

# If it is not safe, it is not food

## Health implications of microbial hazards

Arie Havelaar

National Academies of Science, Engineering and Medicine

Food Forum

Washington DC; September 4, 2024



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# Disclosures



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## ○ Funding

- Bill & Melinda Gates foundation
- US Agency for International Development
- UK Foreign, Commonwealth & Development Office
- USDA National Institute for Agriculture
- US Centers for Disease Control

## ○ Consultancies

- World Health Organization
- University of Liverpool (Global Burden of Animal Diseases project)
- UK Food Standards Agency

# Outline



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- The global perspective
  - Disease burden of unsafe foods
  - Unsafe foods and malnutrition
- The US perspective
  - Health people 2030 goals
  - Food safety is mythical
  - Healthy foods are also the most risky foods
- Conclusions



# The Global Perspective



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# Food safety is a global public health problem



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## The burden of foodborne diseases is substantial

Every year foodborne diseases cause:

almost  
**in 10**  
people to fall ill

**33 million**  
healthy life years lost

Foodborne diseases can be deadly, especially in children <5

**420 000**  
deaths



Children account for  
**1/3**  
of deaths from  
foodborne diseases

**FOODBORNE DISEASES ARE PREVENTABLE.  
EVERYONE HAS A ROLE TO PLAY.**

For more information: [www.who.int/foodsafety](http://www.who.int/foodsafety)

**#SafeFood**

Source: WHO Estimates of the Global Burden of Foodborne Diseases, 2015.



World Health  
Organization



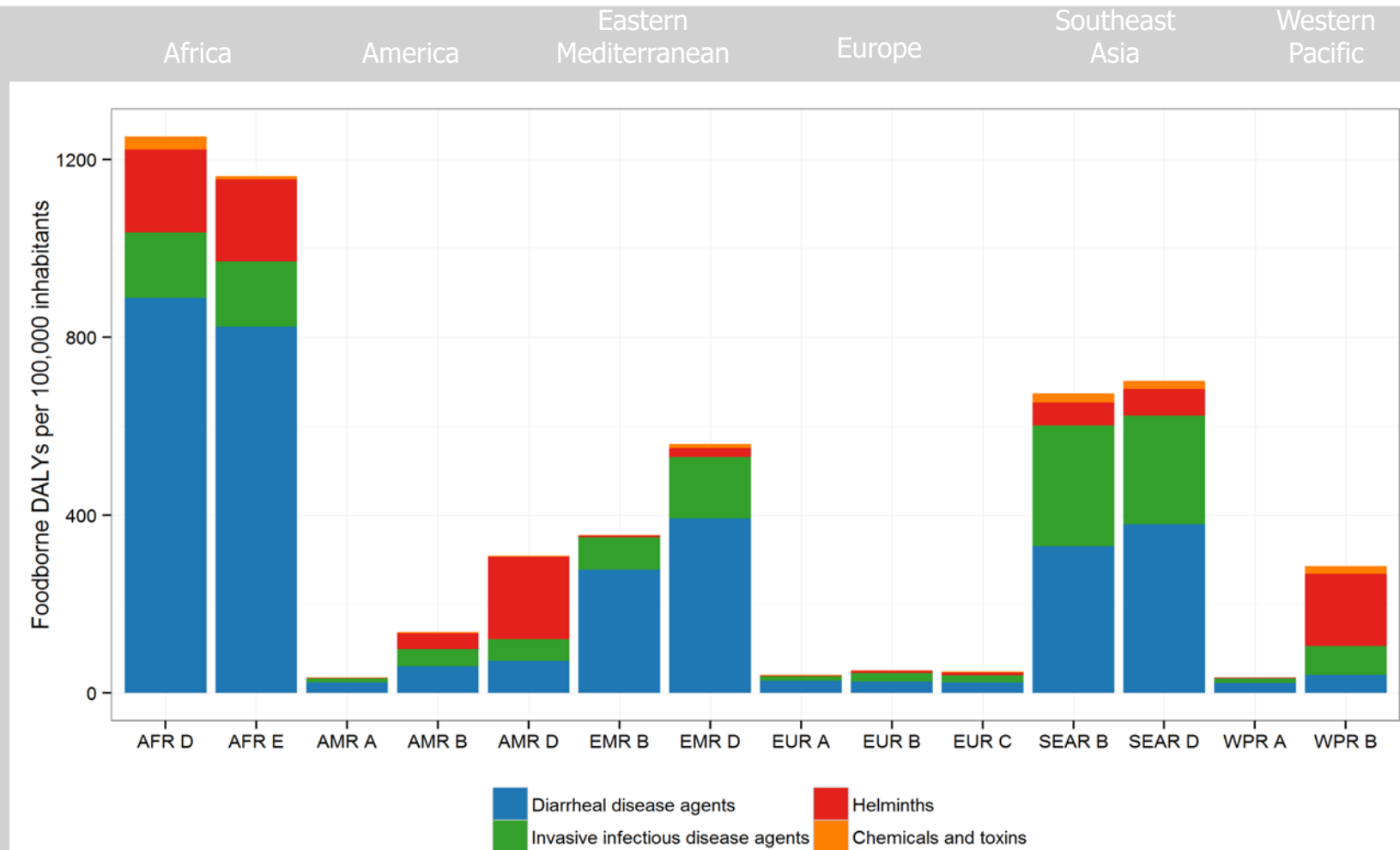
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# The greatest burden is in LMIC



# People living in the poorest areas of the world ...



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- ... make up 41% of the world population
- ... suffer from 53% of all foodborne illnesses
- ... succumb to 75% of foodborne deaths
- ... bear 72% of global foodborne DALYs





