World Health Organization

Estimating the national burden of foodborne diseases

29th June 2021

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Webinar: Burden of foodborne diseases

How can we estimate it, and why do we need it?

Why estimate the burden of foodborne diseases?

- **Prioritize food safety priorities for national resource allocation for disease prevention**
- Contribute towards facilitating trade and compliance with international market access
- Identifying needs and data gaps
- Support development of risk-based food safety systems and (inter)national standards
- Support stakeholder engagement

Prioritising effective food safety interventions

1. **What is the public health impact of different foodborne diseases?**
   How do we compare and prioritise diseases?

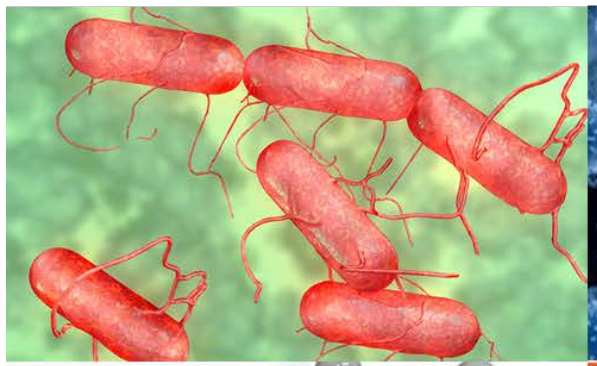
2. What causes these problems?
   - How do we identify sources of disease and routes of transmission

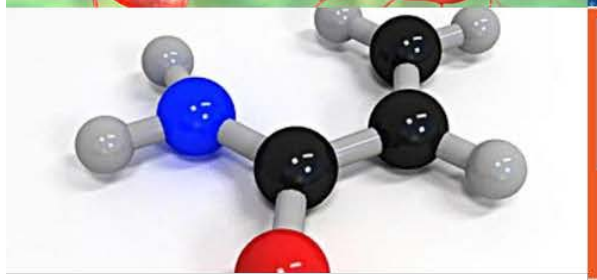
3. What are the options for intervention?
   - Which are more effective?

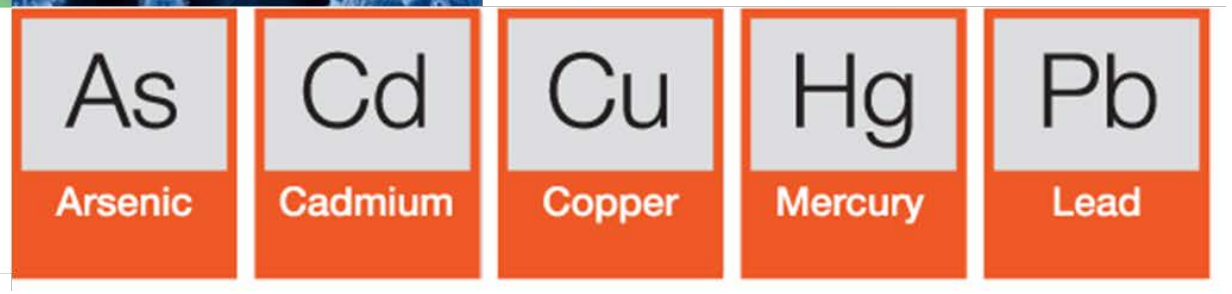
4. How do we measure the effect of each intervention?

Challenges

- Over 250 foodborne diseases, caused by bacteria, viruses and parasites, and chemicals







