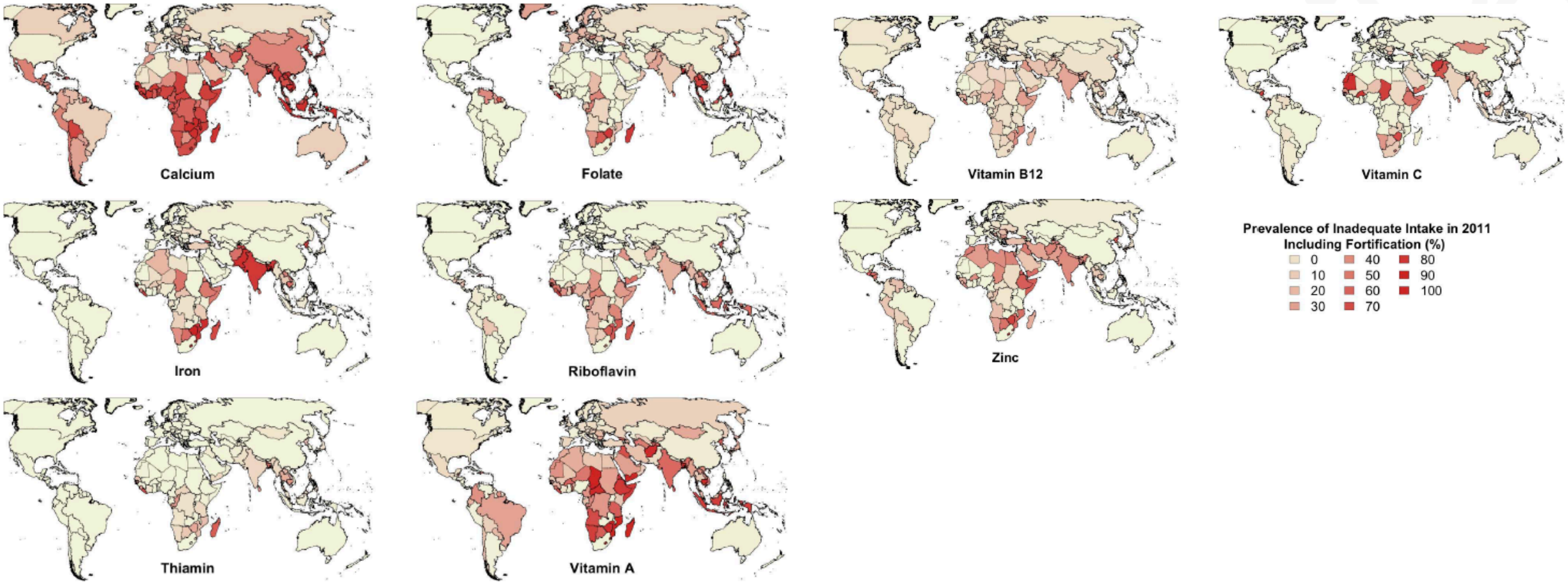
Trends in Micronutrient Density Index and Prevalence of Inadequate Micronutrient Intake Index 1961 - 2011





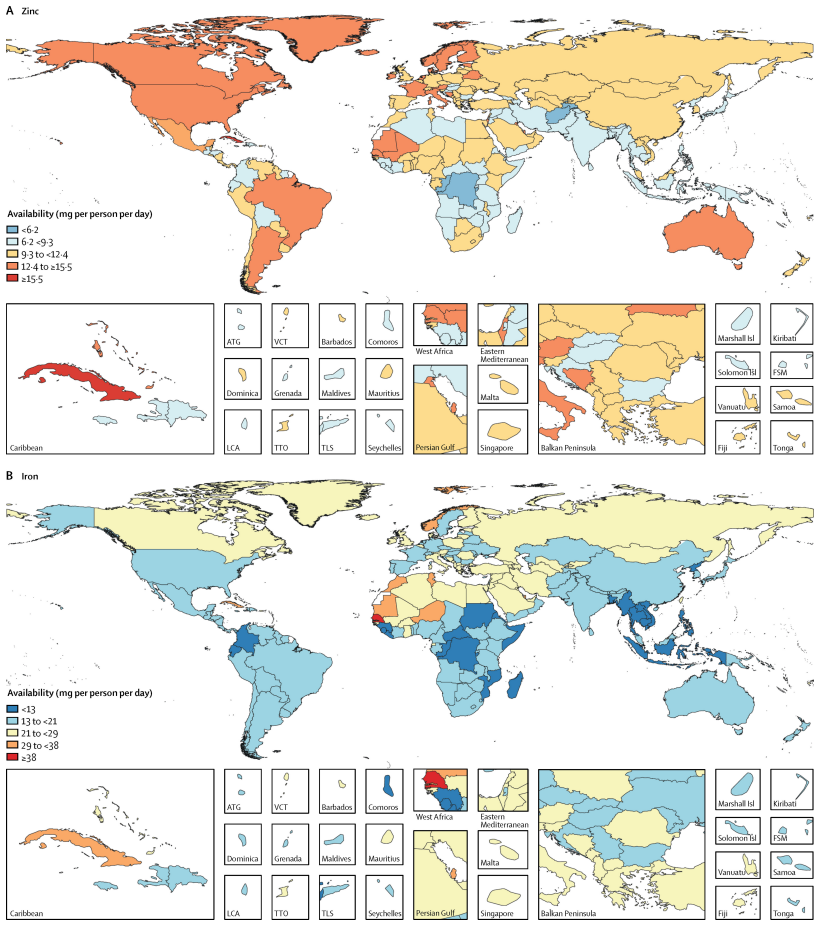
Beal T, Massiot E, Arsenault JE, Smith MR, Hijmans RJ (2017) Global trends in dietary micronutrient supplies and estimated prevalence of inadequate intakes. PLoS ONE 12(4): e0175554.