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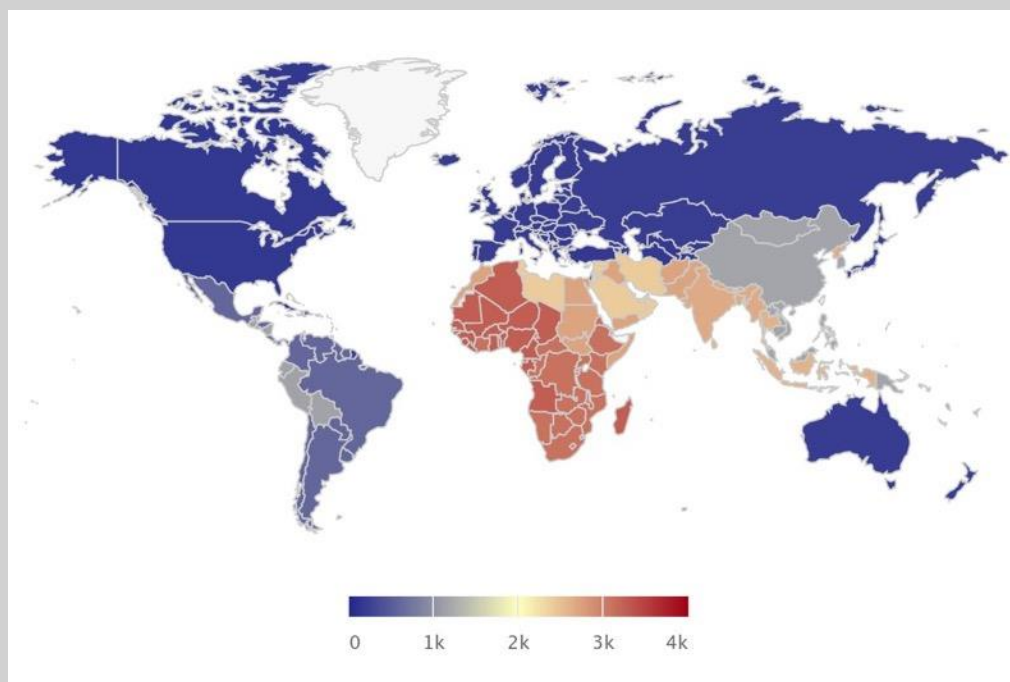
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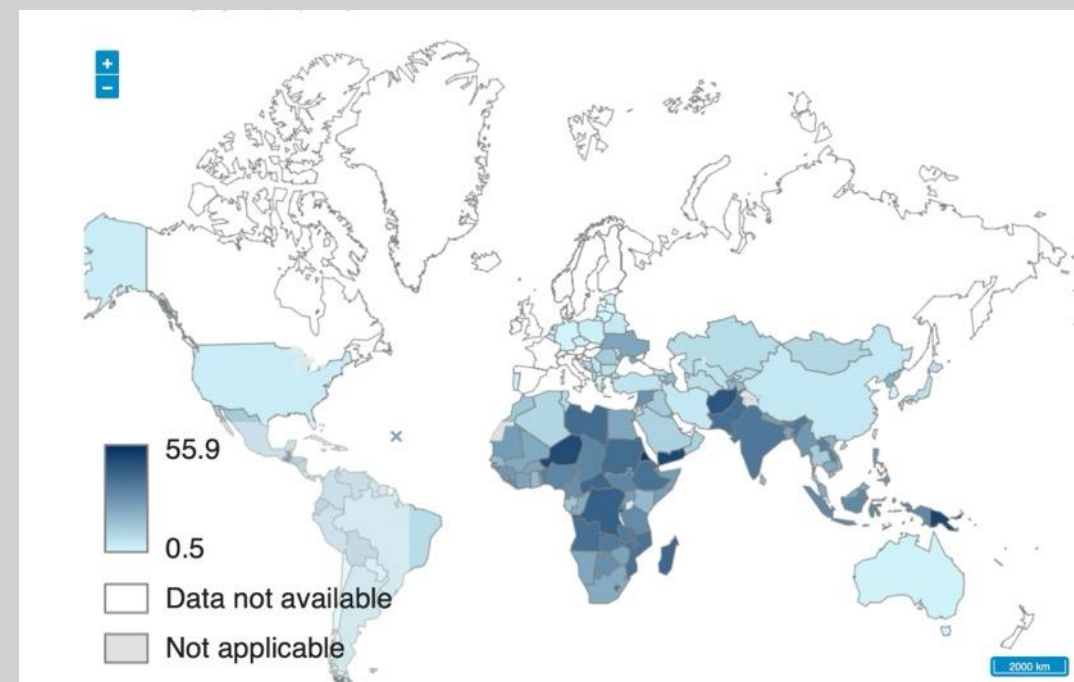
# Association between unsafe food and malnutrition (children under 5 years of age)

