

# Food choice and access to healthy diets: Evidence from food prices and diet costs worldwide

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National Academies of Sciences, Engineering and Medicine, Washington DC

# Understanding food choice and dietary patterns in the U.S. can be informed by data on access to healthy diets worldwide

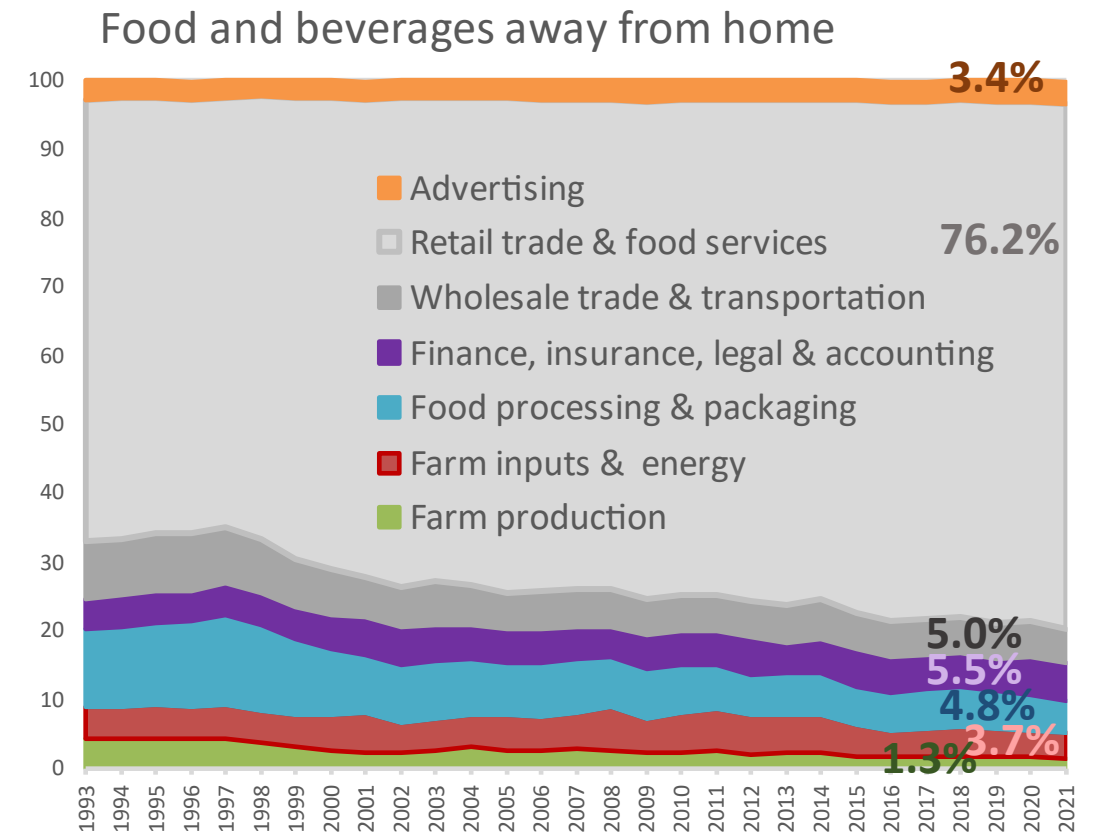
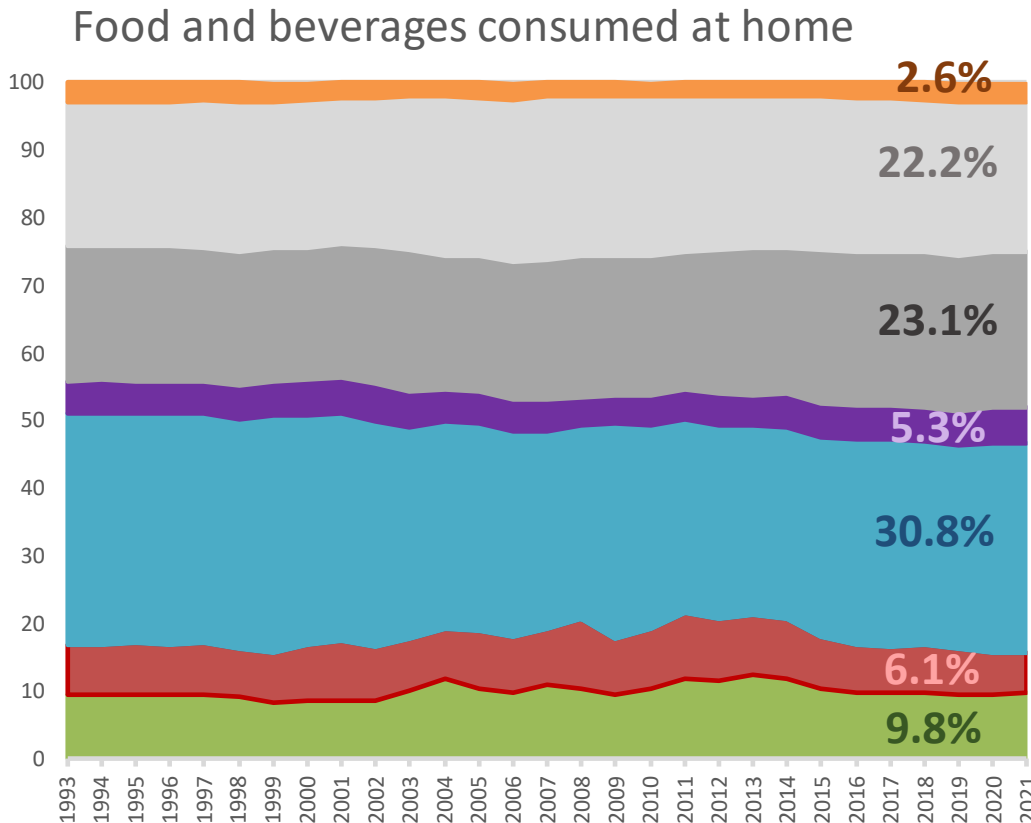
- **Many studies address revealed preferences and effective demand for each type of food**
  - People want healthy food, but may not know how each type of food will affect them and have other goals as well
  - Economists explain observed dietary patterns in terms of three factors:
    - Prices of available foods
    - Incomes available for food
    - Choice among affordable options, driven by preferences, food culture & health beliefs, meal preparation costs etc.
  - Preferences must be inferred from food choice among affordable options, at each set of prices and incomes
    - Price and income elasticities for observed consumption, revealed through *demand system estimation*
    - Willingness to pay for different items under different circumstances, revealed by *food choice experiments*
- **Poor diets could be caused by unaffordability, or by food choice among affordable options**
  - Since 2016, our [Food Prices for Nutrition](#) project has developed least-cost diets for monitoring access & affordability
  - Since 2020, these “Cost of Healthy Diets” metrics have been increasingly adopted to inform intervention
    - Data, results and software tools are downloadable from [Tufts University](#), the [FAO](#) and the [World Bank](#)
  - Monitoring affordability of least-cost healthy diets is designed to diagnose obstacles and guide new investments
    - Where prices for least-cost items are high, need better supply and distribution to *reduce costs*
    - Where incomes available to buy food is low, need better jobs or assistance to *raise affordability*
    - If people could buy a healthy diet but do not, need to address food preferences to *improve food choice*