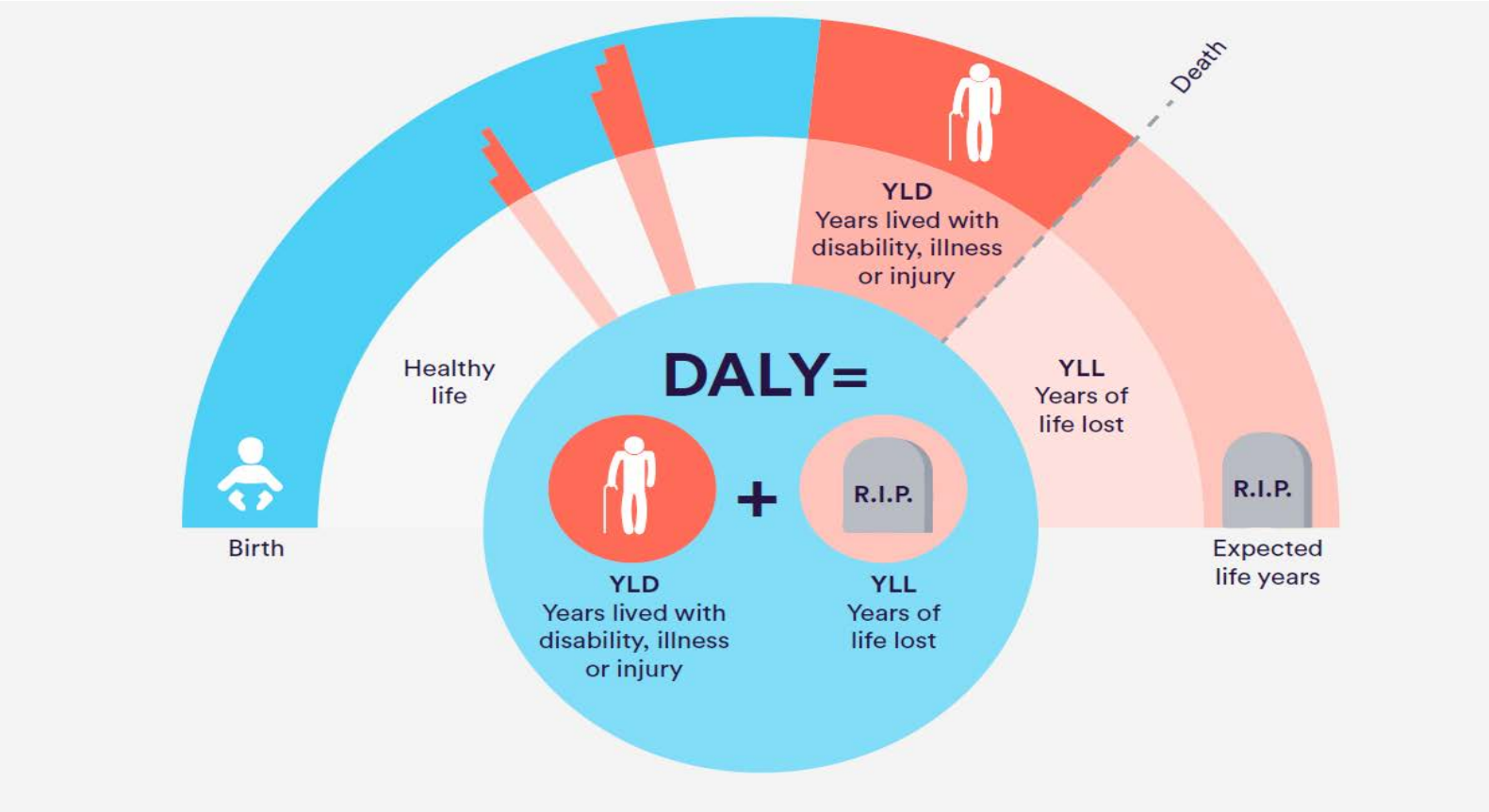
Challenges

- Over 250 foodborne diseases, caused by bacteria, viruses and parasites, and chemicals
- Underreporting
- Diverse health effects – severity, duration, mortality
- Chronic diseases are difficult to attribute to a specific exposure

Burden of foodborne disease studies

- **Goal:** to rank and prioritize foodborne diseases based on their overall public health impact in the population
- **Objectives:**
  - To estimate the burden of disease caused by identified foodborne hazards, in terms of **incidence**, **mortality** and Disability Adjusted Life Years (**DALYs)** by age and sex;
  - Develop a framework for routine updating of estimates and evaluation of trends; and
  - Provide a baseline against which food safety interventions can be evaluated.