## Foodborne DALYs per 100,000



<https://www.foodbornediseaseburden.org/ferg/estimates>

## Stunting prevalence



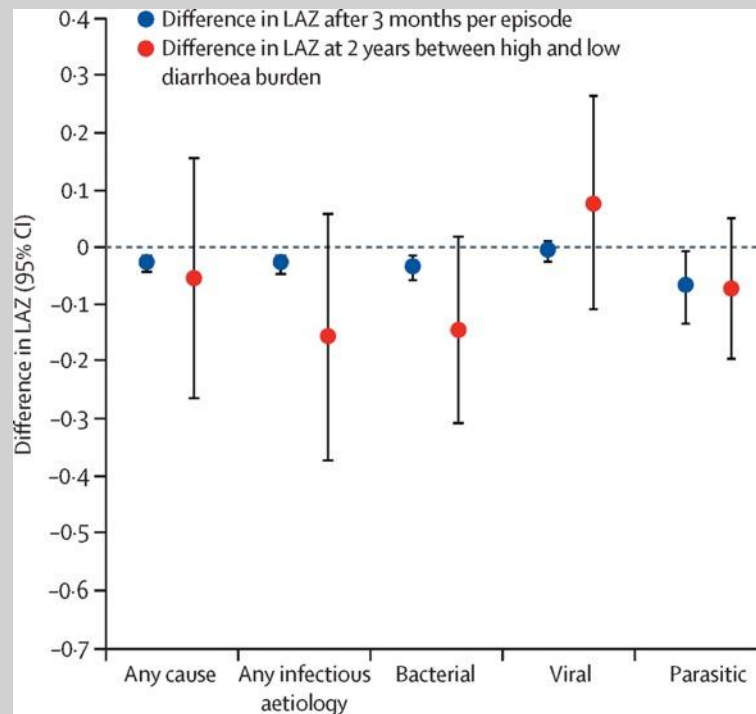
WHO Global Health Observatory



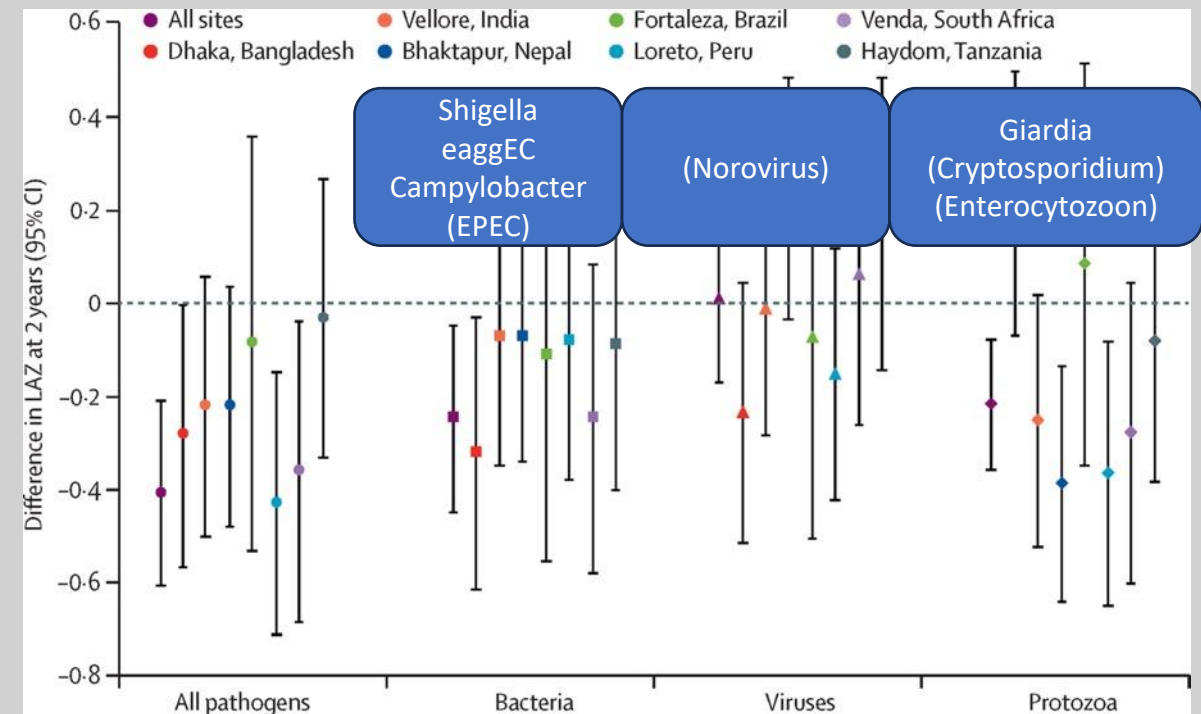


# Association is not causation – or is it?

## Diarrhoeal stools



## Non-diarrheal stools







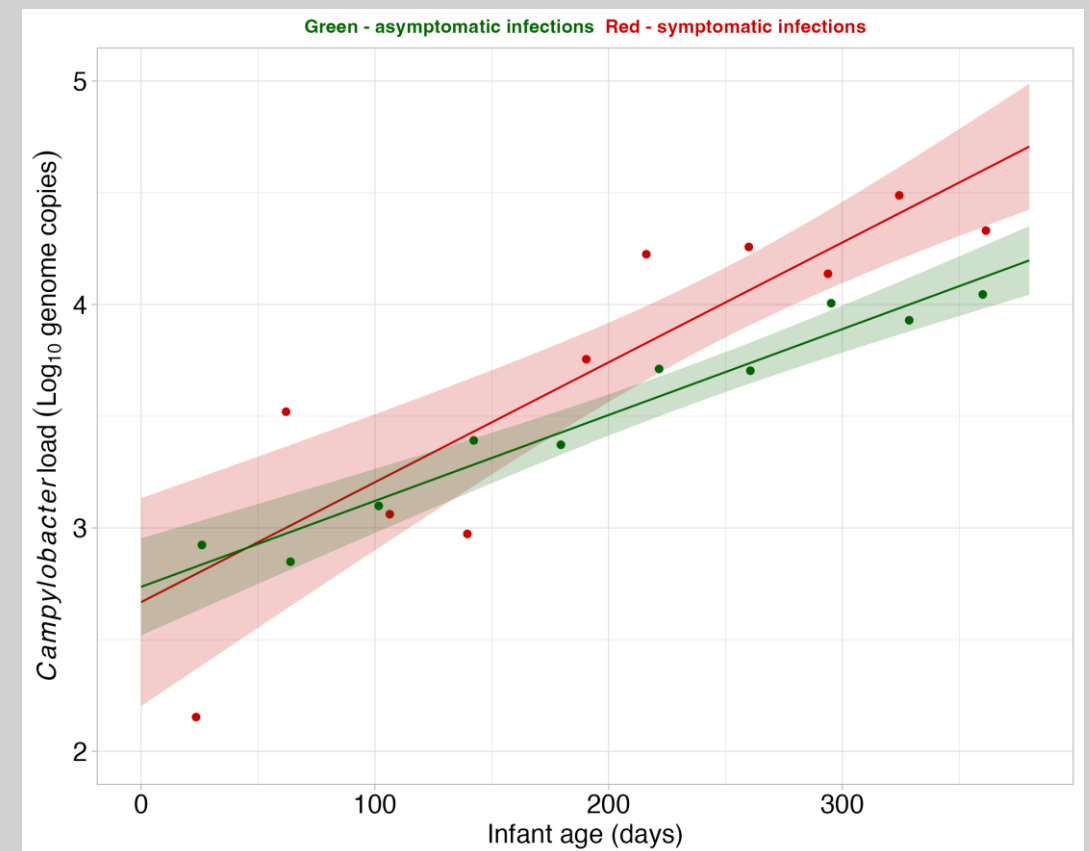
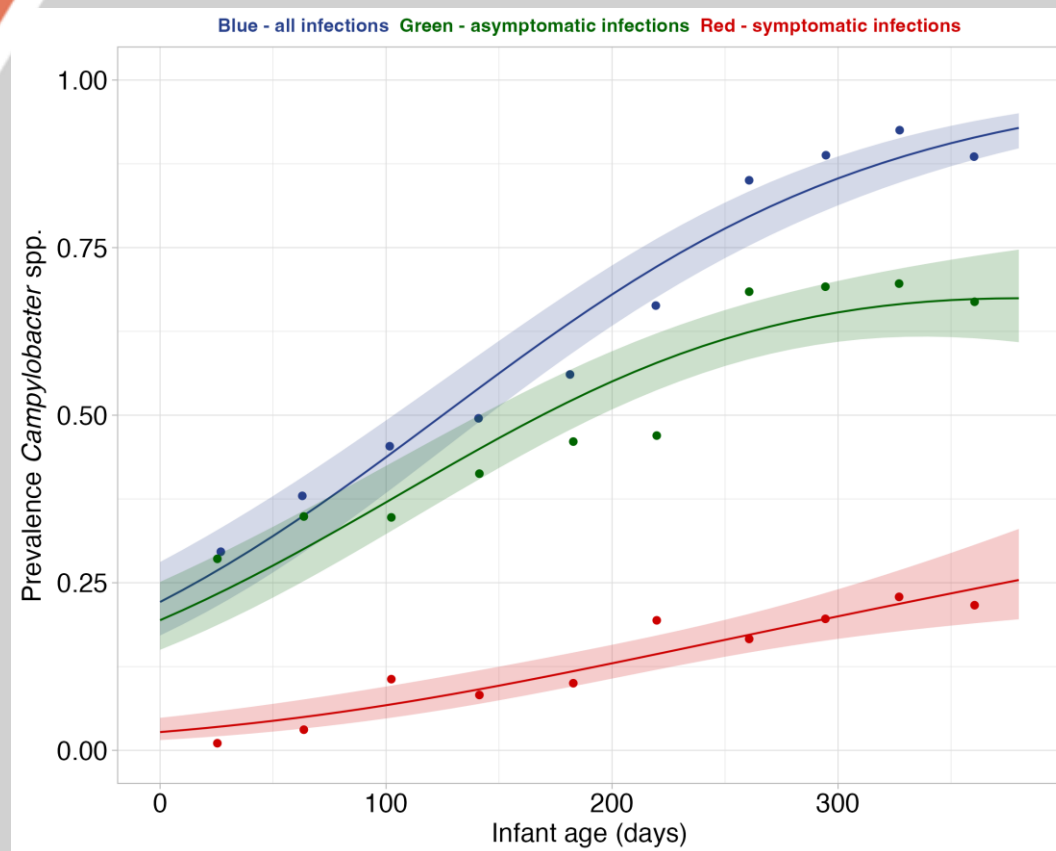
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# Prevalence and load of *Campylobacter* increase with infant age in Eastern Ethiopia