# Food costs for consumers are mostly post-harvest services

Share retail food costs by stage of production and distribution in the U.S., 1993-2021

*When we buy food, we pay a lot for brands & services!*

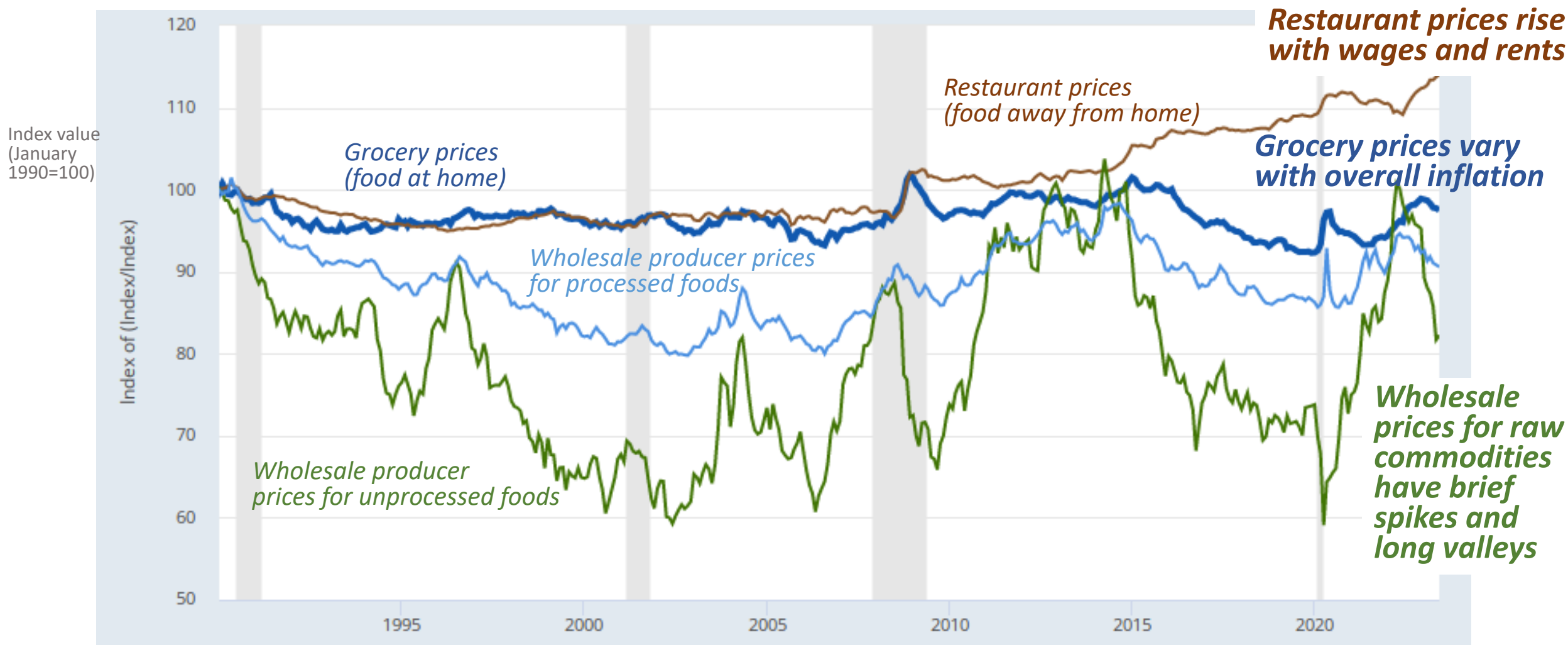
Cumulative percent of consumer price



Note: Author's calculations. Data shown are from the USDA Economic Research Service (2023), *Food Dollar Series*. Last updated Feb. 15, 2023, available at <https://www.ers.usda.gov/data-products/food-dollar-series>. Implied total spending on food advertising is roughly \$60 billion per year, more than the NIH and CDC budgets combined. (Overall food spending is about \$6,200 per person, about half our total health-care spending.) The FAO has piloted a global version of these data based on Yi et al. (2021) "Post-farmgate food value chains make up most of consumer food expenditures globally" in [Nature Food](#), with downloadable data for a few countries available in FAOSTAT at <https://www.fao.org/faostat/en/#data/GFDI>.

