World Health Organization

The Global Burden of Foodborne Disease

Martyn Kirk on behalf of the Foodborne disease Epidemiology Reference Group (FERG)

Australian National University

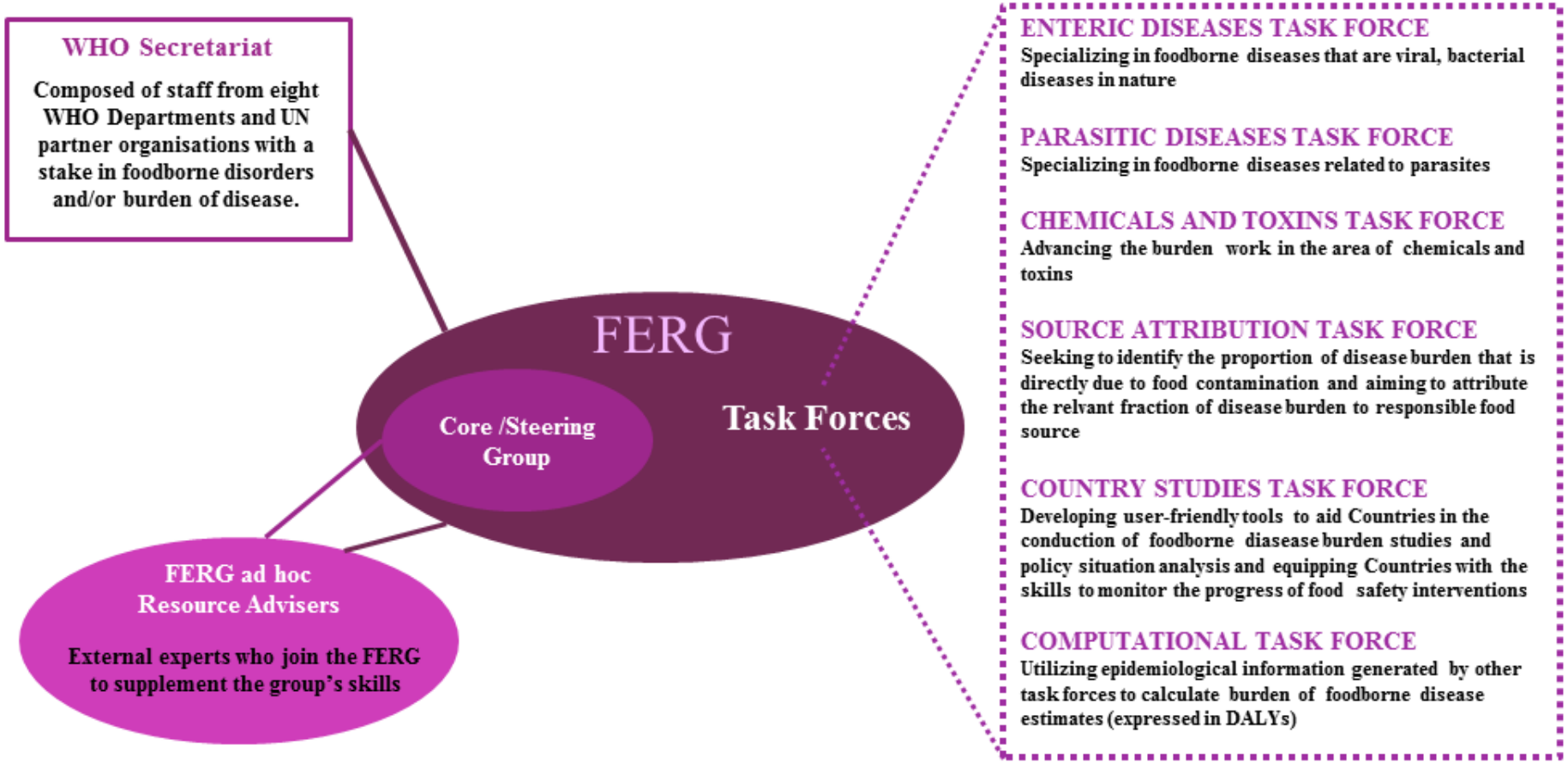
Overview

- FERG: why, what, how?
- Global overview of burden
- Regional differences
- Policy implications
- Further work
- Conclusions

FERG Objectives

1. Mortality, morbidity and disability of foodborne diseases
2. Model disease burden where data lacking
3. Develop source attribution models
4. Tools to study foodborne burden in countries