# Food, contaminated by hands, is the main transmission pathway

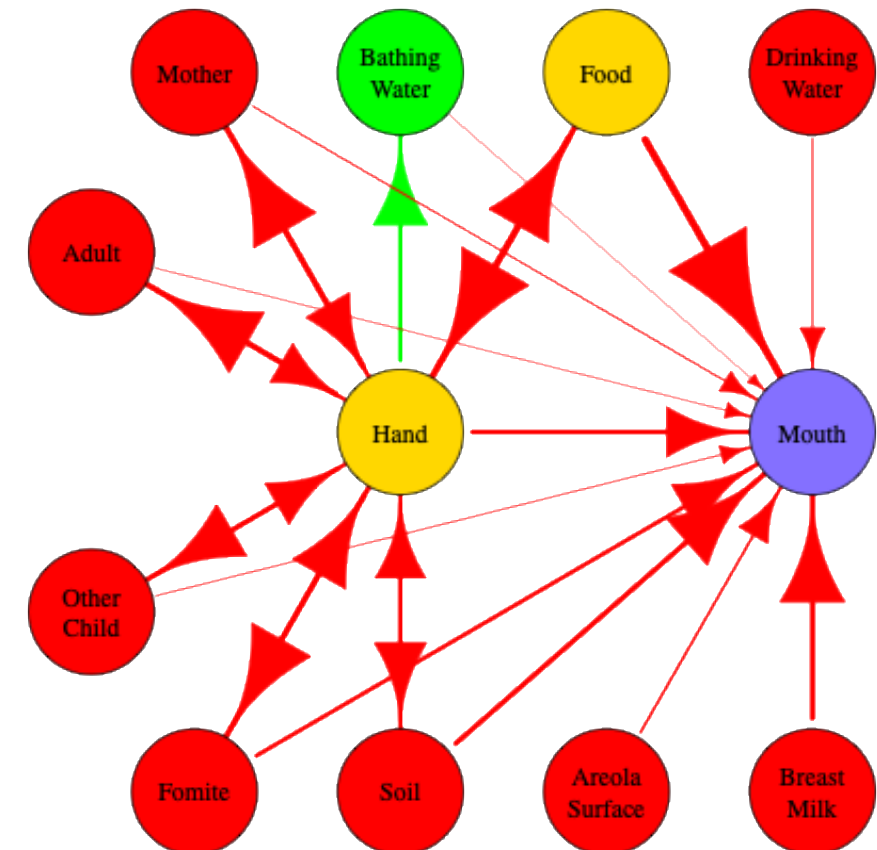
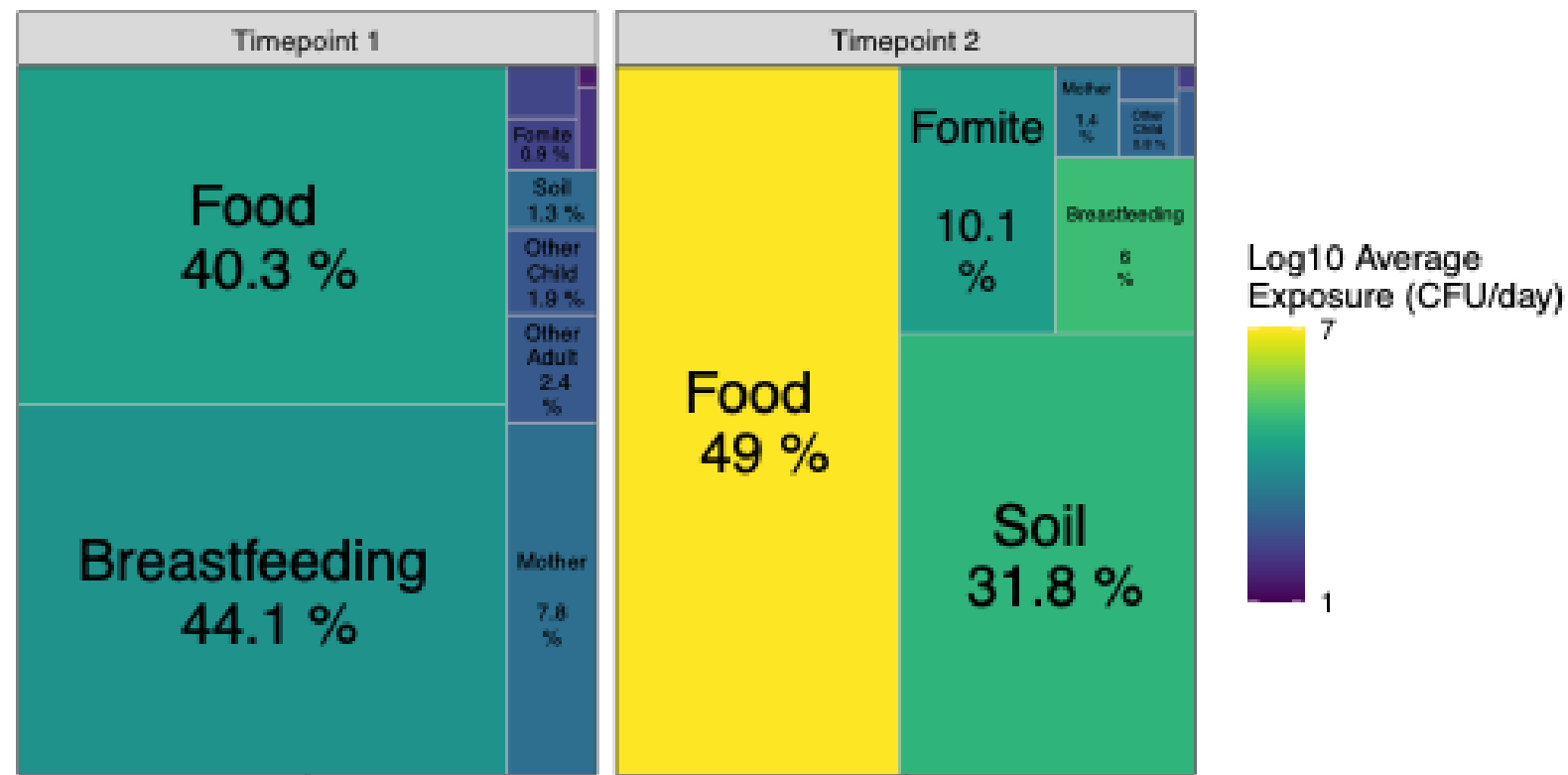


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# The burden of FBD in LMIC is likely to increase