# Food prices are more variable for farmers than consumers

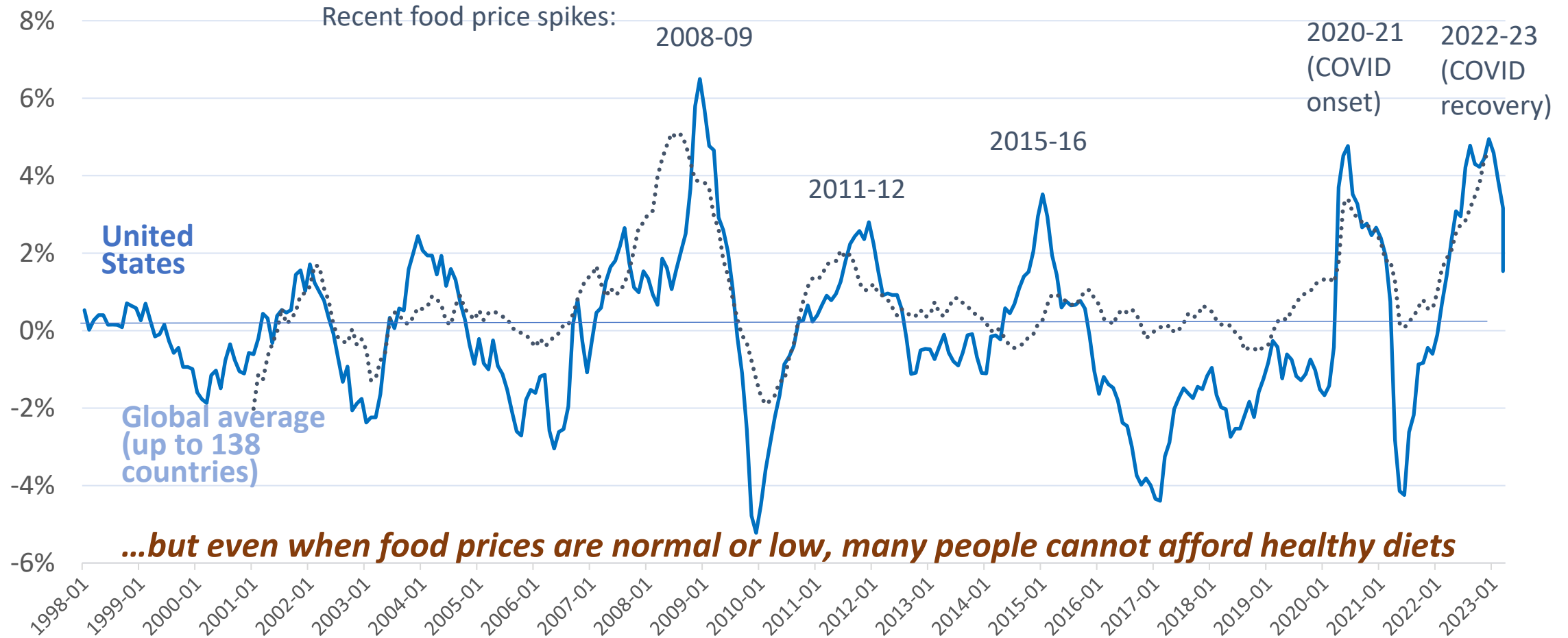
Consumer prices for groceries and restaurants vs. wholesale costs, Jan 1990 – June 2023



Note: Author's calculations. Data shown are from the US Bureau of Labor Statistics, as the average for each category relative to the overall U.S. consumer price index for all goods and services. Data to June downloaded Aug 5<sup>th</sup> 2023, with the latest updated data available from <https://fred.stlouisfed.org/graph/?g=12MMI>.

# Food price spikes cause brief but damaging food crises

Average rise in retail food prices relative to all other goods and services over previous 12 months in the U.S. and worldwide, Jan. 1998 - June 2023



Note: Author's calculations. U.S. data are calculated from the Bureau of Labor Statistics (updates: <https://fred.stlouisfed.org/graph/?g=12Myr>). Global data are from the IMF, averaging up to 138 countries reporting monthly consumer price indexes (CPI) for food and for all goods and services, Jan. 2000 through Dec. 2022. Each observation is the average monthly rise over the previous 12 months, times 12 to obtain an annualized value. Number of countries rises from 51 in Jan 2000 to 95 in 2005 and then 138 from 2015 onwards. Raw data for all countries are at <https://data.imf.org>.

# New global metrics are tracking the cost and affordability of healthy diets



The Food Prices for Nutrition project monitors access to healthy diets using the least expensive locally available foods as a kind of price index, measuring the cost of food as an input to health

Our aim is to distinguish among barriers to healthy eating  
We find a ladder of diet costs for nutrient and other food attributes

*For actual food choice among affordable options, observed consumption often displaces healthy items with other foods*

For SOFI 2022, the updated standard for the Cost of a Healthy Diet (CoHD) is a **“Healthy Diet Basket”** of the 11 least-cost items from 6 food groups

Actual global food spending =  
**\$5.46/day**

For SOFI 2020, we used 10 countries’ guidelines for the Cost of Recommended Diets (CoRD)

**Healthy diets**  
Meets national dietary guidelines by food group  
Global ave. in 2017 = **\$3.31/day**

*Our AJAE 2018 article introduced a Cost of Diet Diversity (CoDD) metric and many other studies analyze the cost of nutrients*



**Nutrient adequacy**  
Avoids deficiency or excess of essential macro- and micronutrients  
Global average in 2017 = **\$2.46/day**

**Daily energy**  
Meets only calorie needs, for short-term survival and physical work  
Global average in 2017 = **\$0.83/day**



ASSA Meeting Invited Paper | Open Access | CC BY

Measuring the Affordability of Nutritious Diets in Africa: Price Indexes for Diet Diversity and the Cost of Nutrient Adequacy

William A. Masters, Yan Bai, Anna Herforth, Daniel B. Sarpong, Fulgence Mishill, Joyce Kinabo, Jennifer C. Coates

SCIENCE ADVANCES | RESEARCH ARTICLE

ECONOMICS

Seasonality of diet costs reveals food system performance in East Africa

Yan Bai, Elena N. Naumova, William A. Masters\*

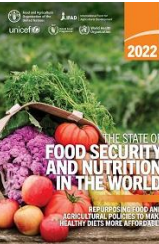
THE LANCET  
Planetary Health

Global variation in the cost of a nutrient-adequate diet by population group: an observational study

Yan Bai, Anna Herforth, William A Masters

Methods and options to monitor the cost and affordability of a healthy diet globally