FERG Structure



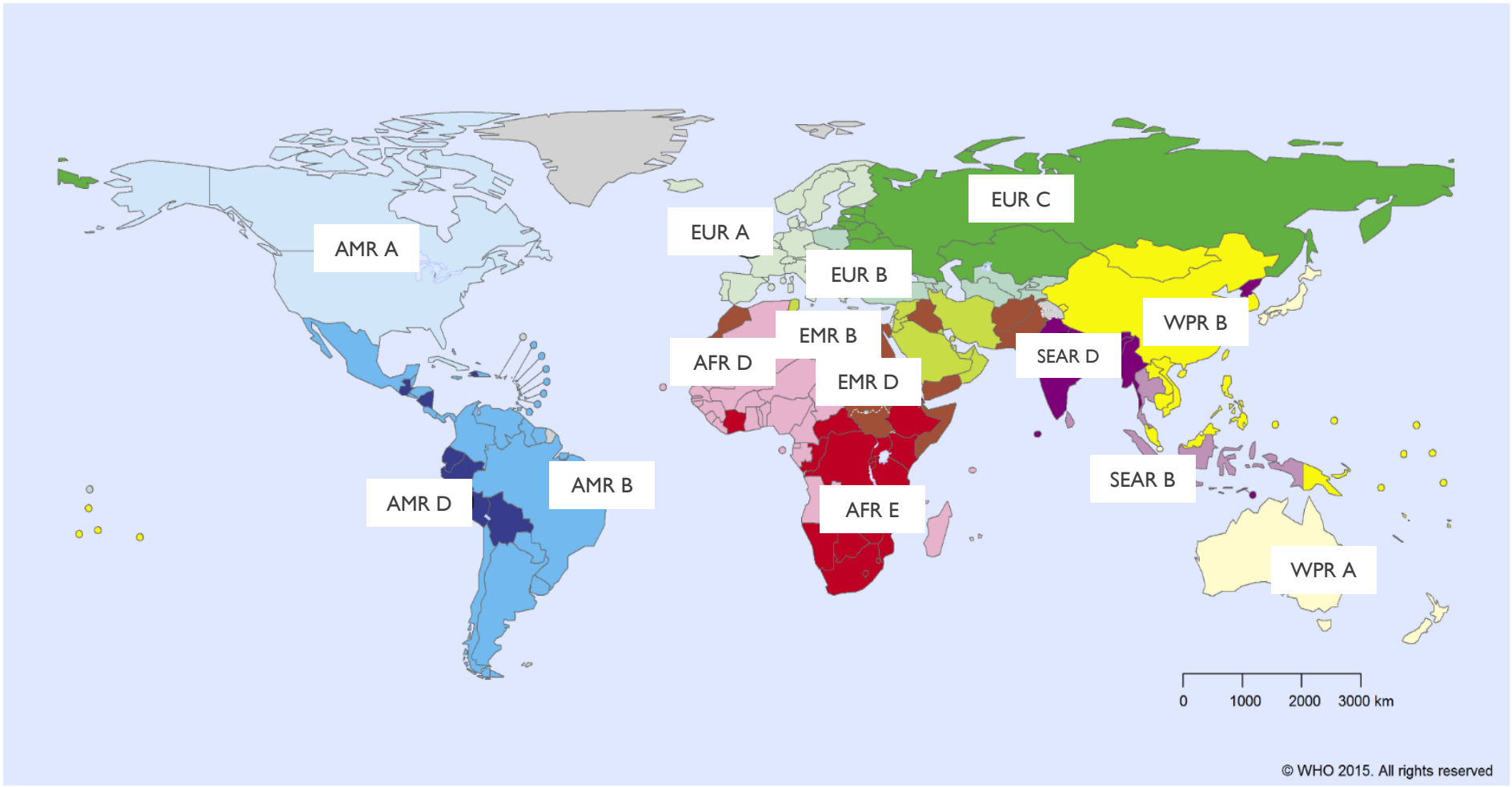
FERG Methods

- Global estimate incidence & mortality for 31 hazards
  - 11 acute diarrheal diseases
  - 7 invasive infectious disease
  - 10 helminths
  - 3 chemicals

Disease Outcome Trees, including sequelae

- Estimates for high-income countries for 4 hazards
  - 4 bacterial toxins; 1 allergen
- Imputation and expert knowledge to fill data gaps
  - Uncertainty distribution instead of point estimate
  - Median, 95% uncertainty interval
- Calculated at country level

14 Sub-Regions

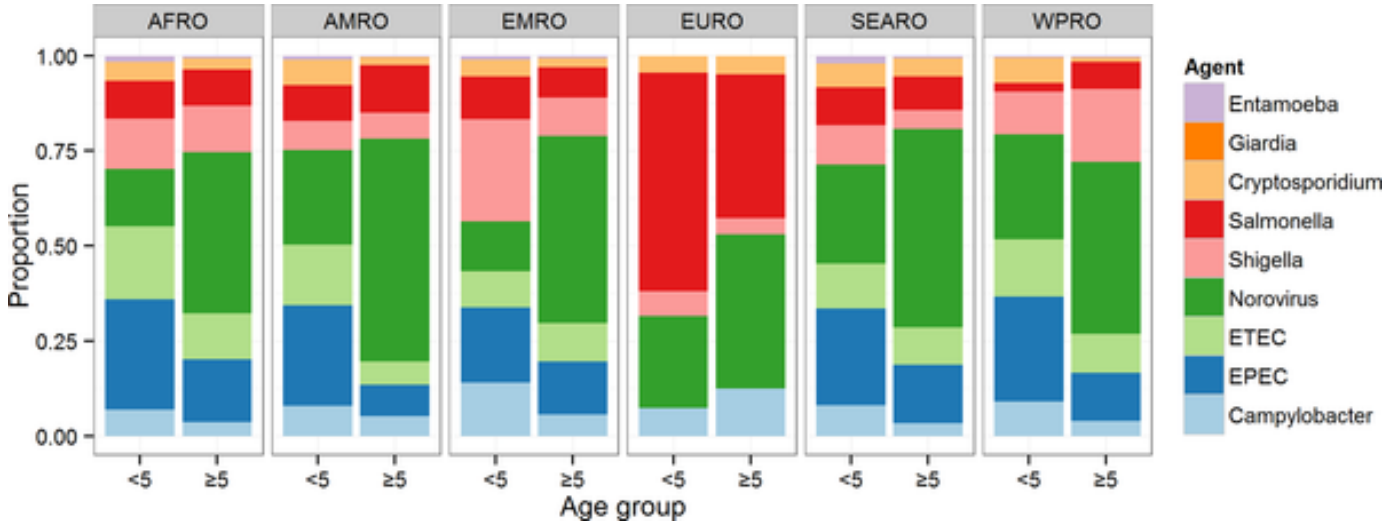


Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJ, Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. Lancet. 2002;360(9343):1347–60.