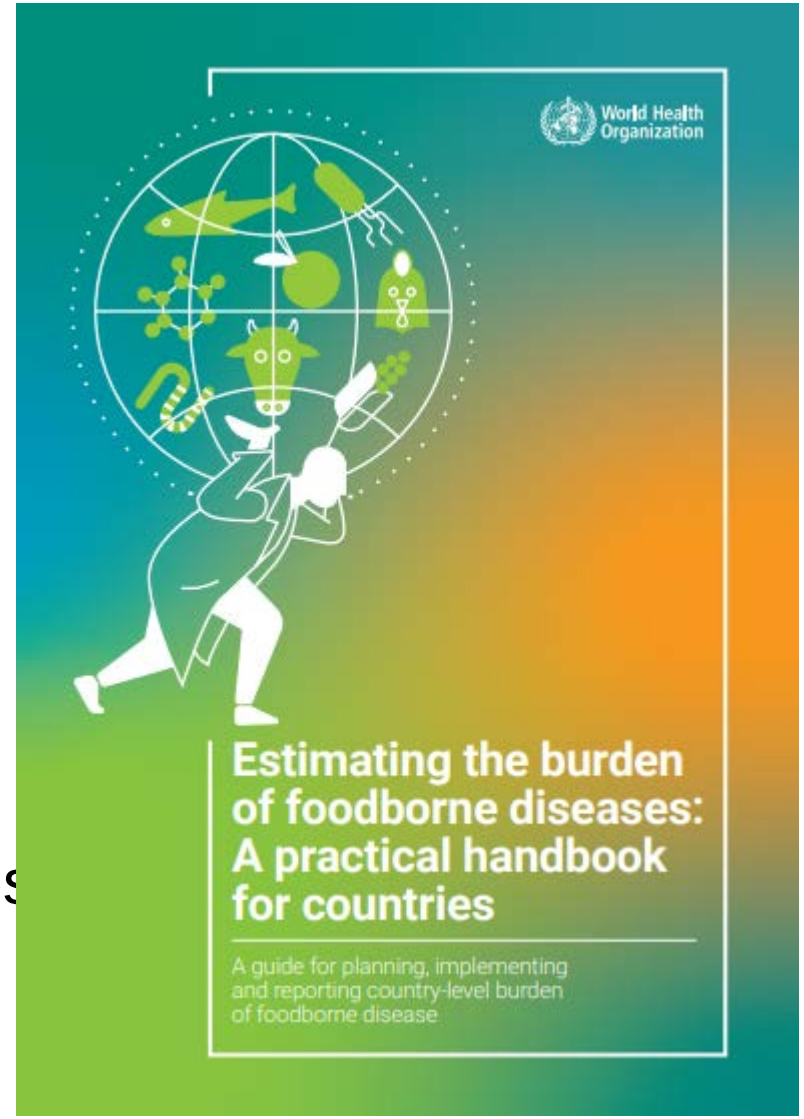
The concept of disability-adjusted life years (DALYs)



Source: Public Health England (2015). Reproduced under Open Government Licence.

Overview of this handbook

1. Introduction
2. Burden of foodborne disease studies
3. Planning a burden of foodborne disease study
4. Data preparation
5. Estimating incidence, mortality and DALYs
6. Estimating foodborne DALYs (source attribution)
7. Interpreting national burden of foodborne disease res
8. Knowledge translation and risk communication
9. Final considerations



Purpose of this handbook

- Guidance for anyone planning to assess the burden of foodborne diseases, particularly at national level
- Complete picture of:
  - the requirements
  - enabling factors
  - challenges and opportunities
  - the steps in the process
- Aims to foster harmonization of methodologies for estimating foodborne disease burden across countries