Background paper for The State of Food Security and Nutrition in the World 2022



THE LANCET  
Global Health

Volume 8, Issue 1, January 2020, Pages e59-e66

Articles

Affordability of the EAT–Lancet reference diet: a global analysis

Kalle Hirvonen PhD <sup>a</sup>, Yan Bai MIB <sup>b</sup>, Derek Headey PhD <sup>d</sup>, Prof William A Masters PhD <sup>b, c, e, f</sup>



Food Policy  
Volume 99, February 2021, 101983



Cost and affordability of nutritious diets at retail prices: Evidence from 177 countries

Yan Bai <sup>a</sup>, Robel Alemu <sup>b, d</sup>, Steven A. Block <sup>b</sup>, Derek Headey <sup>c</sup>, William A. Masters <sup>a, d, e, f, g</sup>

# What foods are included in a least-cost healthy diet globally?



**Foods selected are the least expensive items being sold at the time and place of measurement**  
Each set of 11 items reaches the same Healthy Diet Basket targets for balance across 6 food groups

## Pakistan

**Animal source foods**  
(2 items, 150 kcal each)

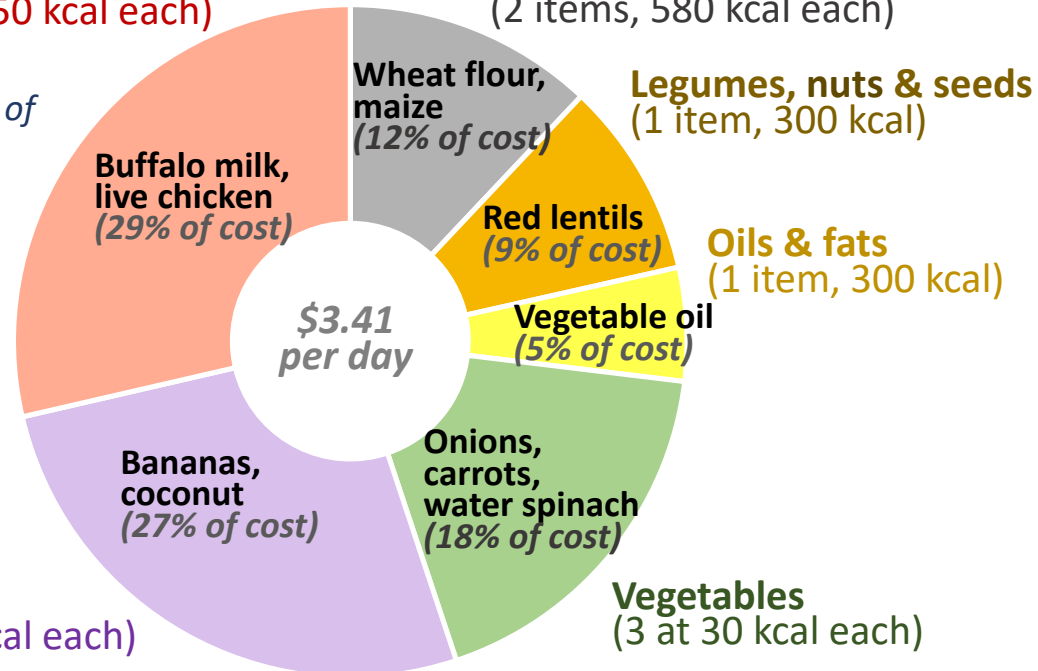
**Starchy staples**  
(2 items, 580 kcal each)

**Legumes, nuts & seeds**  
(1 item, 300 kcal)

**Oils & fats**  
(1 item, 300 kcal)

**Vegetables**  
(3 at 30 kcal each)

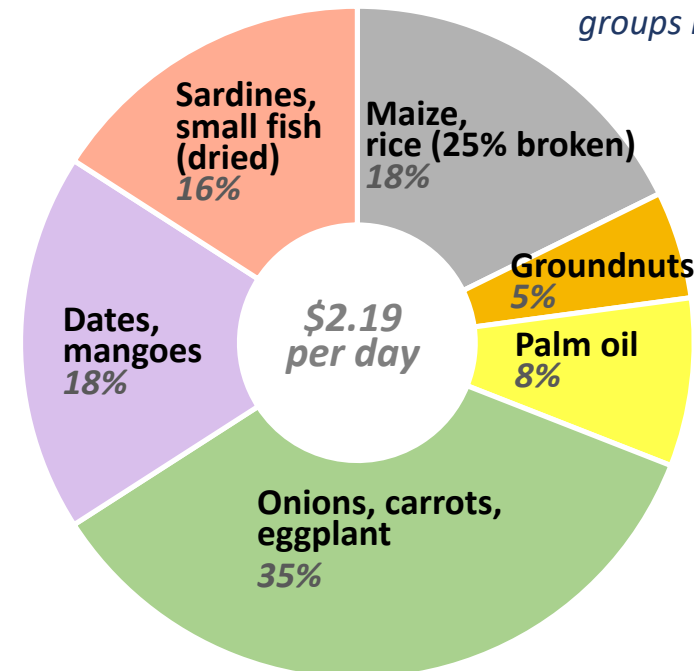
**Fruits**  
(2 at 80 kcal each)



## Senegal

*Items selected reflect local availability and price, delivering the same balance across food groups in all settings*

*All items shown are widely consumed in each country, but in very different quantities from these benchmark diets; in these countries actual diets are mostly starchy staples which results in undernutrition*



Note: Each item's cost is for a sufficient weight or volume to meet the HDB targets, based on matching item descriptions to food composition data. In food groups requiring multiple items, the lowest-cost foods are listed first. Item descriptions are standardized across countries, with its availability and national average price reported by each country's statistical agency to the International Comparison Program (ICP) for 2017. Cost levels are as published by FAO and the World Bank with methods detailed at Food Prices for Nutrition (2022). <https://sites.tufts.edu/foodpricesfornutrition>