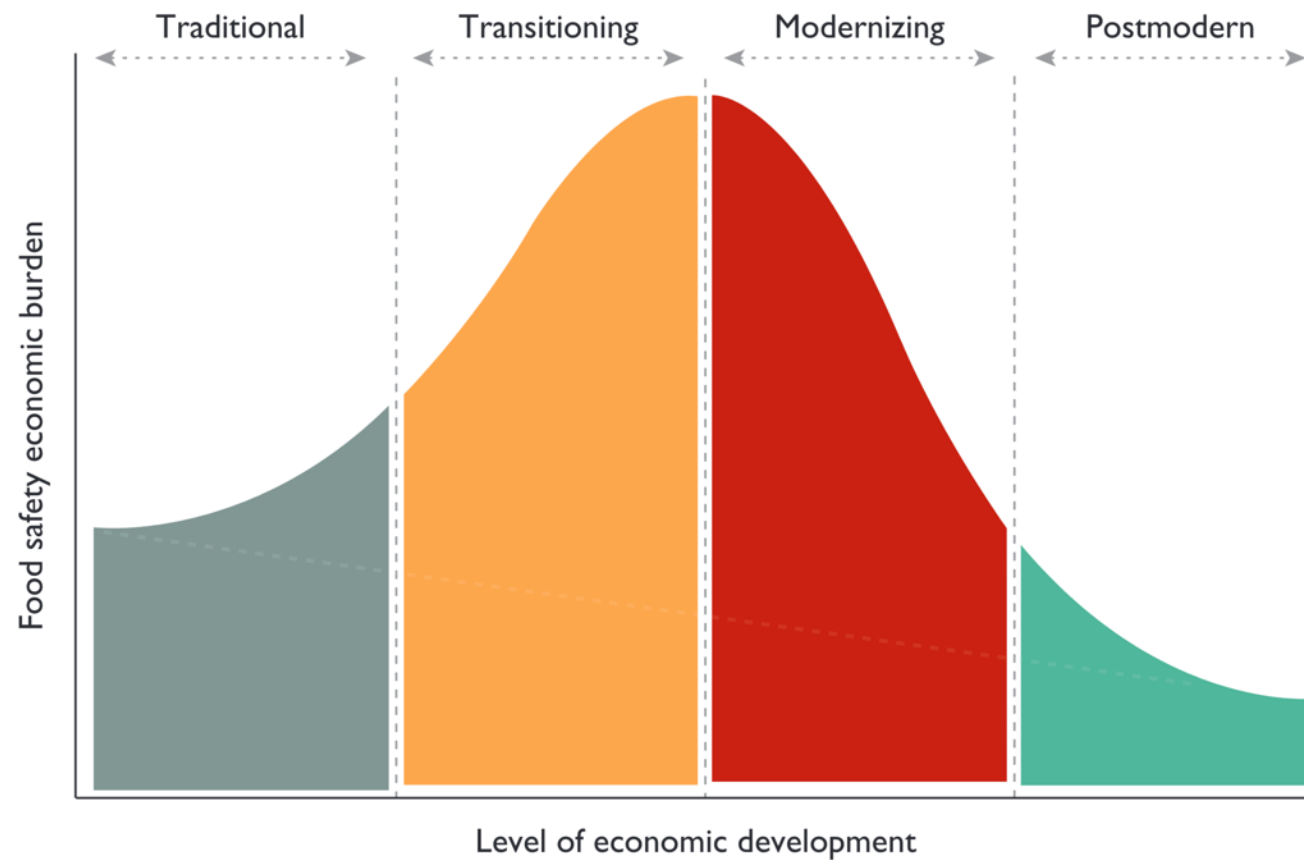


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Source: World Bank.

# The US Perspective



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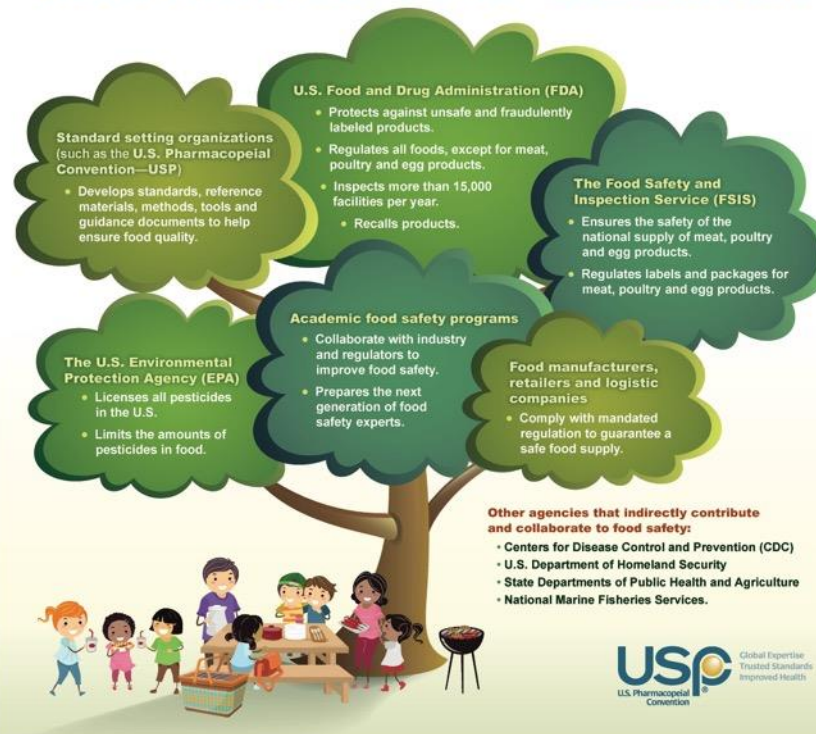
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## All the Branches that Protect Our Food

Below are some of the key agencies and organizations that help make sure the food on your plate is nutritious and free of substances that may harm you.





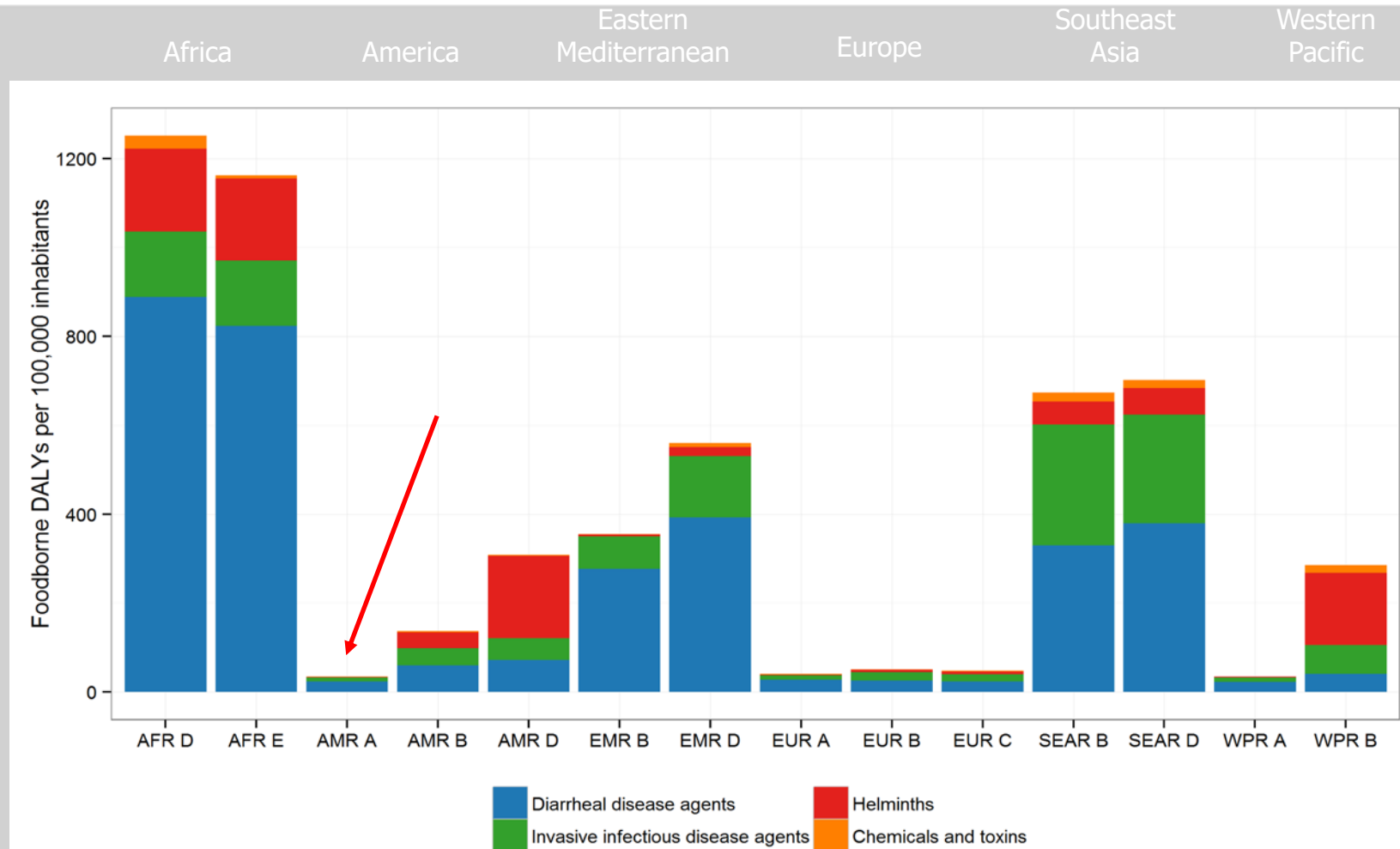
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# The burden in the US is low ....