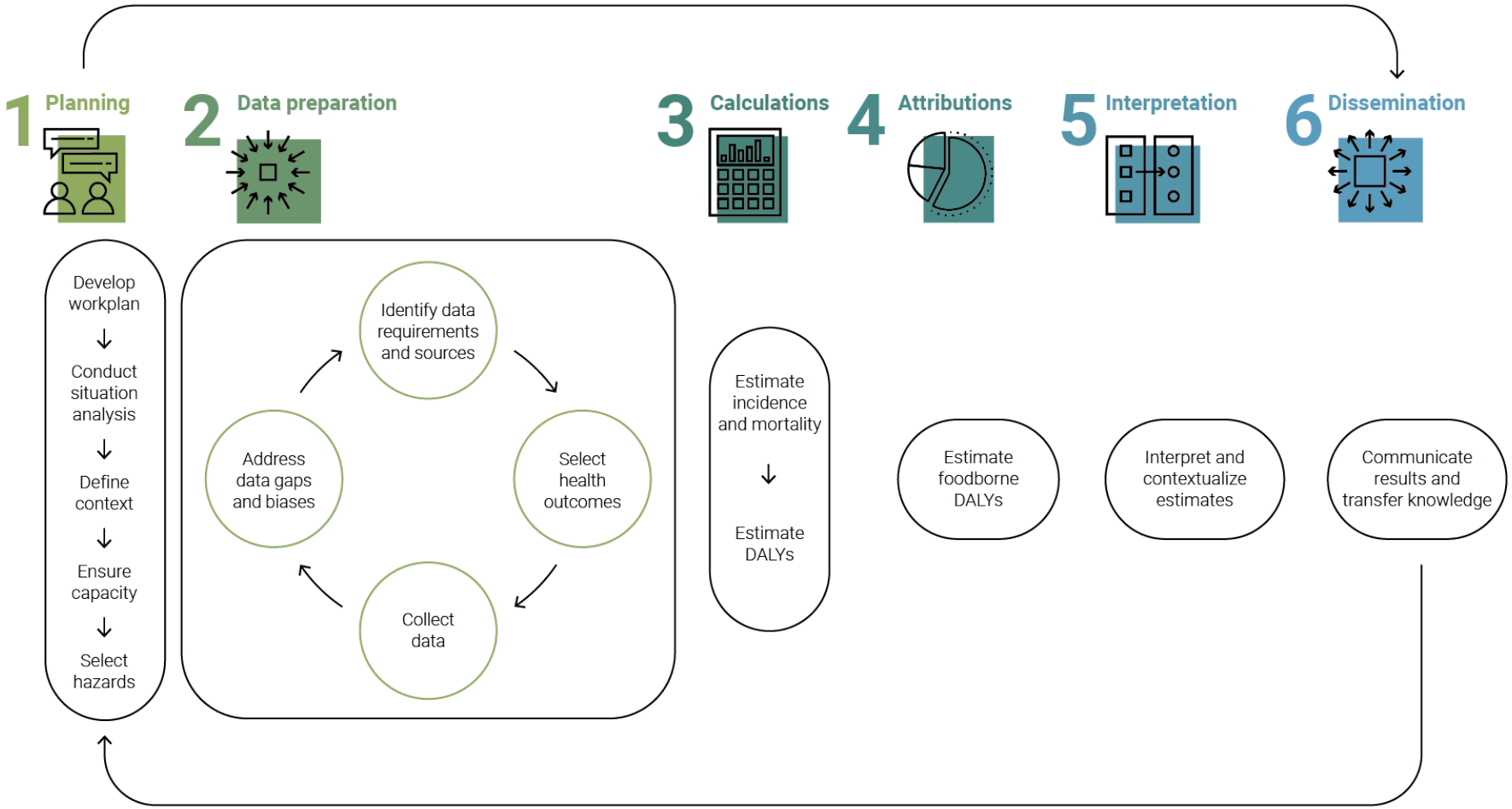
Target audience

- National governments
- Academic institutions
- Others involved in conducting a study of burden of foodborne disease at national or other level (i.e. regional, subnational)
- Food business operators as potential data providers
- Consumer organizations as potential partners to establish priorities