- The Global Burden of Foodborne Disease

Diarrheal Diseases – CHERG Approach

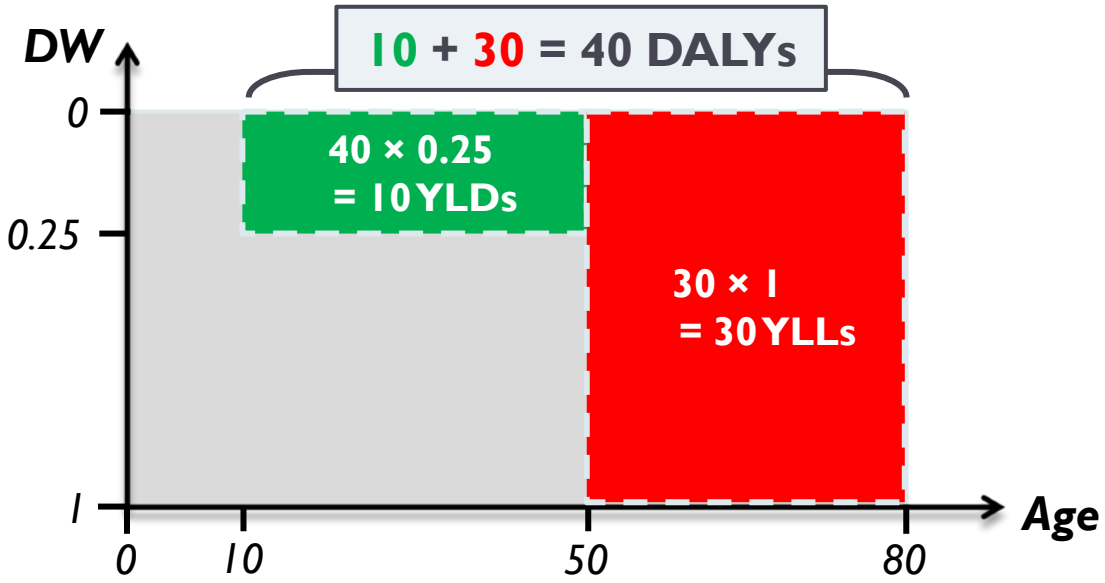
1. Envelope of diarrheal disease
   - Systematic reviews of diarrheal disease incidence
   - WHO estimate of diarrheal mortality
2. Systematic review of etiological agents in stool
   - Assumed inpatient proportion equated to mortality
3. Extrapolated to 133 middle & high mortality countries
   - Estimates by region
   - Global median applied to outliers & countries without data



Diarrheal Diseases – National Approach

- National etiology-specific estimates of foodborne incidence & mortality
  - Australia
  - Canada
  - France
  - New Zealand
  - The Netherlands
  - United Kingdom
  - United States of America
- Median & UI applied to 61 low mortality countries
  - EUR A, B, C, AMR A, WPR A