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# ... but cannot be ignored

- High-income countries have largely controlled foodborne deaths
  - Most deadly hazards do not occur (fishborne trematodes) or are controlled better (aflatoxin, cholera)
  - Better access to and effectiveness of health care systems
- Foodborne disease incidence in these regions is only 3-4-fold lower than the global average
- Incidence of foodborne disease due to norovirus in these regions is like the global average, but incidence of deaths is much lower
- Main causes of foodborne disease burden in these regions are non-typhoidal *Salmonella enterica*, *Campylobacter* spp., *Toxoplasma gondii*, norovirus and *Listeria monocytogenes*

# Progress towards Healthy People 2030 Goals



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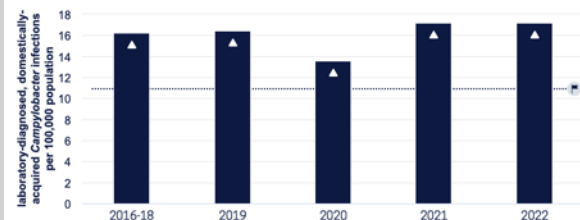
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- Progress is slow, if any
- Notable decrease during 2020 (COVID-19 pandemic)

Laboratory-diagnosed, domestically-acquired *Campylobacter* infections, 2016-18 to 2022

Decrease desired

Total Target: 10.9



Objective: FS-01

Data Source: Foodborne Diseases Active Surveillance Network (FoodNet), CDC/NCEZID

1. Target has been revised. See Data Methodology and Measurement for more information.
2. Baseline has been revised. See Data Methodology and Measurement for more information.

DSU: Data do not meet the criteria for statistical reliability, data quality, or confidentiality.

DNA: Data have not been analyzed.

DNC: Data for specific population not collected.

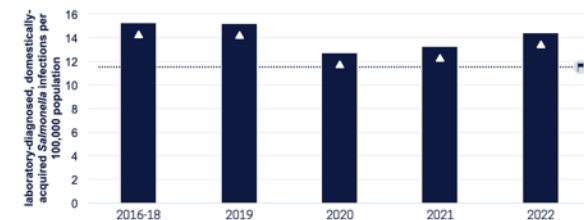
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Laboratory-diagnosed, domestically-acquired *Salmonella* infections, 2016-18 to 2022

Decrease desired

Total Target: 11.6



Objective: FS-04

Data Source: Foodborne Diseases Active Surveillance Network (FoodNet), CDC/NCEZID

1. Target has been revised. See Data Methodology and Measurement for more information.
2. Baseline has been revised. See Data Methodology and Measurement for more information.

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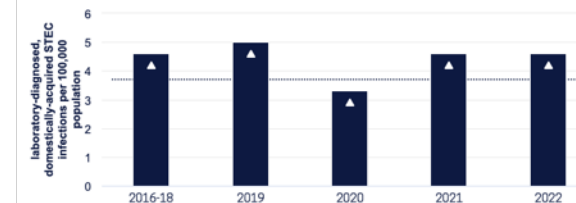
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Laboratory-diagnosed, domestically-acquired Shiga toxin-producing *E. coli* infections, 2016-18 to 2022

Decrease desired

Total Target: 3.7



Objective: FS-02

Data Source: Foodborne Diseases Active Surveillance Network (FoodNet), CDC/NCEZID

1. Target has been revised. See Data Methodology and Measurement for more information.
2. Baseline has been revised. See Data Methodology and Measurement for more information.

DSU: Data do not meet the criteria for statistical reliability, data quality, or confidentiality.

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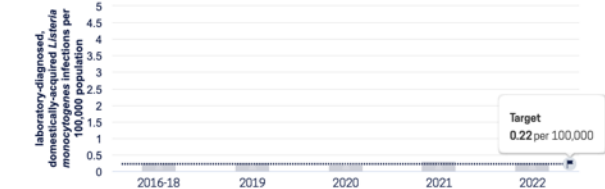
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Laboratory-diagnosed, domestically-acquired *Listeria monocytogenes* infections, 2016-18 to 2022

Decrease desired

Total Target: 0.22



Total: 0.21 for 2020

Objective: FS-03

Data Source: Foodborne Diseases Active Surveillance Network (FoodNet), CDC/NCEZID

1. Target has been revised. See Data Methodology and Measurement for more information.
2. Baseline has been revised. See Data Methodology and Measurement for more information.

DSU: Data do not meet the criteria for statistical reliability, data quality, or confidentiality.

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DNC: Data for specific population not collected.

---: Data are not available.