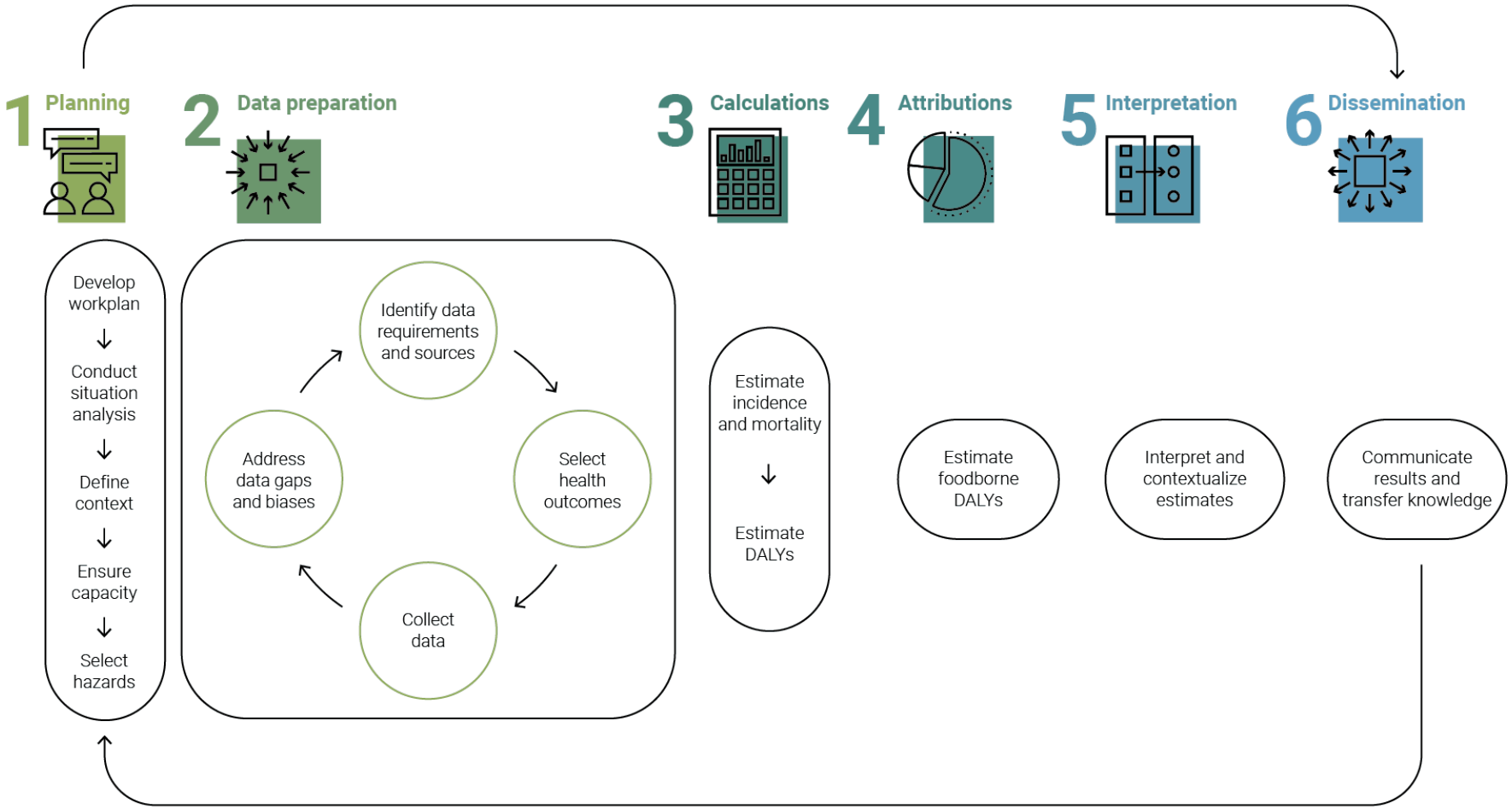
Scope

- Microbiological agents – foodborne bacteria, virus, parasites
- General sequential steps to estimating burden
  - To be adapted to countries capacity and data availability
- Does not cover
  - Chemical hazards
  - Attribution to foods and other sources

Structure and usage



Main elements and steps of a burden of foodborne disease study



Requirements of a burden of foodborne disease study:

- **Data** (surveillance, demographic, contamination and consumption, literature)
- **Capacity** to analyze surveillance data, apply methods to adjust for data gaps and biases, and calculate DALYs
- Possibility to **engage key actors** with clinical and contextual knowledge and experts in selected diseases and data

Getting started

1 Planning

Develop workplan

↓

Conduct situation analysis

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Define context

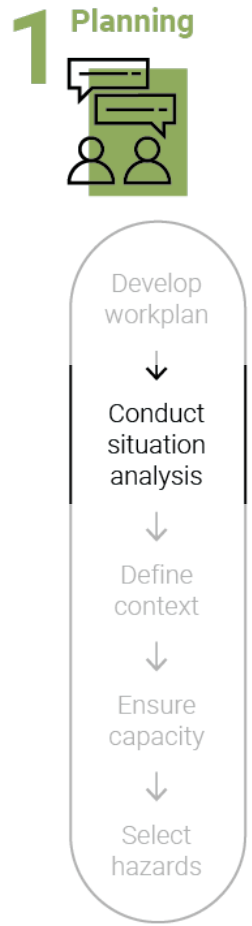
↓

Ensure capacity

↓

Select hazards

Conduct a situation analysis



- Facilitate knowledge translation of burden estimates into policy
- Identify and engage with key actors in food safety
- Position estimates of foodborne disease burden as input to the national policy-makir process
- Strengthen of stakeholder collaboration and sharing of data