Disability-Adjusted Life Years

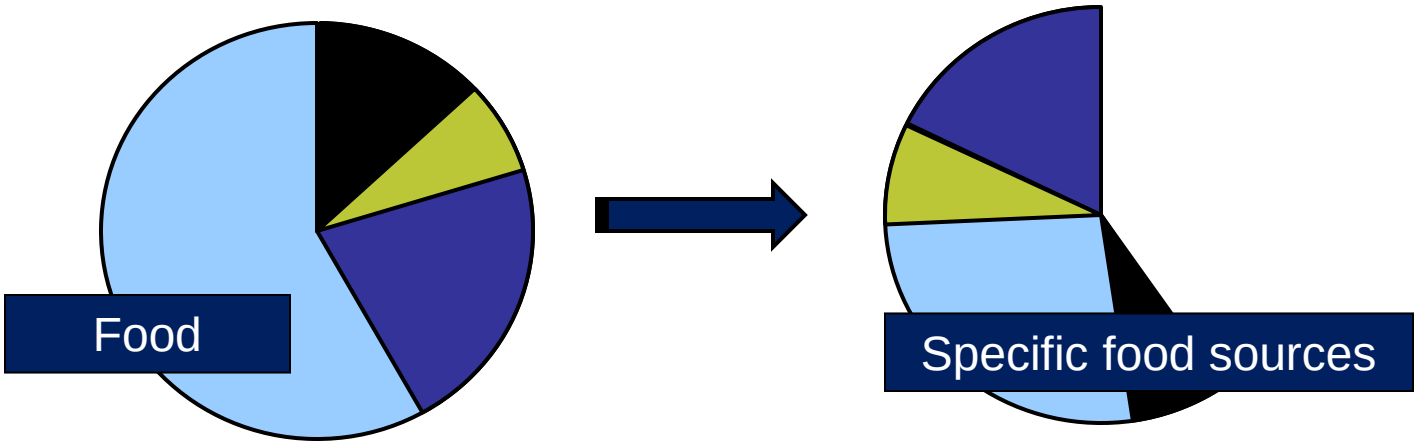


DALY = YLD + YLL

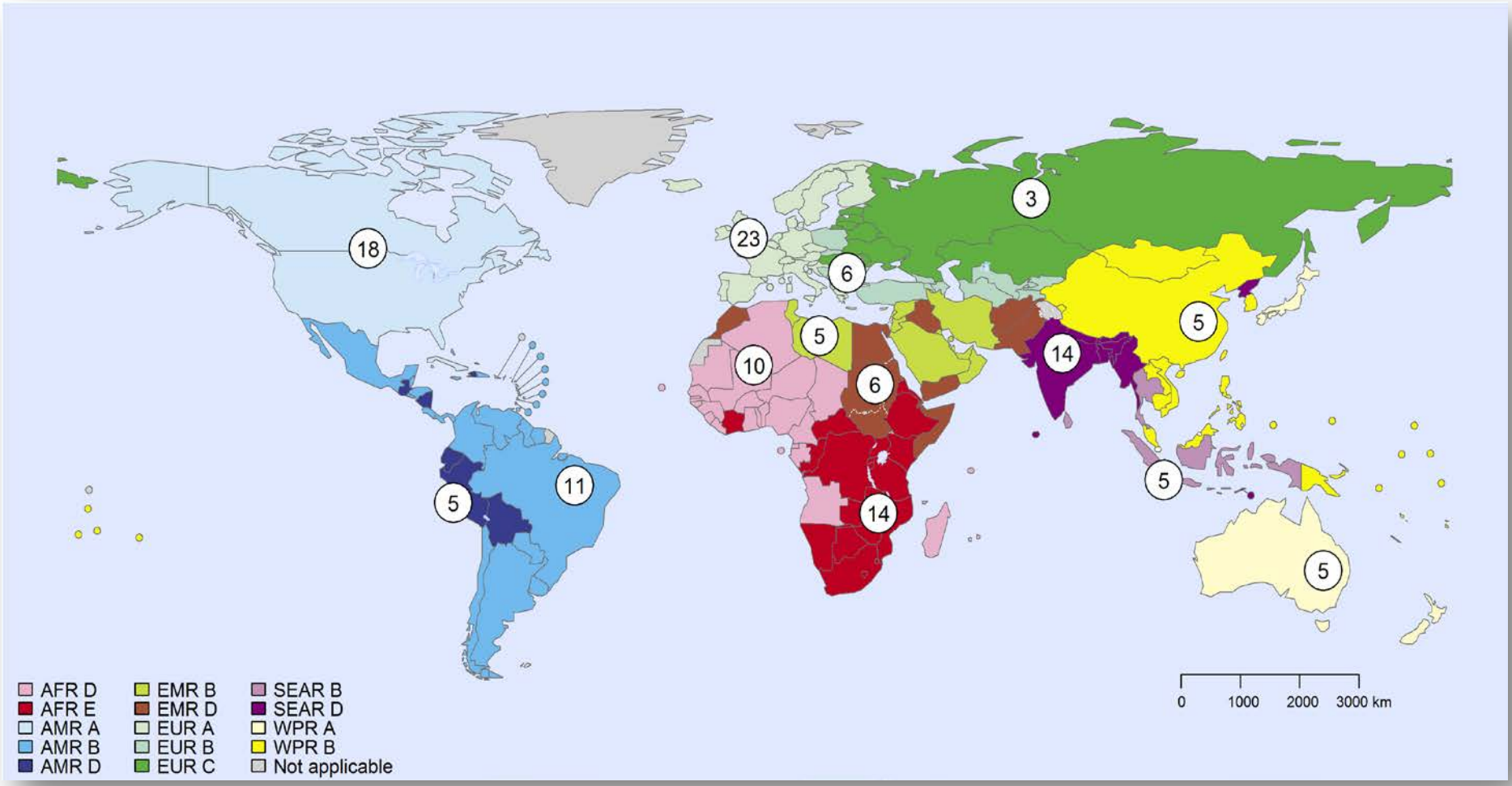
- YLD = Years Lived with Disability = N × D × DW
- YLL = Years of Life Lost = M × RLE

Source Attribution

- Proportion of disease attributable to food
- Identify reservoirs and/or food commodities
- Expert elicitation applied to hazards
  - Except those 100% foodborne
  - Hazards prioritised by thematic task forces
- Cooke's classical model



Expert Elicitation



Global Burden Foodborne Disease

Hazard group	Foodborne illnesses (millions)	Foodborne deaths (thousands)	Foodborne DALYs (millions)
All	600	420	33
Diarrheal	549	230	18
Invasive	36	117	8
Helminths	13	45	6
Chemicals	0.2	19	0.9

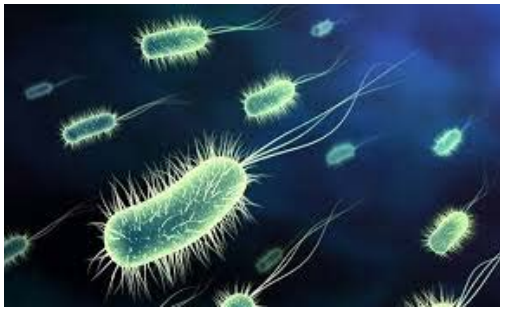
The Global Burden of Foodborne Disease

Most Frequent Global Foodborne….