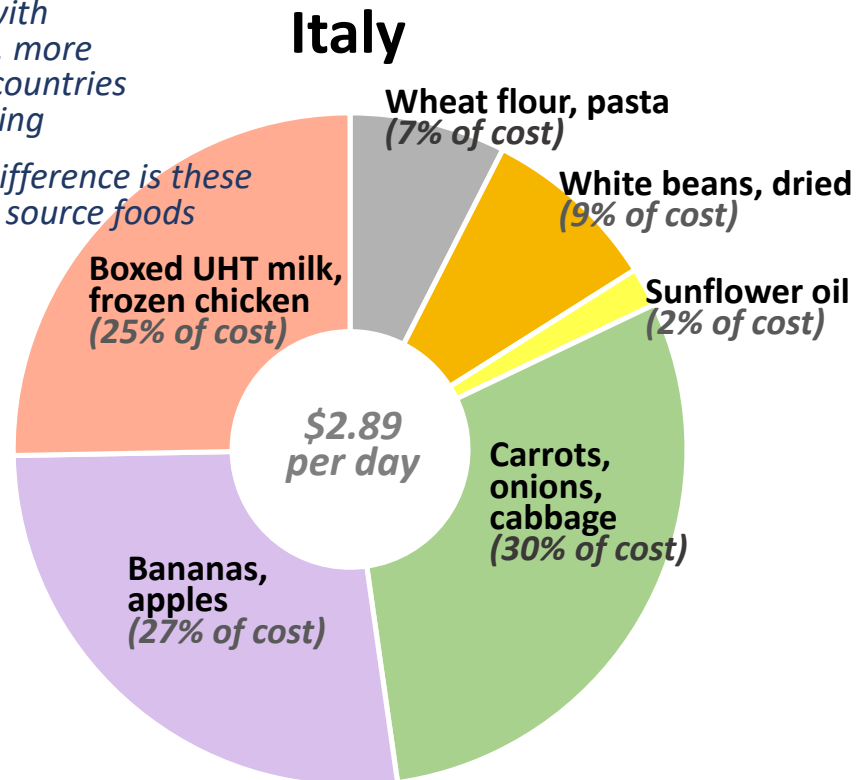
# What foods are included in a least-cost healthy diet globally?



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Each set of 11 items reaches the same Healthy Diet Basket targets for balance across 6 food groups

*Comparisons with higher-income, more industrialized countries are also revealing*

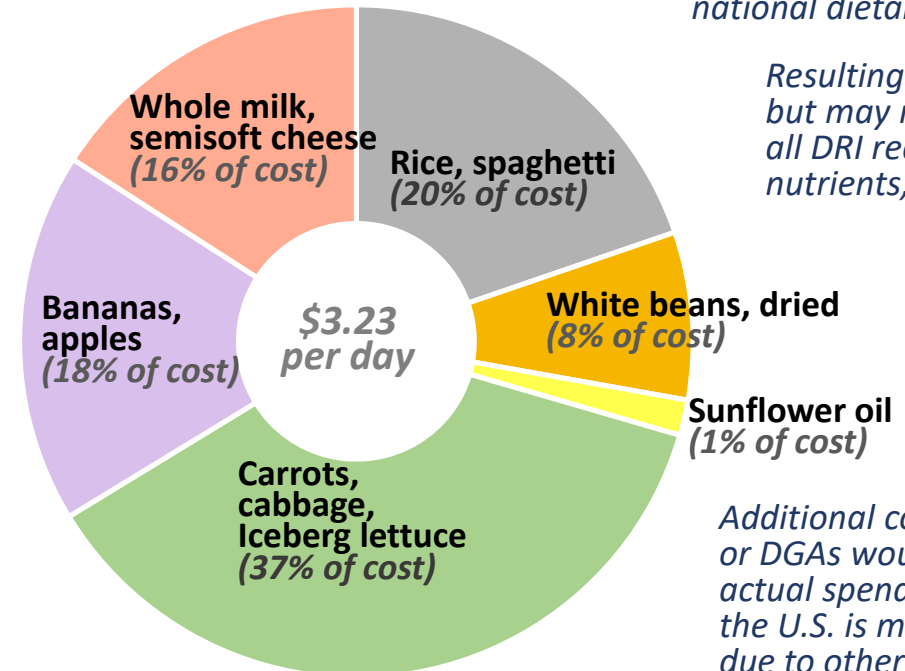
*Main difference is these animal source foods*



## United States

*The HDB target is designed for global monitoring, based on commonalities among national dietary guidelines.*

*Resulting diets are close but may not exactly meet all DRI requirements for nutrients, or the U.S. DGAs*