Ensure capacity

1 Planning

Range of skills needed

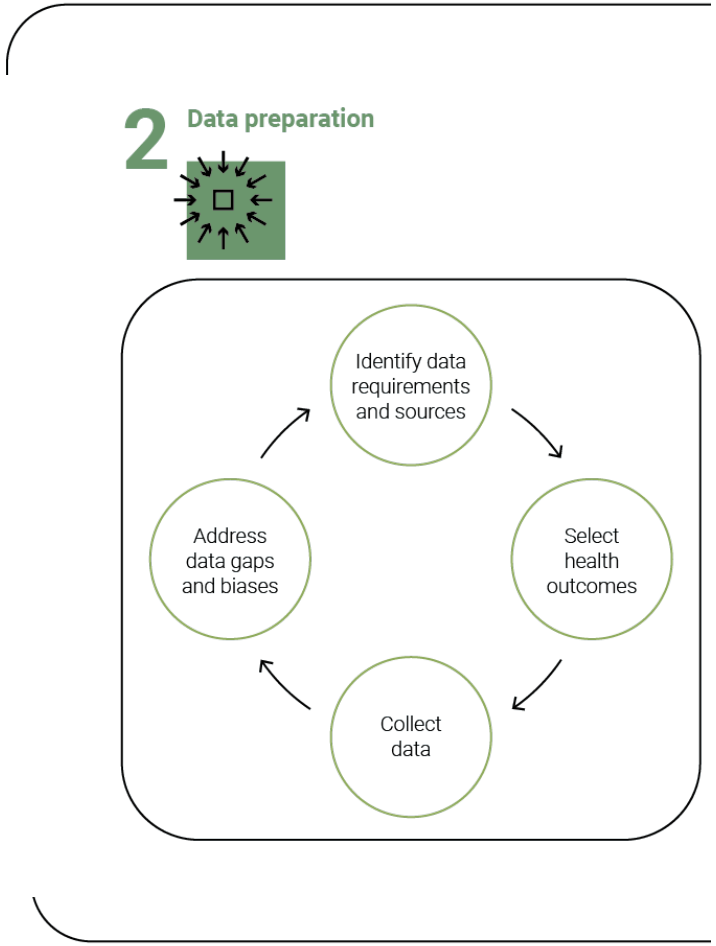
- epidemiology
- data management
- statistics
- modelling
- food science
- public health
- foodborne disease

Select hazards for estimation

Indicator	Questions to guide selection
Public health relevance	Is there evidence of cases of illness occurring in the population? Are there data from national public health surveillance, regional studies or ad hoc research studies?
Occurrence of foodborne outbreaks	Have outbreaks of illness caused by the pathogen been identified in the population? Have these outbreaks been investigated, and linked to specific foods?
Food contamination evidence, including food safety events	Is there evidence of foods or animals being contaminated with the hazard in the country? Are data available from national or regional monitoring programmes, ad hoc studies, or food import control programmes? Has there been any trade issue or concern?
Food consumption habits	Are specific food consumption patterns associated with common hazards?
Evidence from other countries	Has the hazard been identified as of public health concern in other countries? Is it a food safety problem in neighbouring countries?
Research, published studies or reports	Are there national or international studies or reports flagging the hazard as a food safety issue at national, regional or global level?