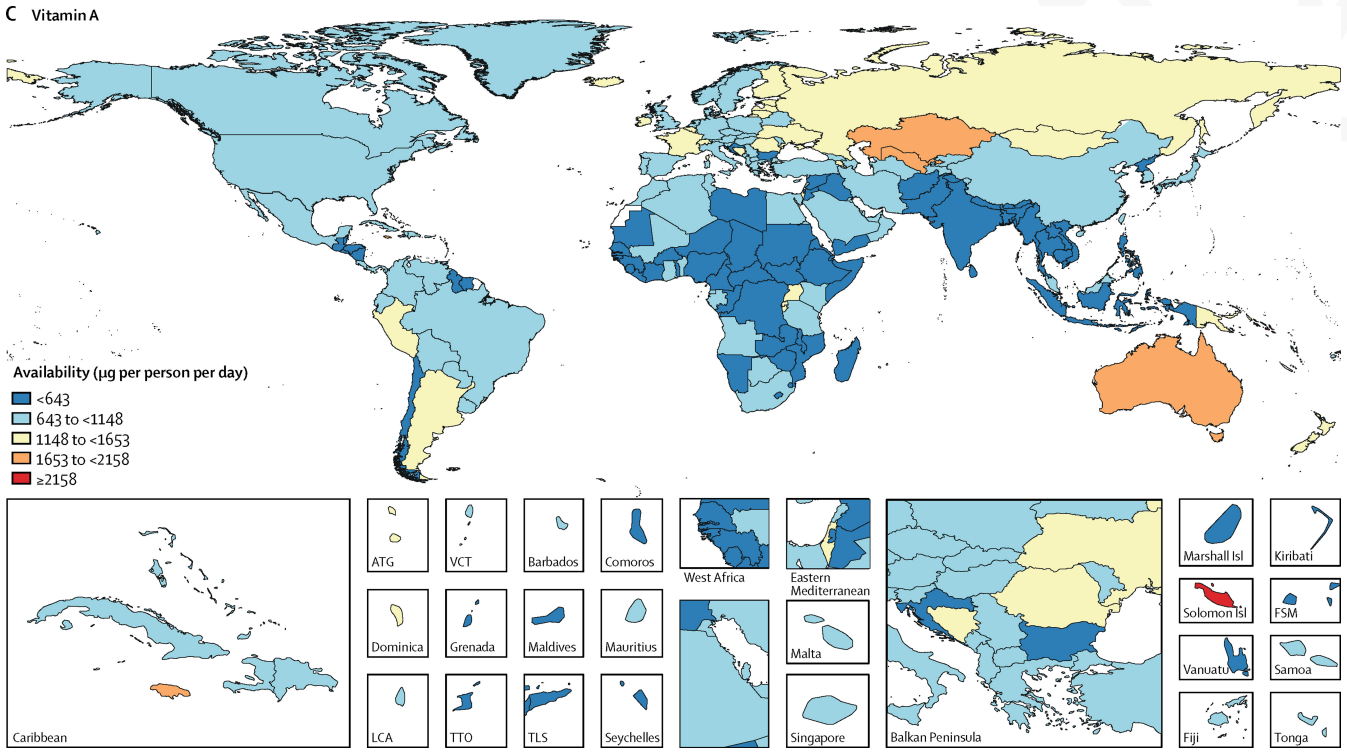
Country-level estimates of inadequate intakes of 9 micronutrients in 2011, taking into account the contribution of food fortification



Beal T, Massiot E, Arsenault JE, Smith MR, Hijmans RJ (2017) Global trends in dietary micronutrient supplies and estimated prevalence of inadequate intakes. PLoS ONE 12(4): e0175554.

The Global Nutrient Database uses the same method to estimate the availability of zinc, iron and vitamin A based on the supply and consumption of nutrients at country level - 2013

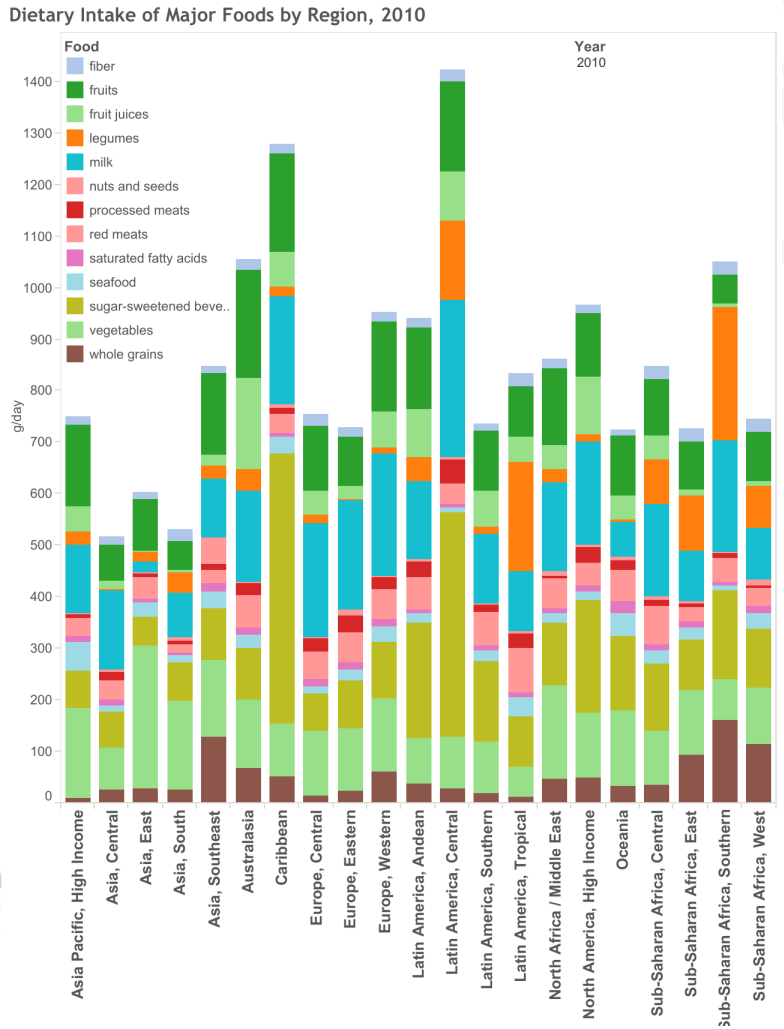




Schmidhuber J, Sur P, Fay K, Huntley B, Salama J, Lee A, Cornaby L, Horino M, Murray C, Afshin A. The Global Nutrient Database: availability of macronutrients and micronutrients in 195 countries from 1980 to 2013. The Lancet Planetary Health. 3 August 2018. doi: 10.1016/S2542-5196(18)30170-0.