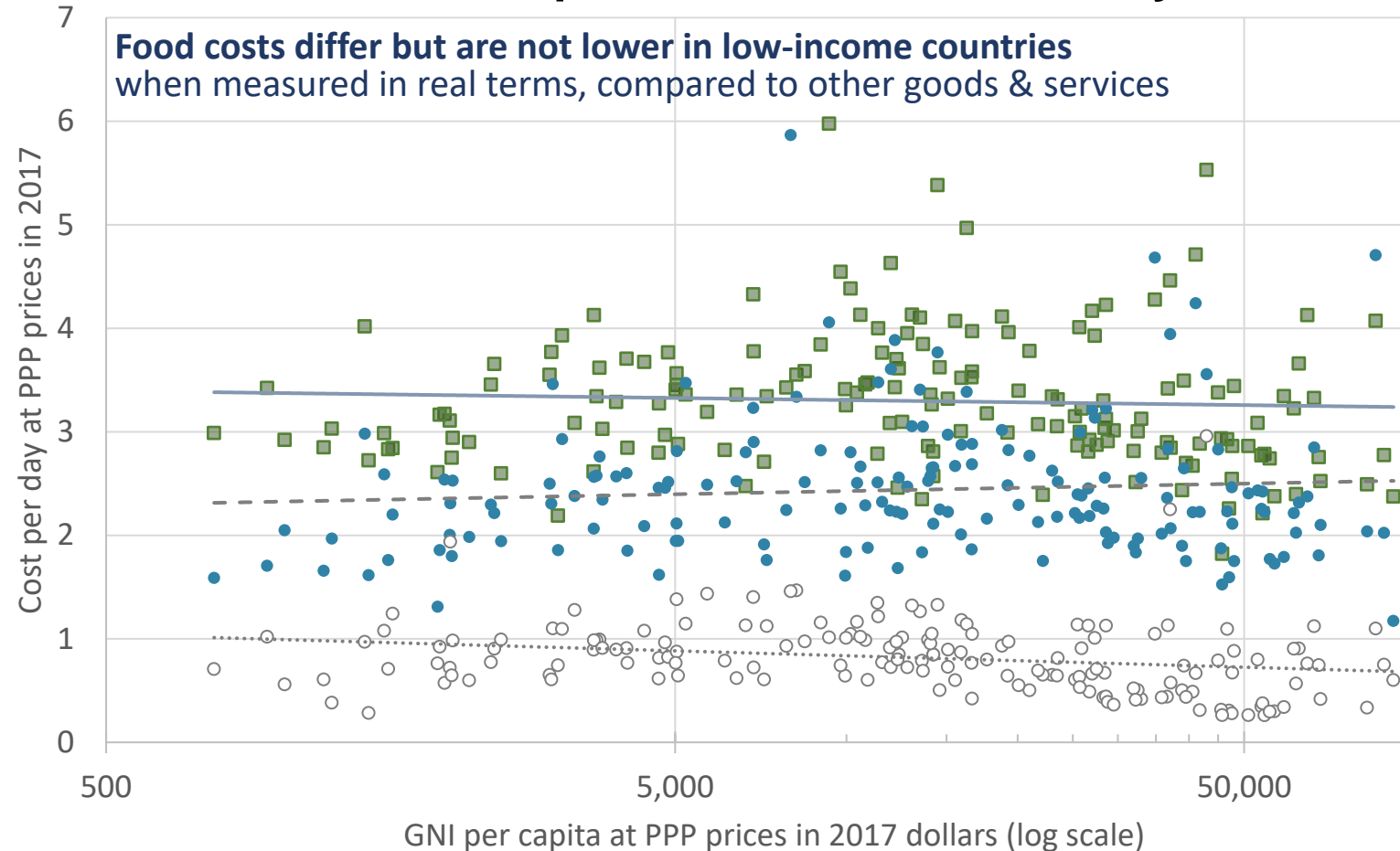
*Additional costs to meet DRIs or DGAs would be small, but actual spending in Italy or the U.S. is much greater due to other attributes of foods being purchased*

Note: Each item's cost is for a sufficient weight or volume to meet the HDB targets, based on matching item descriptions to food composition data. In food groups requiring multiple items, the lowest-cost foods are listed first. Item descriptions are standardized across countries, with its availability and national average price reported by each country's statistical agency to the International Comparison Program (ICP) for 2017. Cost levels are as published by FAO and the World Bank with methods detailed at Food Prices for Nutrition (2022). <https://sites.tufts.edu/foodpricesfornutrition>

# What have we discovered about the cost and affordability of healthy diets?



## Cost of the least expensive items for a healthy diet in 2017



Least-cost healthy diets are unaffordable for the very poor, about 3 billion people

*Based on overall food price inflation relative to incomes, real costs rose to \$3.66 in 2021, up from \$3.54 in 2020*

### Global average costs in 2017

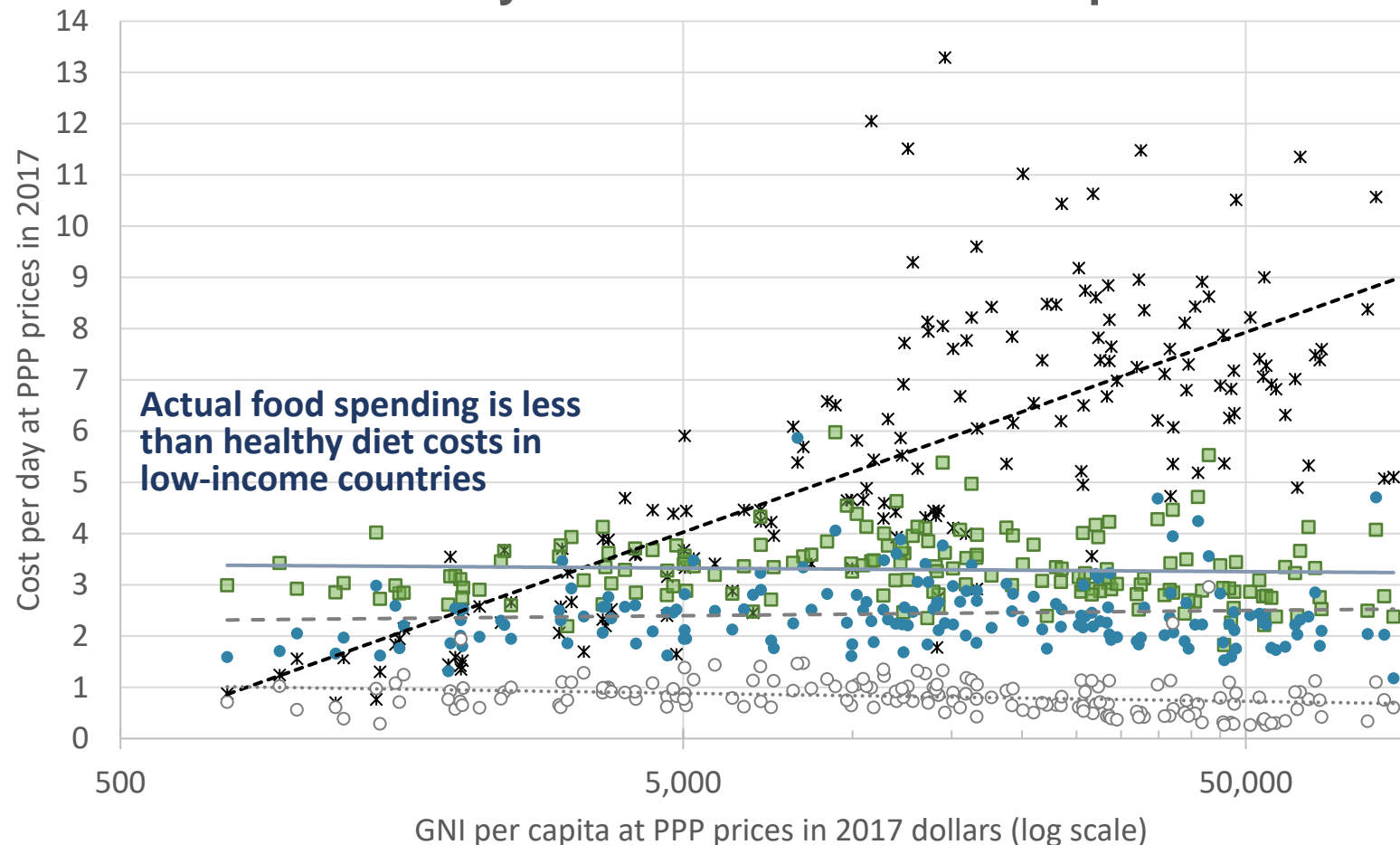
- Cost of a healthy diet [CoHD] **\$3.31**  
(meets dietary guidelines for overall health)
- Cost of a nutrient adequate diet [CoNA] **\$2.46**  
(within upper & lower bounds for nutrients)
- Cost of an energy sufficient diet [CoCA] **\$0.83**  
(sufficient calories for work each day)