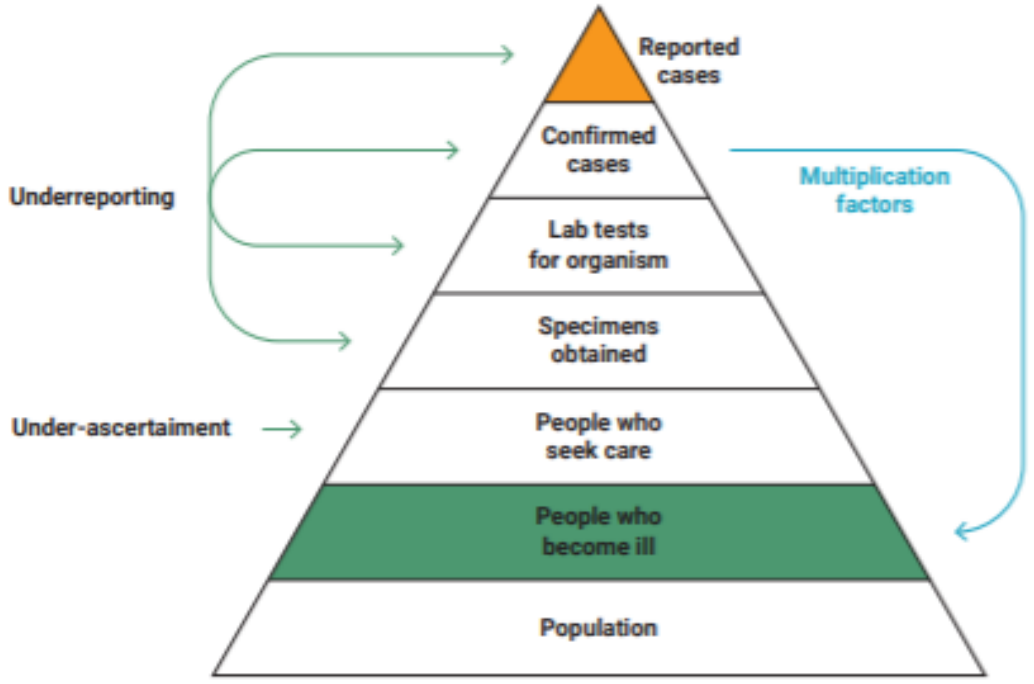
Identifying data requirements and sources (1)

- Incidence
- Mortality
- Demographic data
- Health outcomes' data



Identifying data requirements and sources (2)

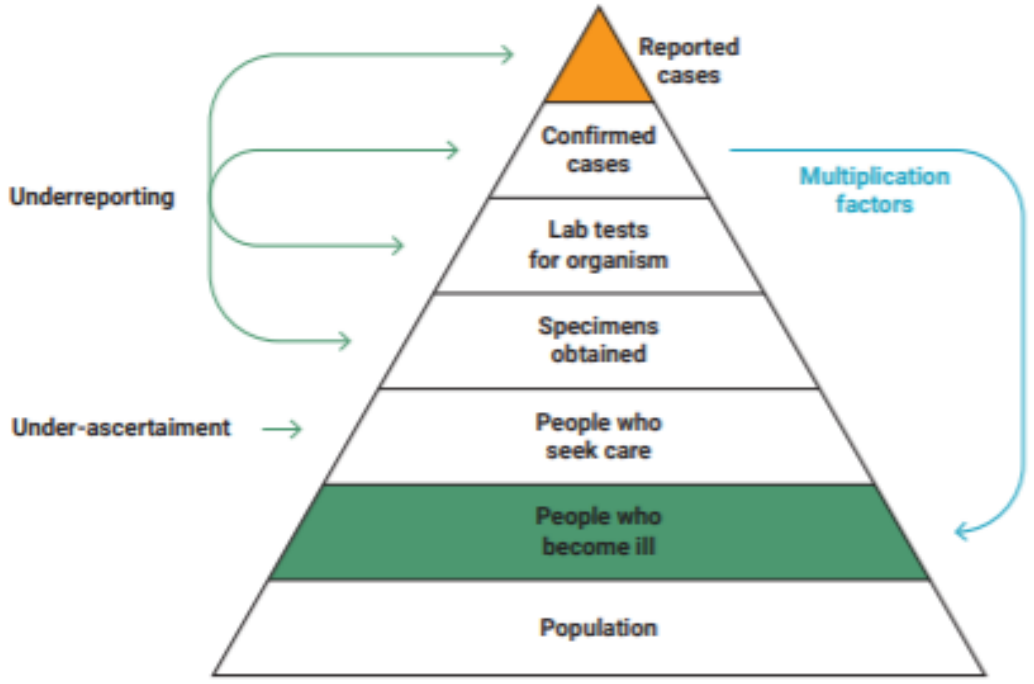
- Incidence
- Mortality
- Demographic data
- Health outcomes's data



Identifying data requirements and sources (3)

Correcting for:

- **Underdiagnosis:** cases in the community that did not seek medical care
- **Under-reporting**: cases for which medical advice was sought, but that were not correctly diagnosed, classified, or notified to the surveillance authority.