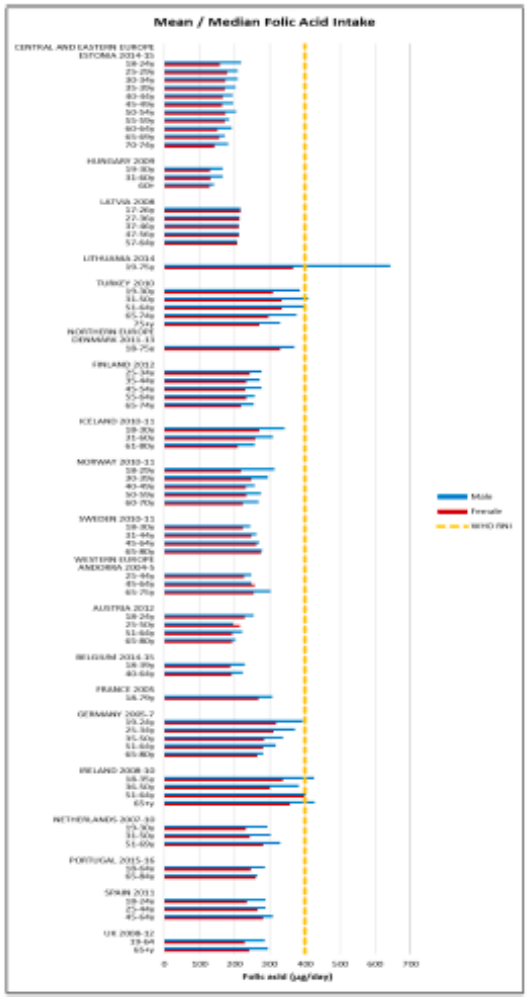
Food and consumption individual intake surveys globally

- **The Global Dietary Database**: focuses on intakes of nutrients known to be detrimental for health (sodium, sugar, SFA)
- **Intake Center for Dietary Assessment**: focuses on dietary intake assessments in low and middle income countries:
  - Different fruits and vegetable consumption
  - Intakes of Animal Source Foods



Dietary intake surveys findings

- Inadequate intakes of multiple micronutrients are common in many LMIC, particularly in children < 5 years, school children and women of reproductive age.
- High prevalences of inadequate intakes found for iron, calcium, vitamin A, folate, and zinc but these may vary depending on context.
- For instance in Phillippino schoolchildren a high prevalence of nutrient inadequacy was found for thiamine 55%, riboflavin 67%, vitamin C 81%, vitamin A 63%, vitamin B6 30%, vitamin B12 9%, folate 70%, calcium 93%, phosphorous 48%, iron 87%, and zinc 38%.
- In children and adolescents in Europe: iron, vitamin D and folate was inadequate, particularly among adolescent girls.

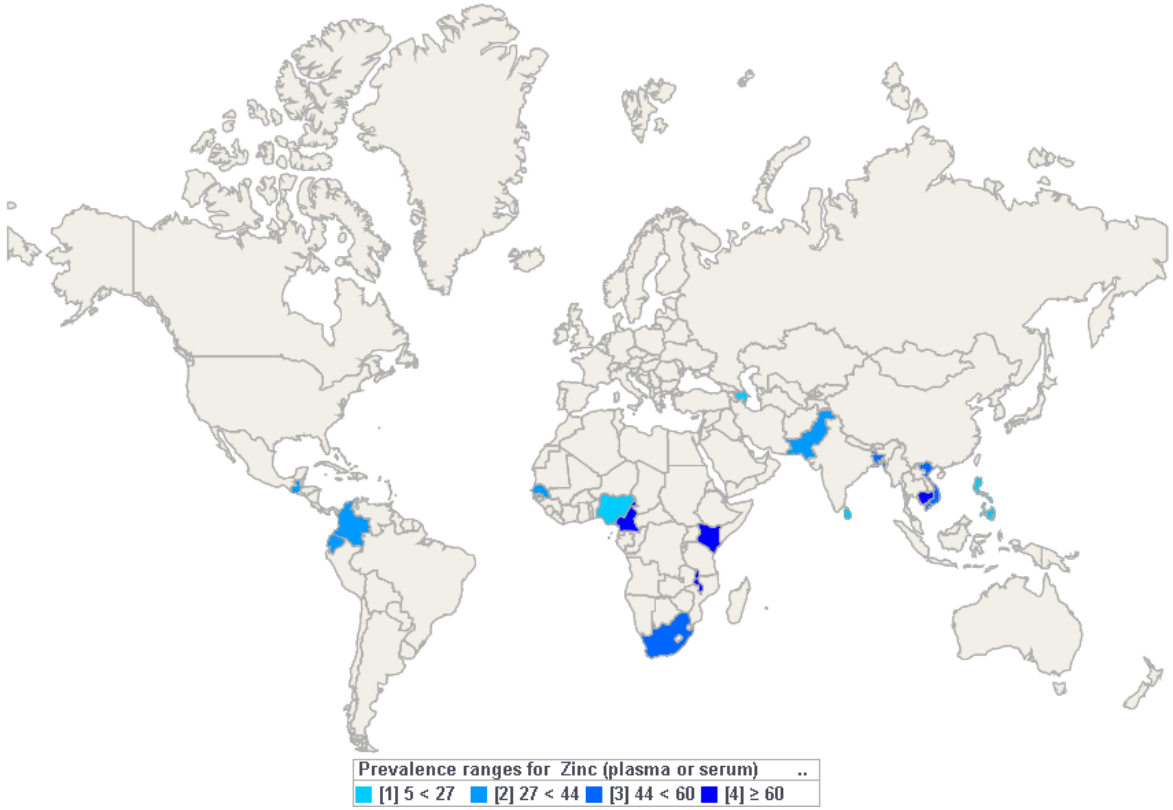


Angeles-Agdeppa I, Dinney L, Capanzana MV. Usual Energy and Nutrient Intakes and Food Sources of Filipino Children Aged 6-12 Years from the 2013 National Nutrition Survey. Nestle Nutr Inst Workshop Ser. 2019;91:111-122. doi: 10.1159/000493702. Epub 2019 Mar 13. PubMed PMID: 30865964; Ripin et al. Nutrients 2017,9,1288 ; Rippin, H., Hutchinson, J., Jewell, J., Breda, J., & Cade, J. (2019). Child and adolescent nutrient intakes from current national dietary surveys of European populations. *Nutrition Research Reviews, 32*(1), 38-69. doi:10.1017/S0954422418000161

The WHO Micronutrients Database has recently been updated and provides the most comprehensive dataset on micronutrient biomarker status to date….