Diet cost data are from FAO and the Food Prices for Nutrition project, using item prices reported by national statistical organizations through the International Comparison Program (ICP), downloaded from <https://databank.worldbank.org/source/food-prices-for-nutrition>, and national income (GNI) is from the World Development Indicators <https://databank.worldbank.org/source/world-development-indicators>. Guidelines are linear in the logarithm of income shown on the horizontal axis.

# How does actual spending on food compare to the cost of healthy diets?



## Least-cost healthy diets and actual food expenditure in 2017



Average food spending is much greater than least-cost healthy diets in middle- and high-income countries *...but that is the national average, many households in these countries cannot afford healthy diets*

## Global average costs in 2017

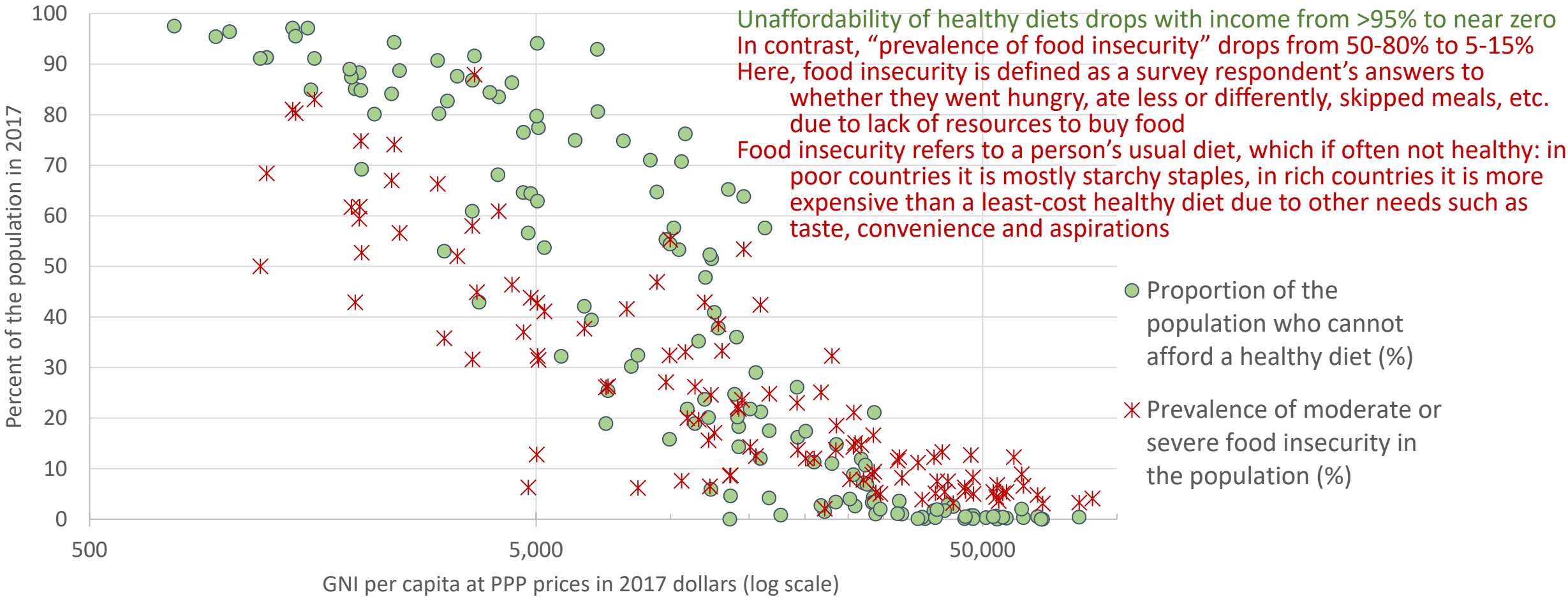
- \* Food expenditures (FoodExp) **\$5.64**  
(pursues many goals other than health)
- Cost of a healthy diet [CoHD] **\$3.31**  
(meets dietary guidelines for overall health)
- Cost of a nutrient adequate diet [CoNA] **\$2.46**  
(within upper & lower bounds for nutrients)
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# How does affordability of healthy diets relate to hunger and food insecurity?



Unaffordability of healthy diets and prevalence of food insecurity in 2017



Data shown are FAO estimates, downloaded from <https://databank.worldbank.org/source/food-prices-for-nutrition> for affordability of healthy diets, and from <https://databank.worldbank.org/source/world-development-indicators> for experience of food insecurity and national income (GNI).