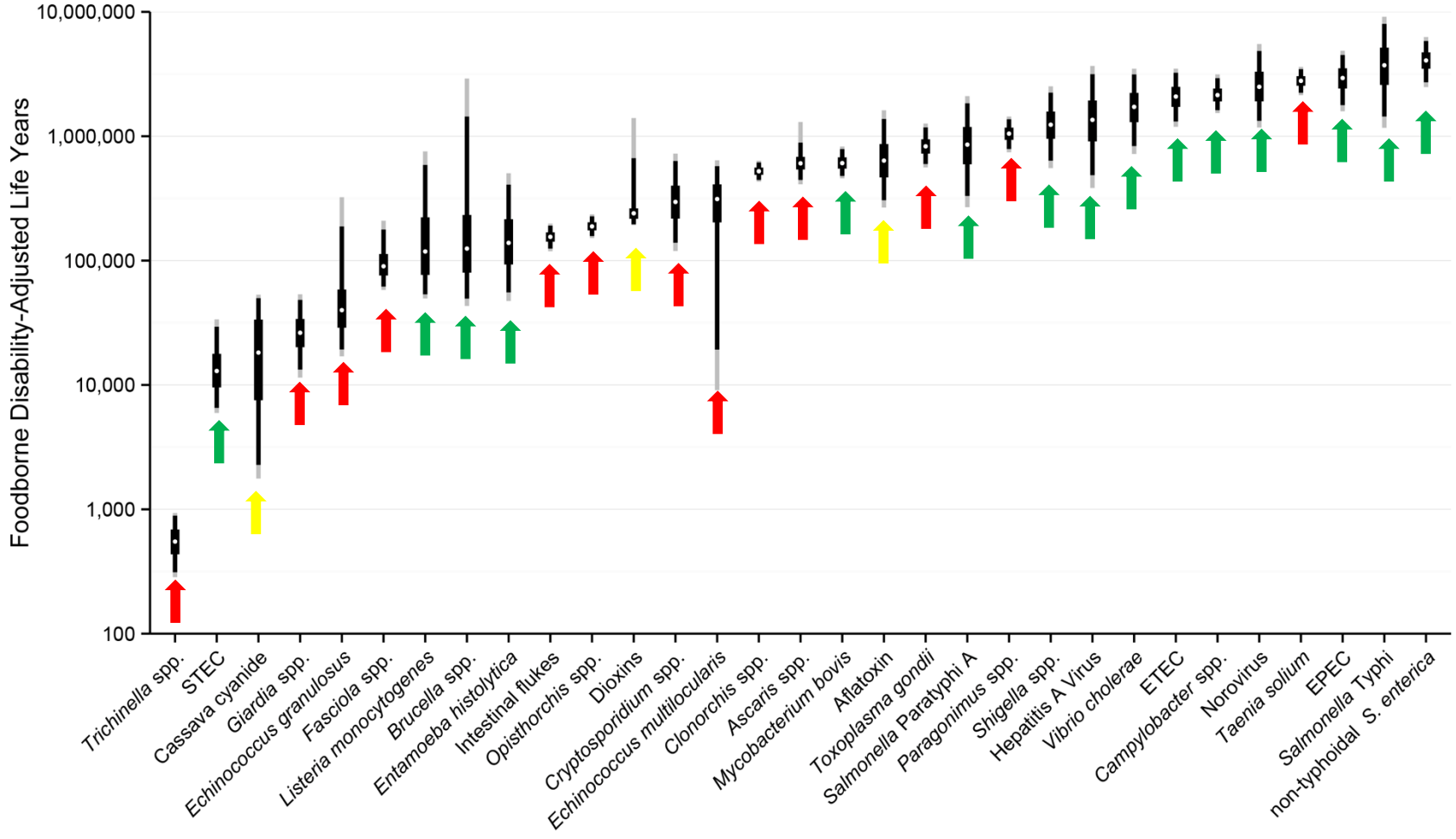
- Illnesses: norovirus, *Campylobacter* spp.
- Deaths: non-typhoidal *Salmonella enterica*, *Salmonella* Typhi, *Taenia solium*, hepatitis A virus, aflatoxin
- DALYs: non-typhoidal *S. enterica*, enteropathogenic and enterotoxigenic *Escherichia coli*; *Taenia solium*, norovirus, *Campylobacter* spp.

Global Findings

- 1 in 10 people in the world affected annually
- Diarrhea most common cause
  - 550,000 million cases
  - 230,000 deaths
    - non-typhoidal *Salmonella enterica* causes 60,000 deaths
    - including 22,000 iNTS deaths in non-HIV patients
- Diarrhea >50% global foodborne DALYs