World Health Organization

Micronutrients Database
as part of the Vitamin and Mineral Nutrition Information System (VMNIS)

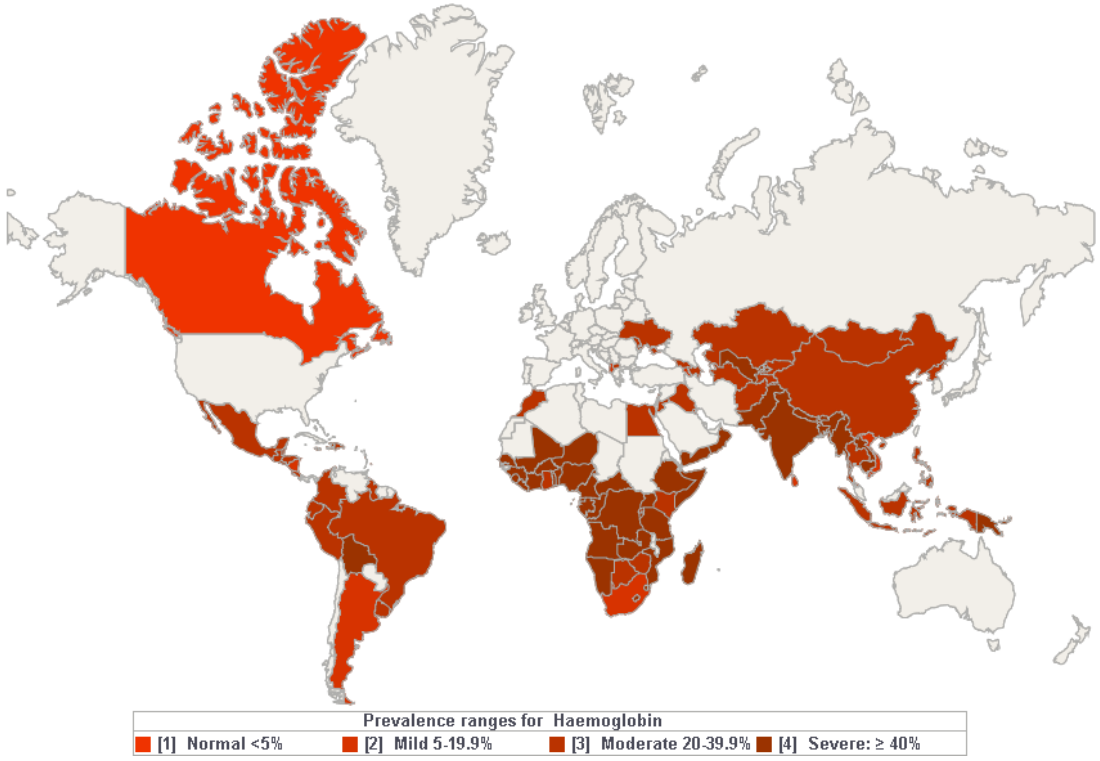


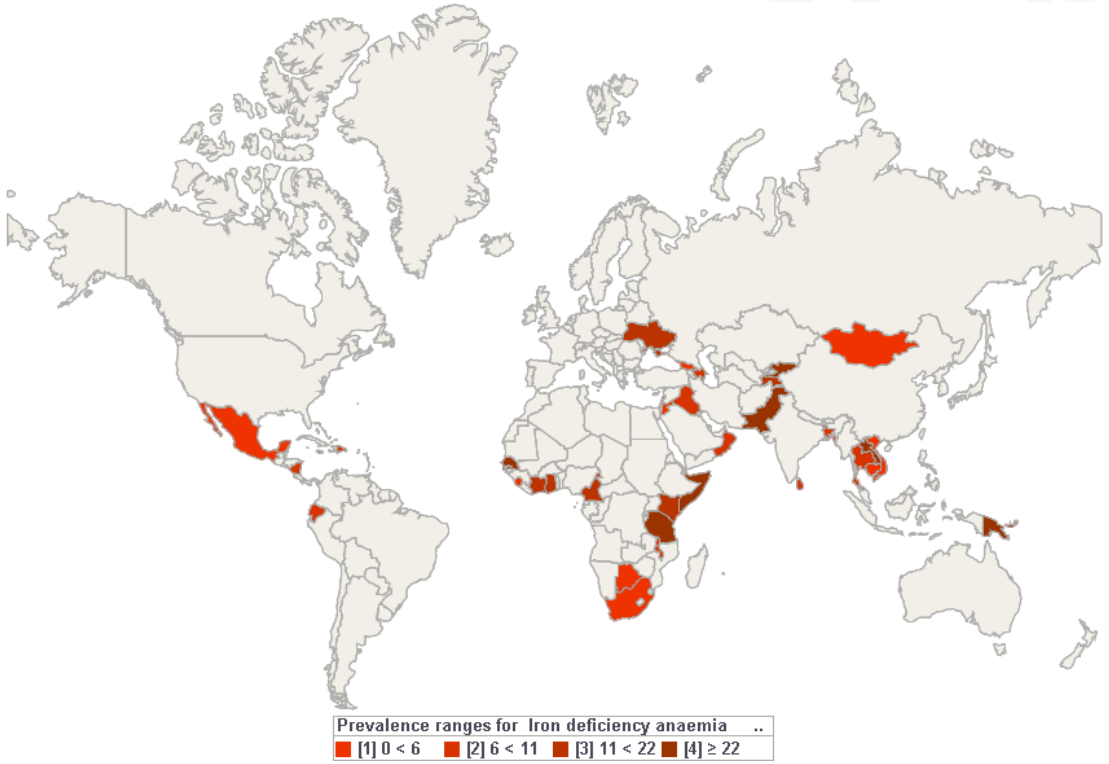
Yes, it lacks information on micronutrient status from many countries.