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# Food safety is mythical

Never ending

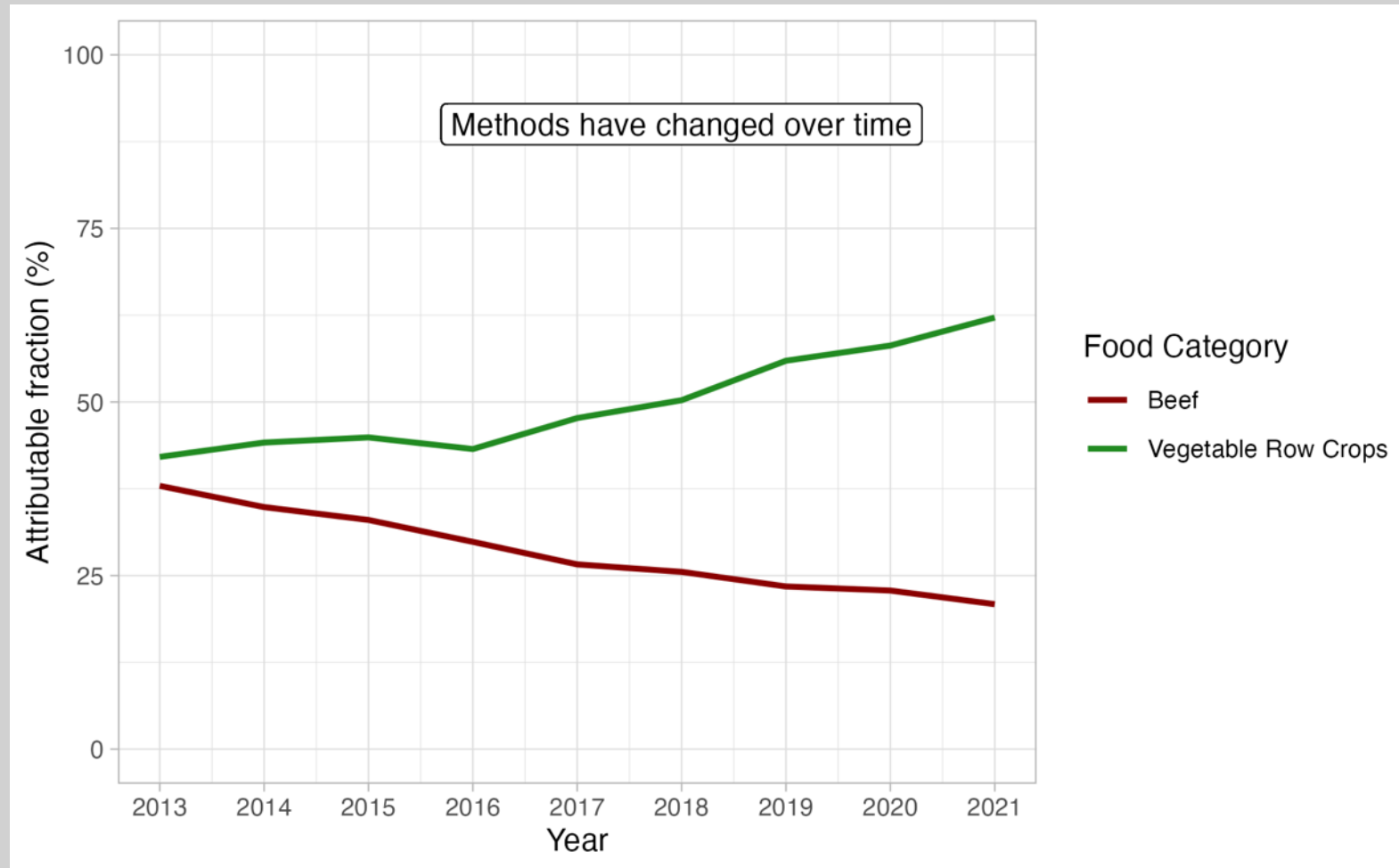


Always changing





# Change in attribution of STEC O157 in the US





# Emergence of listeriosis as a foodborne disease



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## Epidemic Listeriosis — Evidence for Transmission by Food

**Authors:** Walter F. Schlech, III, M.D., Pierre M. Lavigne, M.D., Robert A. Bortolussi, M.D., Alexander C. Allen, M.D., E. Vanora Haldane, M.D., A. John Wort, M.D., Allen W. Hightower, M.S., Scott E. Johnson, M.S., Stanley H. King, M.D., Eric S. Nicholls, M.D., and Claire V. Broome, M.D. [Author Info & Affiliations](#)

Published January 27, 1983 | N Engl J Med 1983;308:203-206 | DOI: 10.1056/NEJM198301273080407

VOL. 308 NO. 4



## Epidemic Listeriosis Associated with Mexican-Style Cheese

**Authors:** Michael J. Linnan, M.D., Laurene Mascola, M.D., Xiao Dong Lou, M.D., Veronique Goulet, M.D., Susana May, M.D., Carol Salminen, R.N., David W. Hird, D.V.M., [+7](#), and Claire V. Broome, M.D. [Author Info & Affiliations](#)

Published September 29, 1988 | N Engl J Med 1988;319:823-828 | DOI: 10.1056/NEJM198809293191303

VOL. 319 NO. 13



# Large outbreaks of listeriosis continue to happen



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## Listeria Outbreak Linked to Meats Sliced at Delis

### FOOD SAFETY ALERT

Investigation start date: July 19, 2024

Investigation status: Open

Recall issued: Yes

Latest update: More illnesses and deaths have been reported in this outbreak. *Listeria* is a hardy germ that can remain on surfaces, like meat slicers, and foods, even at refrigerated temperatures. It can also take up to 10 weeks for some people to have symptoms of listeriosis. Do not eat recalled deli meats. Some of the products have sell by dates into October 2024.

[Updates](#)

[Locations](#)

[Timeline](#)

### FAST FACTS

- Cases: 57 (14 new)
- Hospitalizations: 57 (14 new)
- Deaths: 9 (6 new)
- States: 18 (5 new)

CDC, September 2, 2024

# Foodborne transmission of Chagas disease



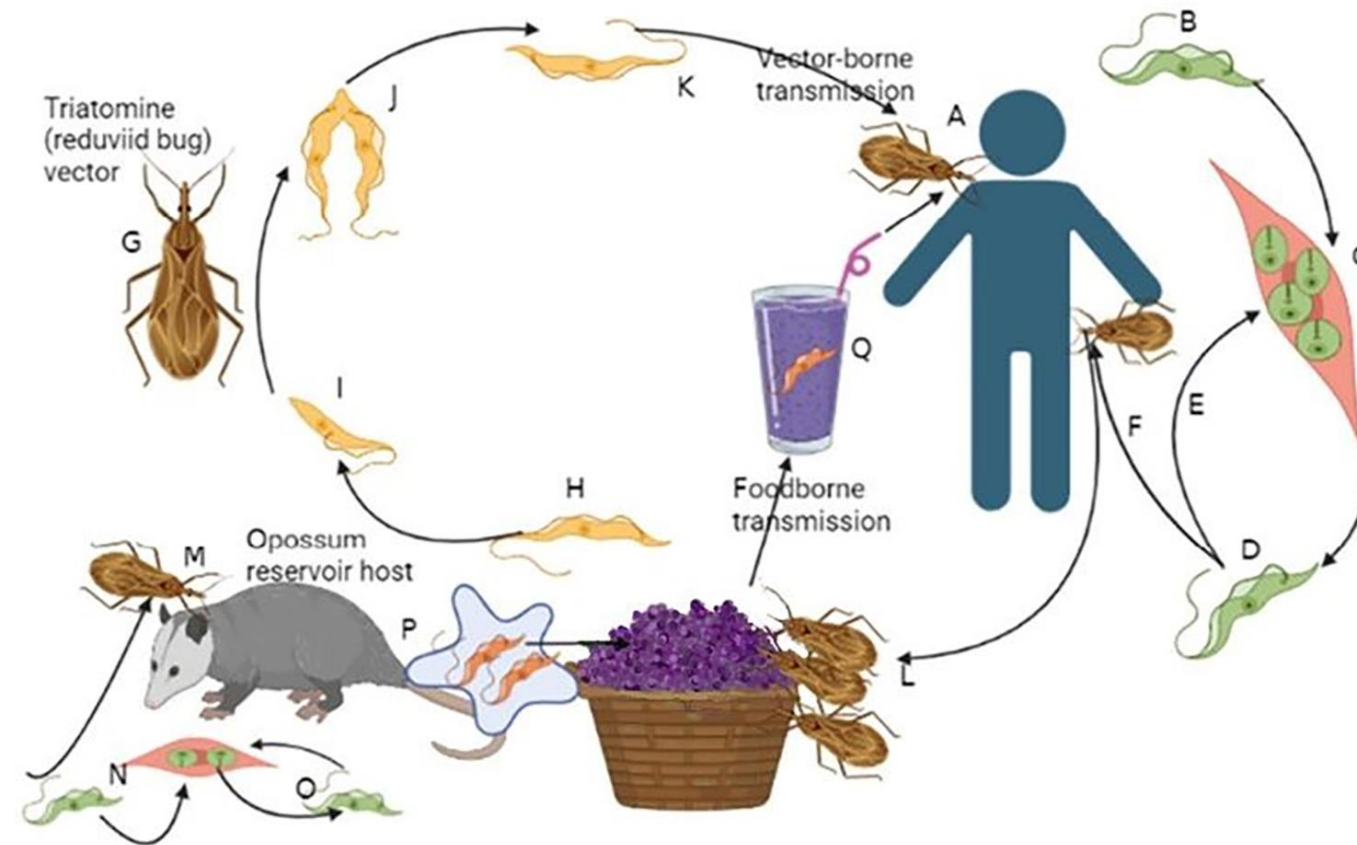
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Note: none of the images  
are drawn to scale