Foodborne Hazards Ranking DALYs



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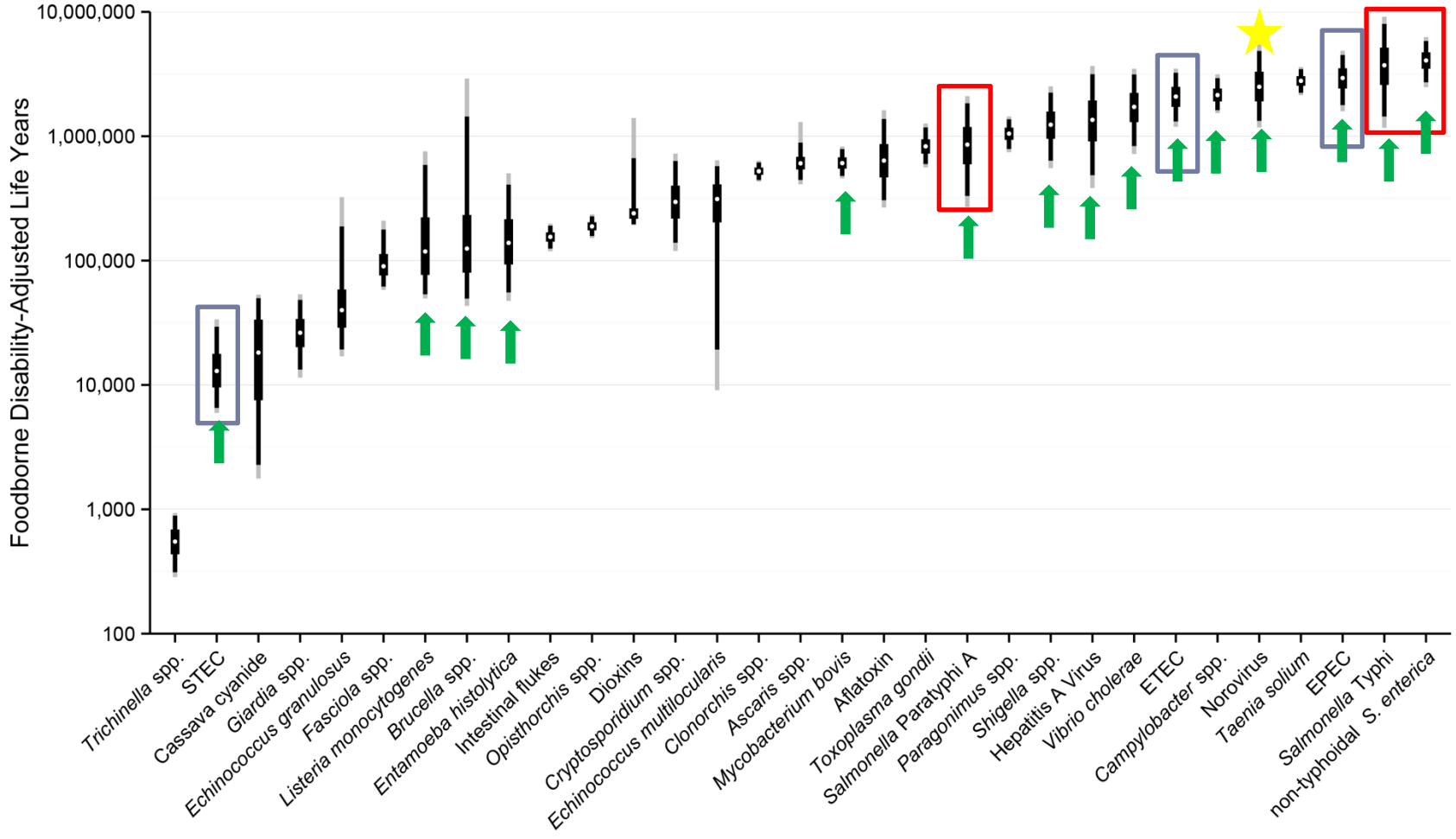