For instance only 18 countries have serum zinc data on preschool children!

Folate data is available for only 8 countries, and none used red blood cell folate

Even data on iron deficiency anemia is incomplete:

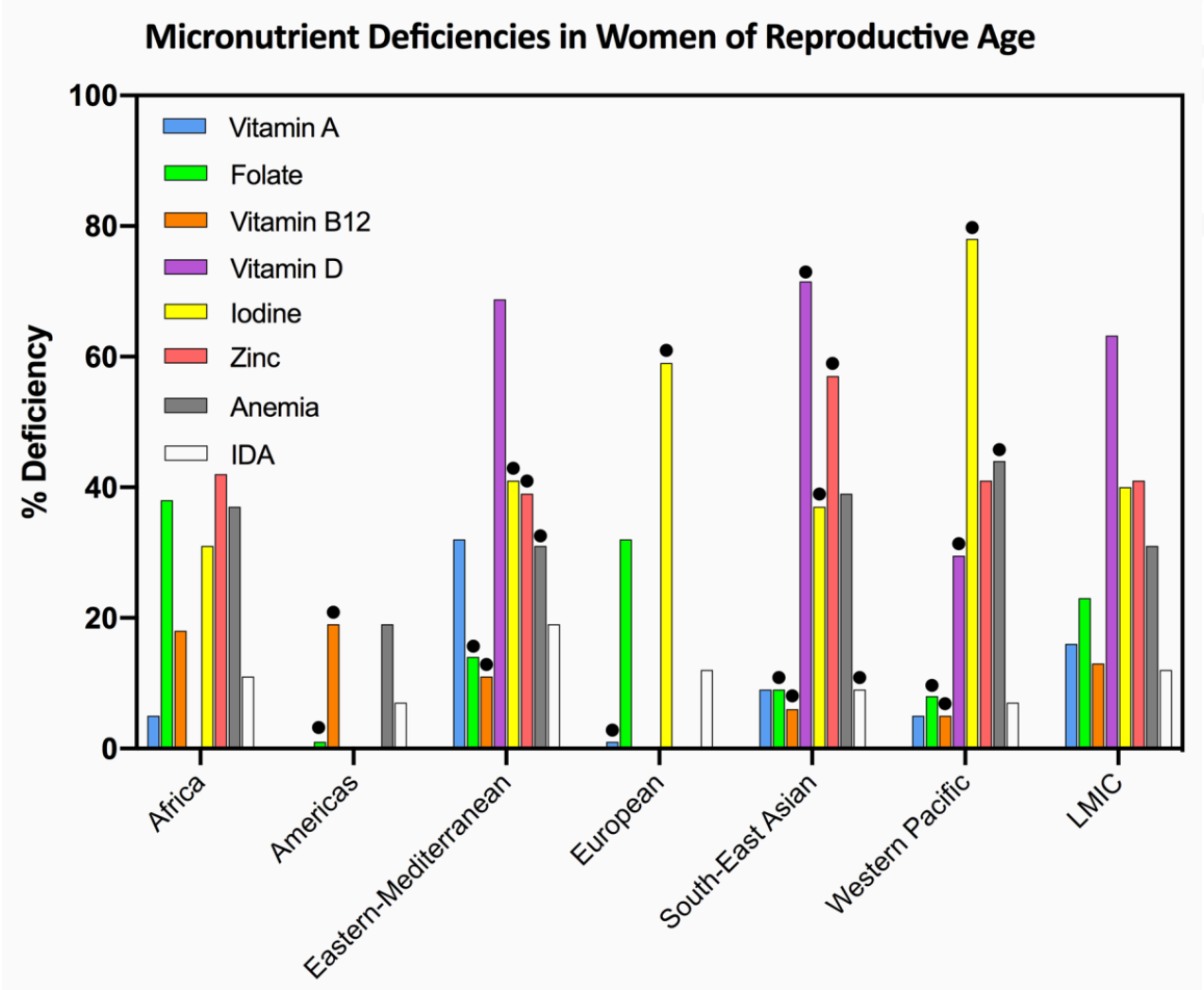




Whereas 88 countries have data on Anemia (based on Hemoglobin) in pre-school children; only 38 countries have data on Iron Deficiency Anemia in preschool children

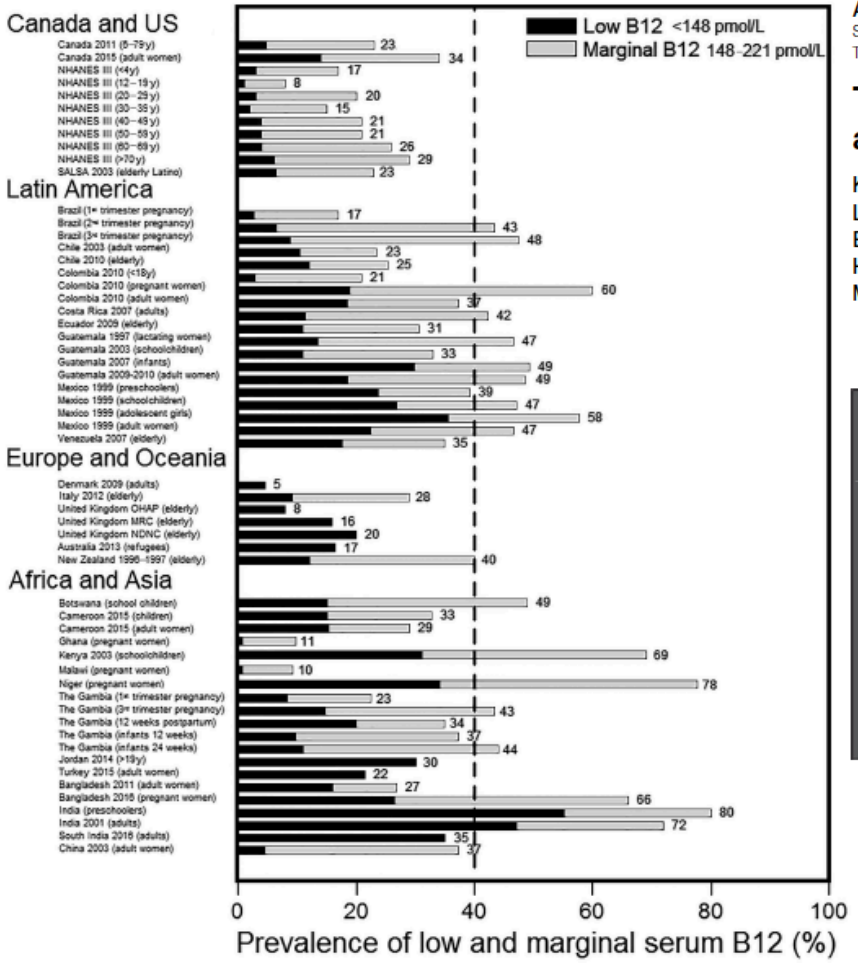
Recent estimates of micronutrient deficiencies in women of reproductive age by region