## EMERGING INFECTIOUS DISEASES®

EID Journal > Volume 28 > Number 7—July 2022 > Main Article

Volume 28, Number 7—July 2022

CME ACTIVITY - Synopsis

Updated Estimates and Mapping for Prevalence of Chagas Disease among Adults, United States

Amanda Irish, Jeffrey D. Whitman, Eva H. Clark, Rachel Marcus, and Caryn Bern

On This Page

We estimated  $\approx 10,000$  prevalent cases of locally acquired *T. cruzi* infection

# Nutrient-dense foods are the riskiest foods

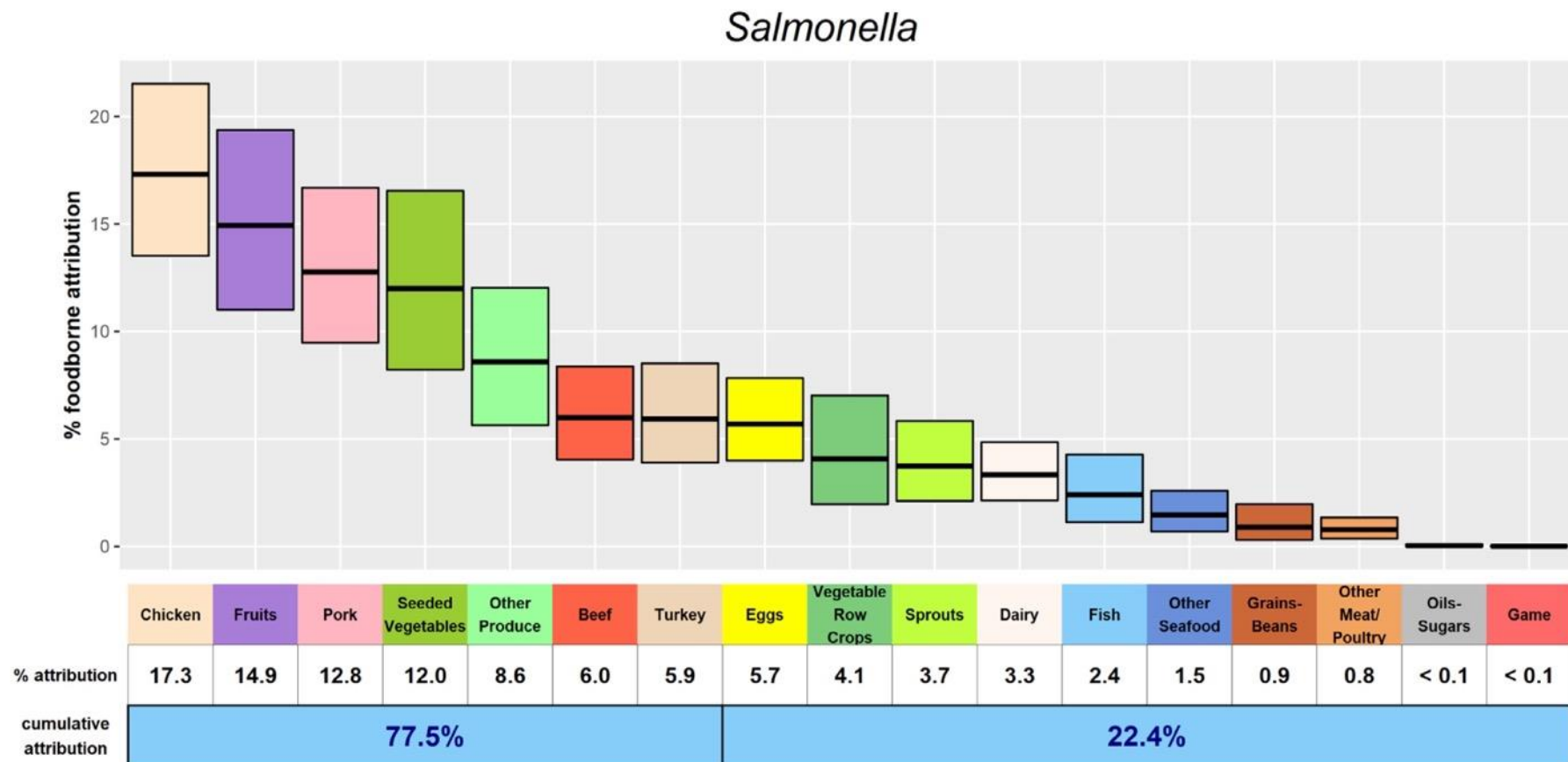


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# Nutrition and food safety are not trade-offs



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- Unsafe food cannot be nutritious
- Symptomatic and asymptomatic infections with enteric pathogens are increasingly recognized as contributing to malnutrition
- Unsafe foods disproportionately affect the vulnerable
- Producing safe food is constrained by economic, technical, political and logistic factors
- Consumers can reduce their risks by practicing food hygiene and avoiding certain foods (e.g., pregnant women, undercooked high-risk foods)
- Industry has the responsibility to provide safe foods to their customers

# Conclusions

- Unsafe food is a global public health problem
- Unsafe food contributes to malnutrition
- No food security without food safety
- The food safety landscape is ever changing
- Microbial hazards in food are largely preventable
- The battle cannot be won, but with constant effort we can prevail



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