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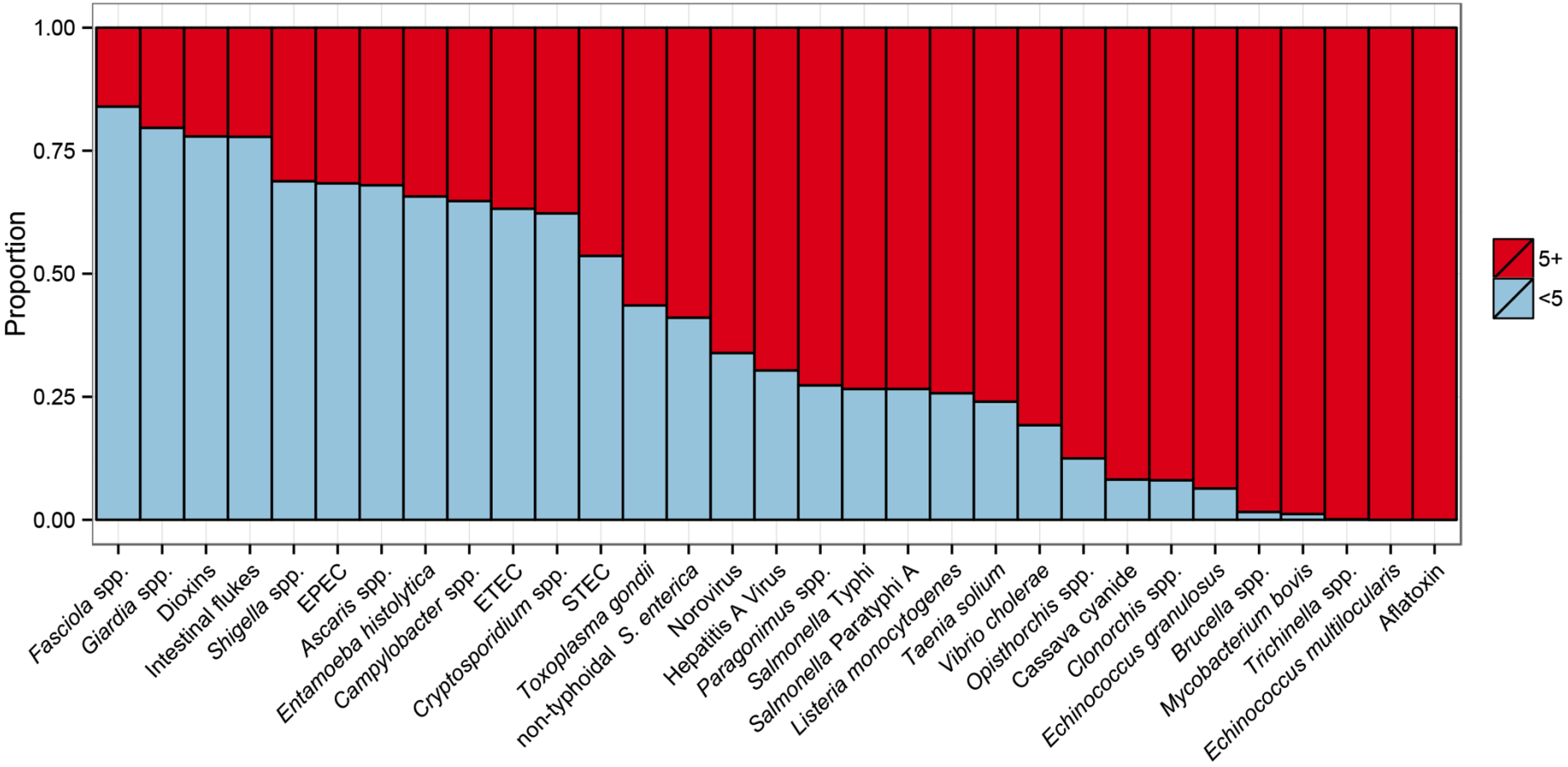
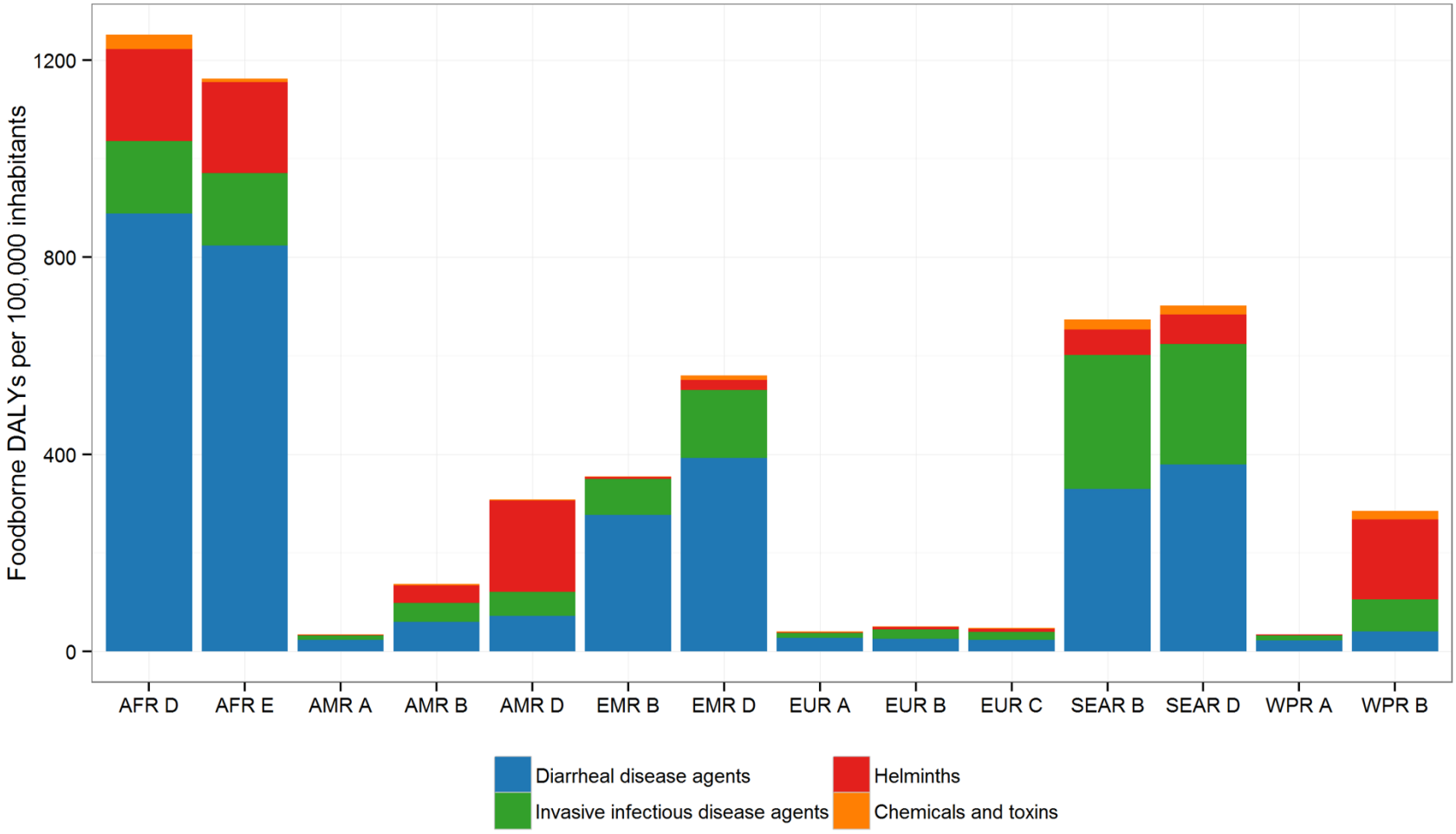
Age Distribution DALYs



- The Global Burden of Foodborne Disease


9% of world population
38% of foodborne illnesses
30% of foodborne deaths
40% of foodborne DALYs

Regional Differences



The Global Burden of Foodborne Disease: Overview and Implications


41% of the world population
53% of foodborne illnesses
75% of foodborne deaths
72% of foodborne DALYs

Food Safety Implications

- Unsafe food results in significant burden
  - Particularly for children
- Regional differences highlight preventability
  - Economic development & effective food safety systems
  - Need preventive risk-based systems
- Regional food safety strategies
- Globally important pathogens need novel controls
- Food safety needs new intelligence base