- The most common deficiencies among women of reproductive age are iron, zinc, vitamin D, and folate
- Depending on the context, deficiencies of vitamin A, vitamin B12 and iodine may be common as well



Bourassa M, Osendarp S, Adu-Afarwuah S, et al. Review of the Evidence Regarding the Use of Antenatal Multiple Micronutrient Supplementation in Low- and Middle-Income Countries. NYAS Journal (2019)

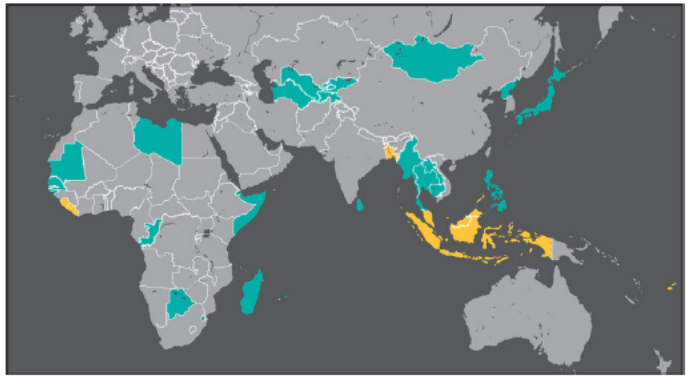
Recent reviews have compiled evidence on micronutrients currently not (sufficiently) covered in the VMNIS



ANNALS OF THE NEW YORK ACADEMY OF SCIENCES
Special Issue: *Global Prevalence and Disease Burden of Thiamine and Vitamin D Deficiencies*
TECHNICAL REPORT

Thiamine deficiency disorders: diagnosis, prevalence, and a roadmap for global control programs

Kyly C. Whitfield,[1] Megan W. Bourassa,[2] Bola Adamolekun,[3] Gilles Bergeron,[2] Lucien Bettendorff,[4] Kenneth H. Brown,[5] Lorna Cox,[6] Aviva Fattal-Valevski,[7] Philip R. Fischer,[8] Elizabeth L. Frank,[9] Laurent Hiffler,[10] Lwin Mar Hlaing,[11] Maria Elena Jefferds,[12] Hallie Kapner,[13] Sengchanh Kounnavong,[14] Maral P.S. Mousavi,[15] Daniel E. Roth,[16] Maria-Nefeli Tsaloglou,[17] Frank Wieringa,[18] and Gerald F. Combs Jr.[19]



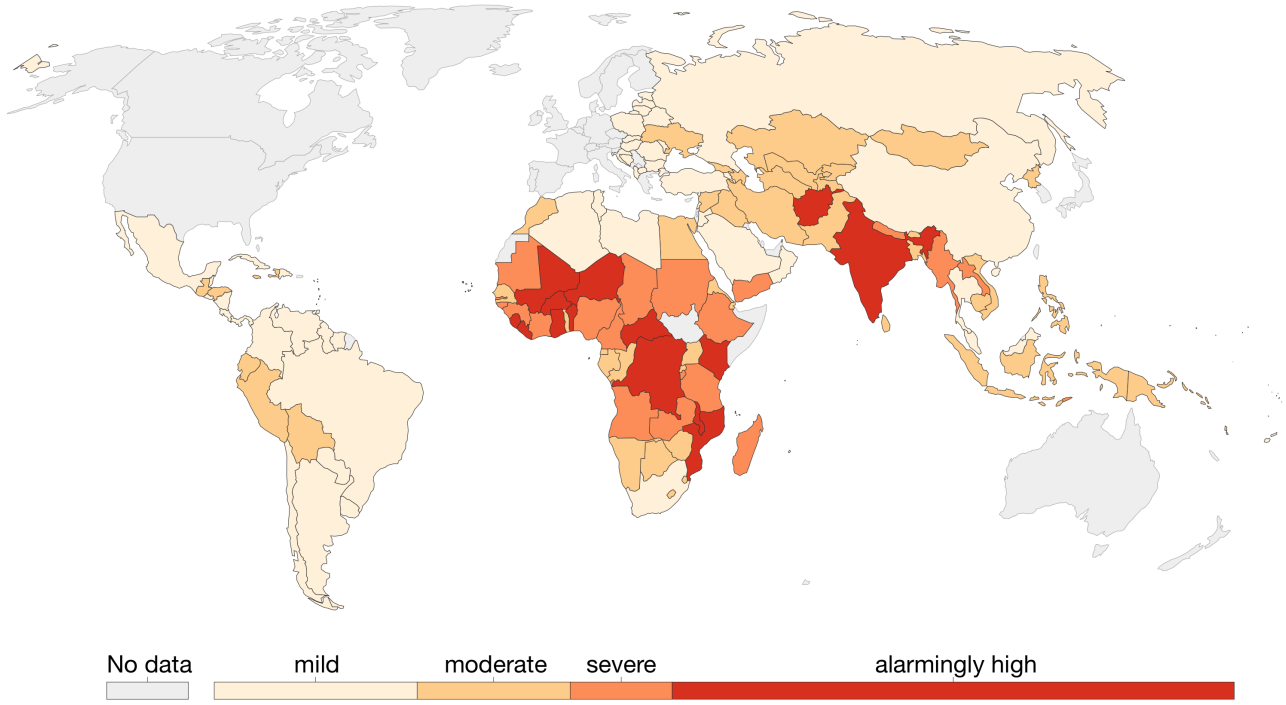
Allen LH, Miller JW, de Groot L, Rosenberg IH, Smith AD, Refsum H, Raiten DJ. Biomarkers of Nutrition for Development (BOND): Vitamin B-12 Review. J Nutr. 2018Dec 1;148(suppl_4):1995S-2027S. doi: 10.1093/jn/nxy201. PubMed PMID: 30500928;PubMed Central PMCID: PMC6297555.