# Conclusion: Improving dietary patterns can be informed by least-cost healthy diets



- **For about 3 billion people (40% of the global population), healthy diets remain unaffordable**
  - Nutrient-rich foods are more costly to grow and distribute than starchy staples, vegetable oil & sugar
  - At times and places where prices are unusually high, supply improvements can lower cost
  - Most unaffordability is due to low incomes, so healthier diets will require higher earnings or safety nets
- **For almost all Americans (and most people worldwide), healthy foods are “affordable” but not used**
  - Many factors beyond health drive food choice, as people transition from inadequacy to excess
    - overshooting on animal-source foods, sweeteners and oils, even for home-cooked meals
    - switching to food away from home and packaged items, leading to excess salt, refined grains etc.
  - Frontiers for future work include time use and cost of meal preparation, role of nonfood factors
- **Identifying least-cost items and diet costs helps guide intervention**
  - Which items have the most potential to improve affordability of healthy diets
  - Which people would need higher incomes or safety nets to afford healthy diets
  - How and why unhealthy foods enter to displace the items in least-cost healthy diets
    - many different interventions are likely needed, as discussed by others in this workshop

# Thank you!



Photo by Anna Herforth  
at Agbogloboshi market, Ghana

We thank the many price collectors and contributors to the diverse databases used in this work and are grateful for funding to the Bill & Melinda Gates Foundation and UKAid, as well as complementary funding from FAO.

**BILL & MELINDA**  
**GATES** *foundation*

  
Foreign, Commonwealth  
& Development Office



**Other slides**

# How do we define healthy diets to measure their cost and affordability?



## Use national dietary guidelines, in terms of food groups

- Meet target quantities of each food group needed for a healthy diet
- Allow substitution within energy balance, by converting volume and weight to calories

## Guidelines differ in details, but food group requirements are similar

- For CoRD (SOFI 2020), used median cost of 10 quantified guidelines from all UN regions
- Now in CoHD (SOFI 2022), a single Healthy Diet Basket from 31 guidelines with food guides
- Methods refined through many workshops with stakeholders in priority countries



### Definition of the Healthy Diet Basket

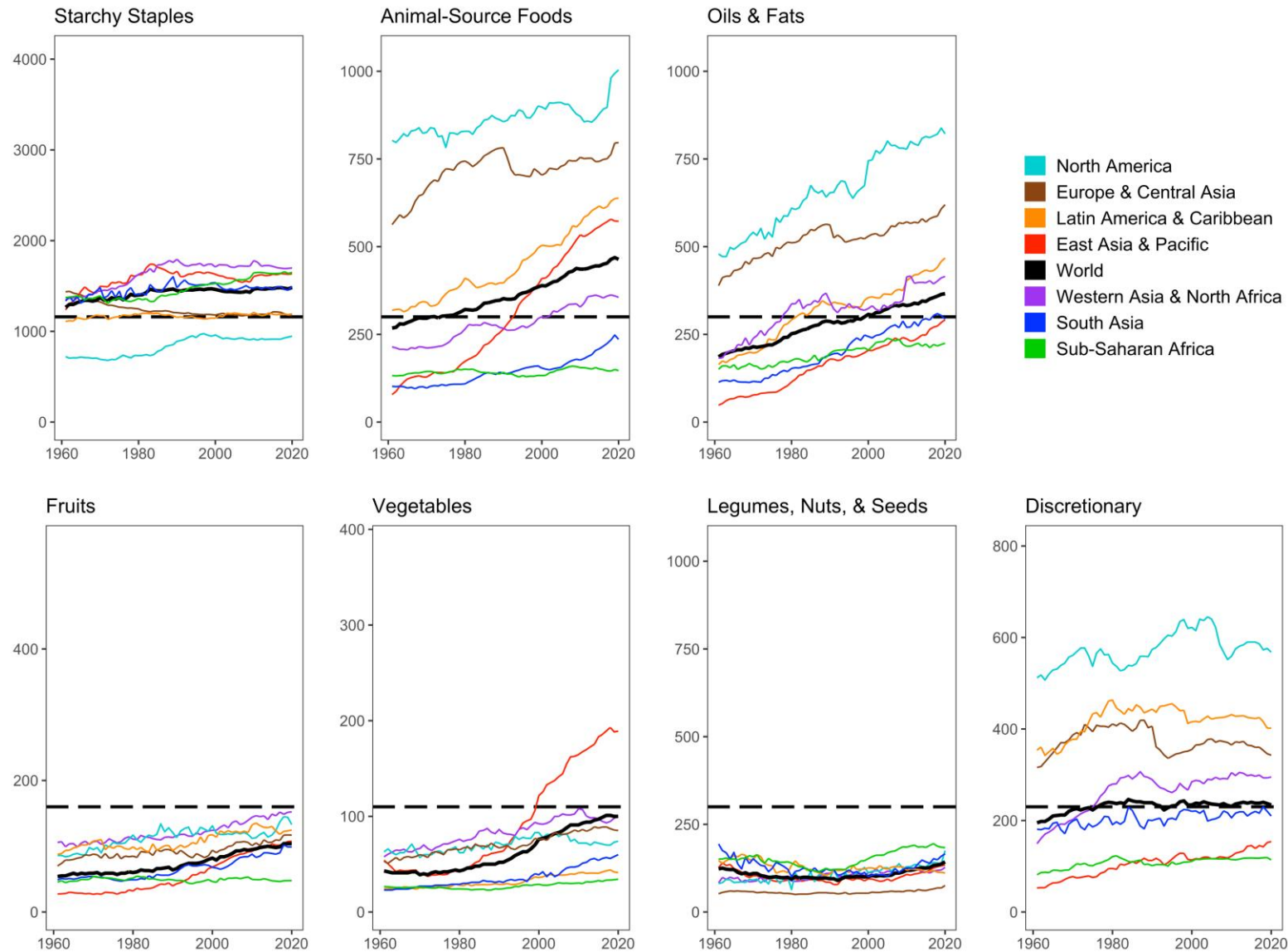
Food group	Number of items	Total energy (kcal)
Starchy staples	2	1,160
Vegetables	3	110
Fruits	2	160
Animal-source foods	2	300
Legumes, nuts & seeds	1	300
Oils and fats	1	300

Total: 2,330

### Quantities of food in the healthy diet

Typical weight (grams)	Typical volume (plate share)
322g dry rice	25%
270-400g veg.	25%
230-300g fruits	25%
210g egg	
85g dry bean	25%
34g oil	

# The foods required for a healthy diet are not yet available in the food supply; LAC is especially low in vegetables



Food supply data are from FAO Food Balance Sheets and show total daily kilocalories available per capita for food consumption in each geographic region, aggregated by HDB food group.