Limitations

- Data availability and quality
  - Particularly low-income countries
    - Imputation and expert judgment
    - Presentation at regional level rather than country level
    - Large uncertainty intervals
- Underestimation
  - Limited number of hazards
  - Not all endpoints considered, eg - stunting
  - HIV-positive burden excluded
  - Metrics do not quantify full societal impact
  - Indirect transmission of disease agents from food production

Next Steps…

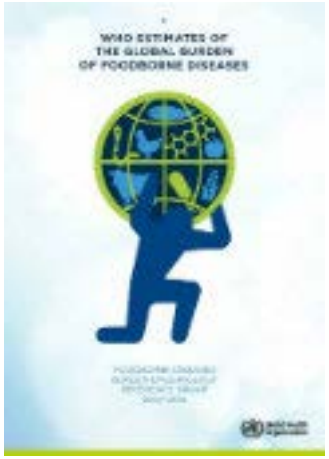
- High-level advocacy
- Country studies
- Elucidate burden from chemicals
- Intervention studies focusing on food
- Burden estimates for specific food commodities
- Animal & human vaccines
- Economic analysis

Conclusions

- WHO established comprehensive estimates
- Address lack of data for food safety policy
- Burden considerable…despite gaps & limitations
- Largely borne by children & low-income countries
- Priority hazards differ between regions
- Control methods exist for many hazards
- Need novel interventions

More information

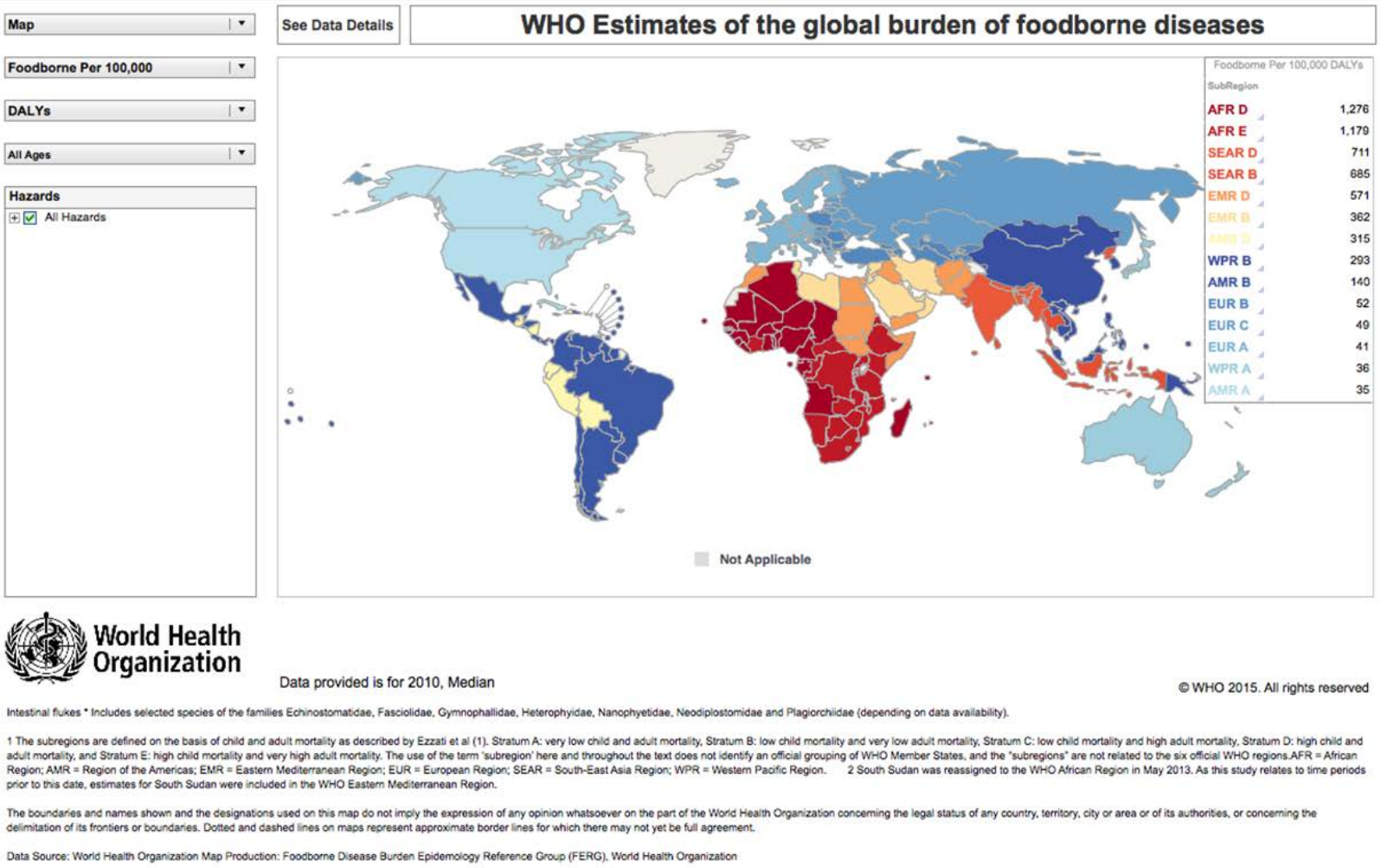
- WHO website
  http://www.who.int/foodsafety/areas_work/foodborne-diseases/ferg/en/



- PLOS collection
  http://collections.plos.org/ferg2015

- Interactive tool
  https://extranet.who.int/sree/Reports?op=vs&path=/WHO_HQ_Reports/G36/PROD/EXT/FoodborneDiseaseBurden

Interactive tool



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Questions?