Hidden Hunger Index based on an average of prevalence estimates of stunting, anemia due to Iron Deficiency and Vitamin A deficiency:

Global Hidden Hunger Index in pre-school children

Global Hidden Hunger Index scores in pre-school (aged under-5) children (GHI-PD) over the period 1999-2009. Hidden Hunger Index (HHI-PD) for preschool-age children is calculated as the average of three deficiency prevalence estimates: preschool children affected by stunting, anemia due to iron deficiency, and vitamin-A deficiency. The HHI-PD score ranged between the best and worst possible scores of 0 and 100, respectively. Applying arbitrary cut-offs, HHI-PD scores between 0 and 19.9 were considered mild, 20-34.9 as moderate, 35-44.9 as severe, and 45-100 as alarmingly high.

Our World in Data



Source: Hidden Hunger Index in pre-school children - Muthayya et al. (2013)

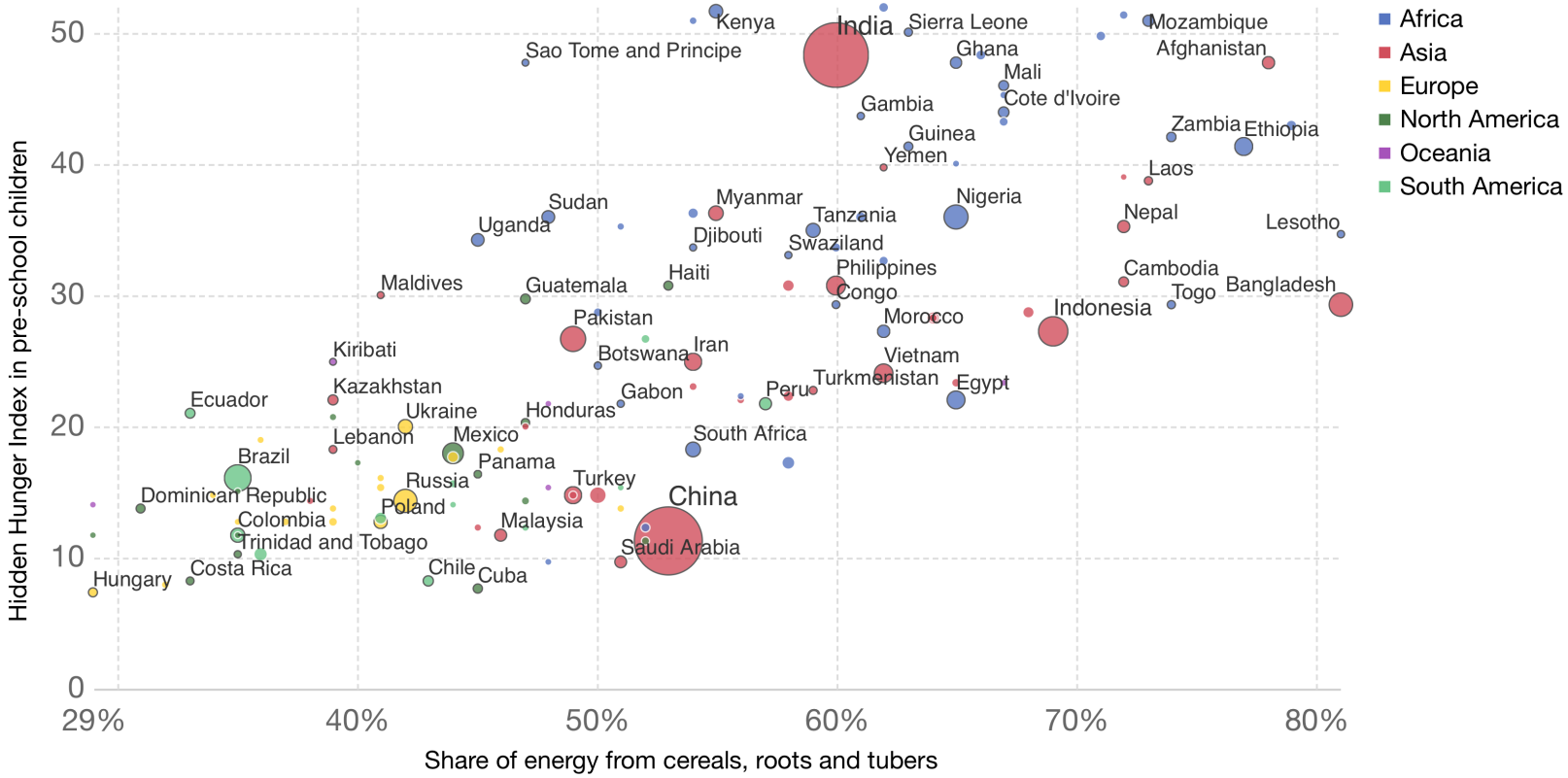
OurWorldInData.org/micronutrient-deficiency/ • CC BY

Hidden Hunger Index correlates strongly with poor dietary diversity

Hidden Hunger Index vs. share of energy intake from cereals, roots and tubers, 2009

Our World in Data

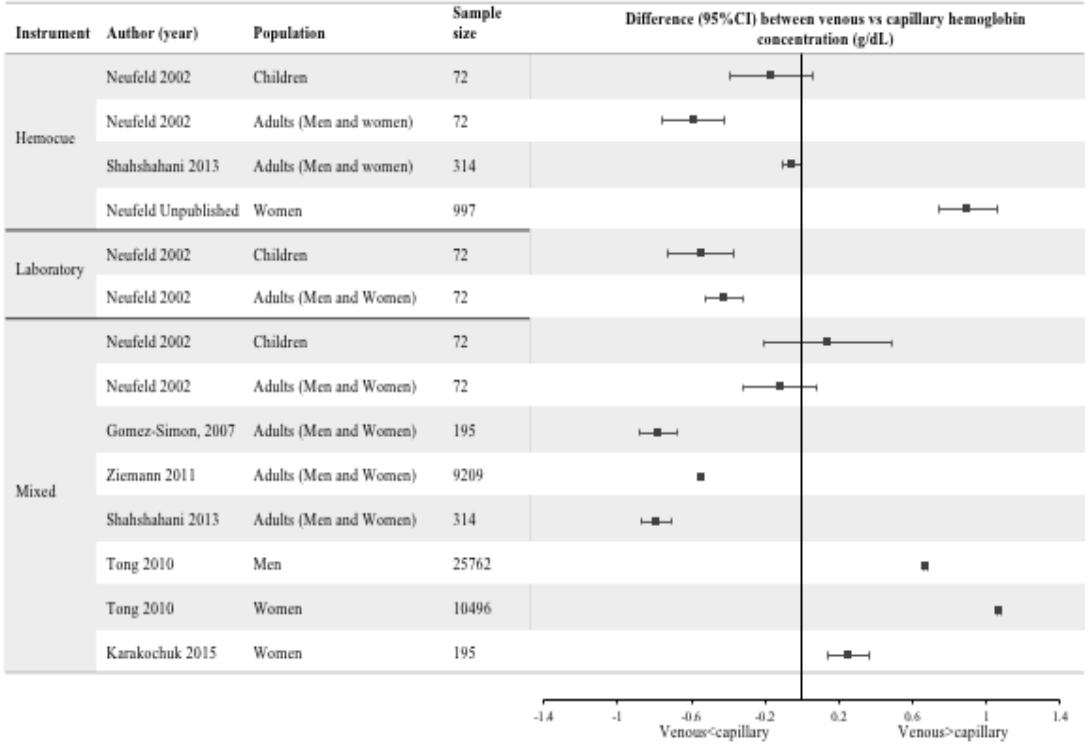
The Hidden Hunger Index in pre-school children (HHI-PD), measured as an index of three deficiency prevalence estimates: preschool children affected by stunting, anemia due to iron deficiency, and vitamin-A deficiency, measured against the share of energy intake derived from cereals, roots and tubers (an indication of poor dietary diversity) in a given population. The HHI-PD score ranges between the best and worst possible scores of 0 and 100.



Source: Share of energy from cereals, roots and tubers - FAO (2017), Hidden Hunger Index in pre-school children - Muthayya et al. (2013)
OurWorldInData.org/micronutrient-deficiency/ • CC BY

Not just a lack of data, the quality of data varies as well:

- Variability in Hemoglobin data collected through capillary vs venous blood samples:



- Lower cut-offs to define zinc deficiency for fasting vs non-fasting serum zinc concentrations:

Time of day and fasting status	Suggested lower cutoffs for serum zinc concentration (µg/dL)[1]		
	<10 years	≥10 years	
	Males and females	Non-pregnant females	Males
Morning, fasting[2]	not available	70	74
Morning, non-fasting	65	66	70
Afternoon, non-fasting	57	59	61

[1] For conversion to µmol/L, divide by 6.54.
[2] Fasting is defined as no food or beverage consumption for at least 8 hours.

Neufeld et al. Anemia diagnosis in venous and capillary blood: biological basis and policy (submitted).
IZINCG Technical Brief (2012)

What causes this significant data gap in micronutrient deficiencies:

- Costs and complexity of collection, transportation and laboratory analyses
- Lack of guidance, standardized methodologies and technical support
- Capacity: training of staff and technical know-how

- Demographic Health Surveys (DHS) do not routinely collect data on micronutrient deficiencies, other than anemia and intakes of vitamin A- and iron-rich foods

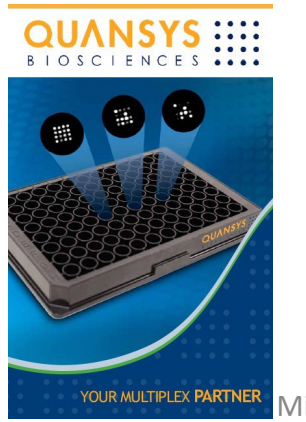
The DHS Program
Demographic and Health Surveys

Efforts are underway to improve the routine collection of micronutrient status data through large-scale surveys

- CDC has published micronutrient field surveys
- OpeN-Global compiles much needed information on nutrition biomarkers including methods of assessment, laboratory methods and SOPs
- DHS will integrate micronutrient status assessment for the first time in upcoming Rwanda survey
- New methods to collect data on multiple biomarkers have been developed but are currently not used in surveys

OpeN Global

Open access knowledge hub of
Nutrition biomarkers for
Global health



Micronutrient Forum looks forward to contribute to filling the data-gap in micronutrient deficiencies by:

- Fostering collaboration among micronutrient interest groups
- Generating, synthesizing, interpreting and disseminating knowledge into practical field guides, manuals and modules:
  - With BMGF: development of Target Product Profiles for specimen collection and analytical devices
  - Develop and pilot-test field manuals and micronutrient modules for inclusion in large-scale survey methodologies
  - Refine the process to estimate burden and impact of micronutrient malnutrition in Global Burden of Disease database
- Mobilize stakeholders to accelerate action and advocacy

What micronutrients are most limiting and where?

- Staggering data gap in micronutrient nutrition

- National food balance sheets used to describe the global estimates of micronutrient adequacies, showing global inadequate intakes of calcium, iron, vitamin A, and zinc, particularly in, *but not restricted* to, LMIC.

- The recently launched WHO Micronutrient Database (VMNIS) has recently been updated

- Several efforts have been undertaken or are currently planned to fill the data-gap in micronutrient malnutrition

Micronutrient Forum 5th Global Conference

Bangkok

Building New Evidence and Alliances for Improving Nutrition

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