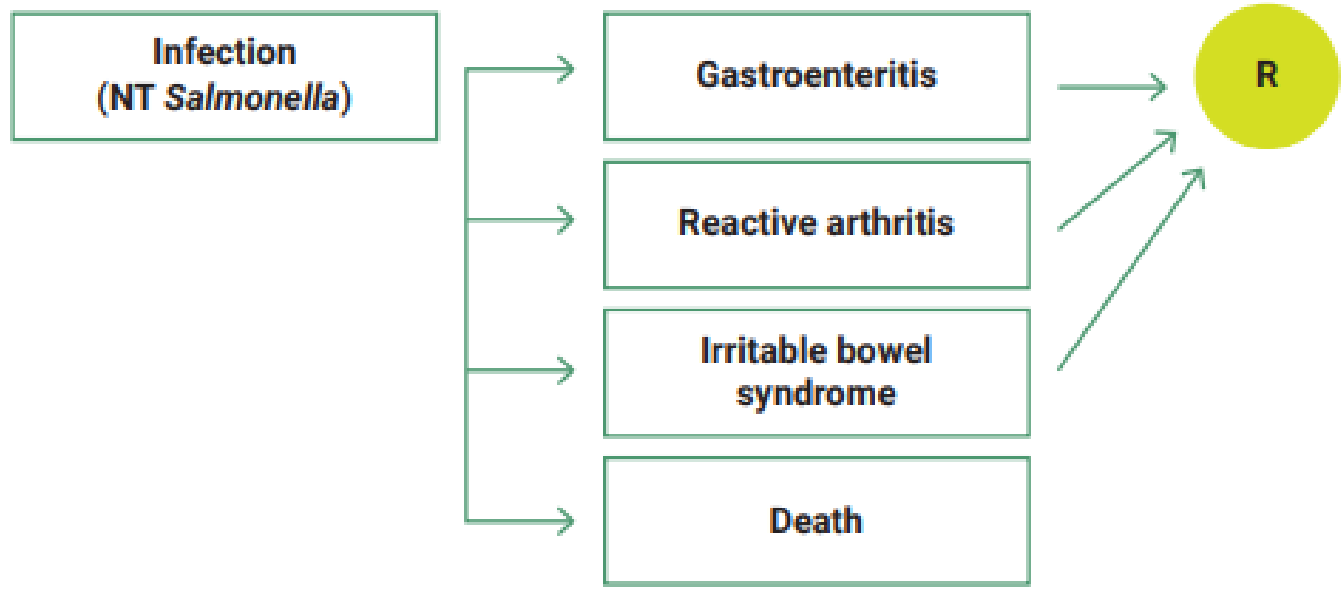
Identifying data requirements and sources (3)

Chemical hazards

- Surveillance/monitoring of chemicals in foods– for example Total Diet Studies
- Food consumption data

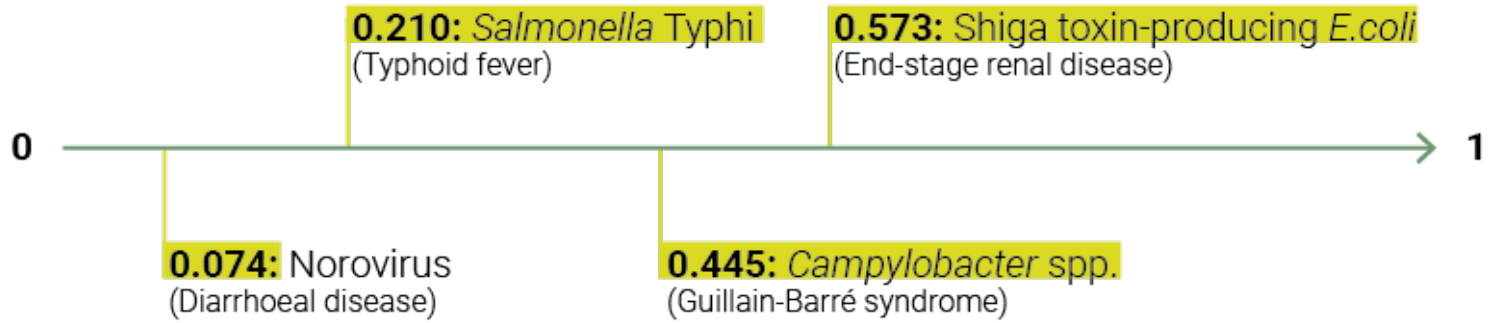
Identifying data requirements and sources (4)

- Incidence
- Mortality
- Demographic data
- **Health outcomes's data**



Selecting health outcomes
Disability weights

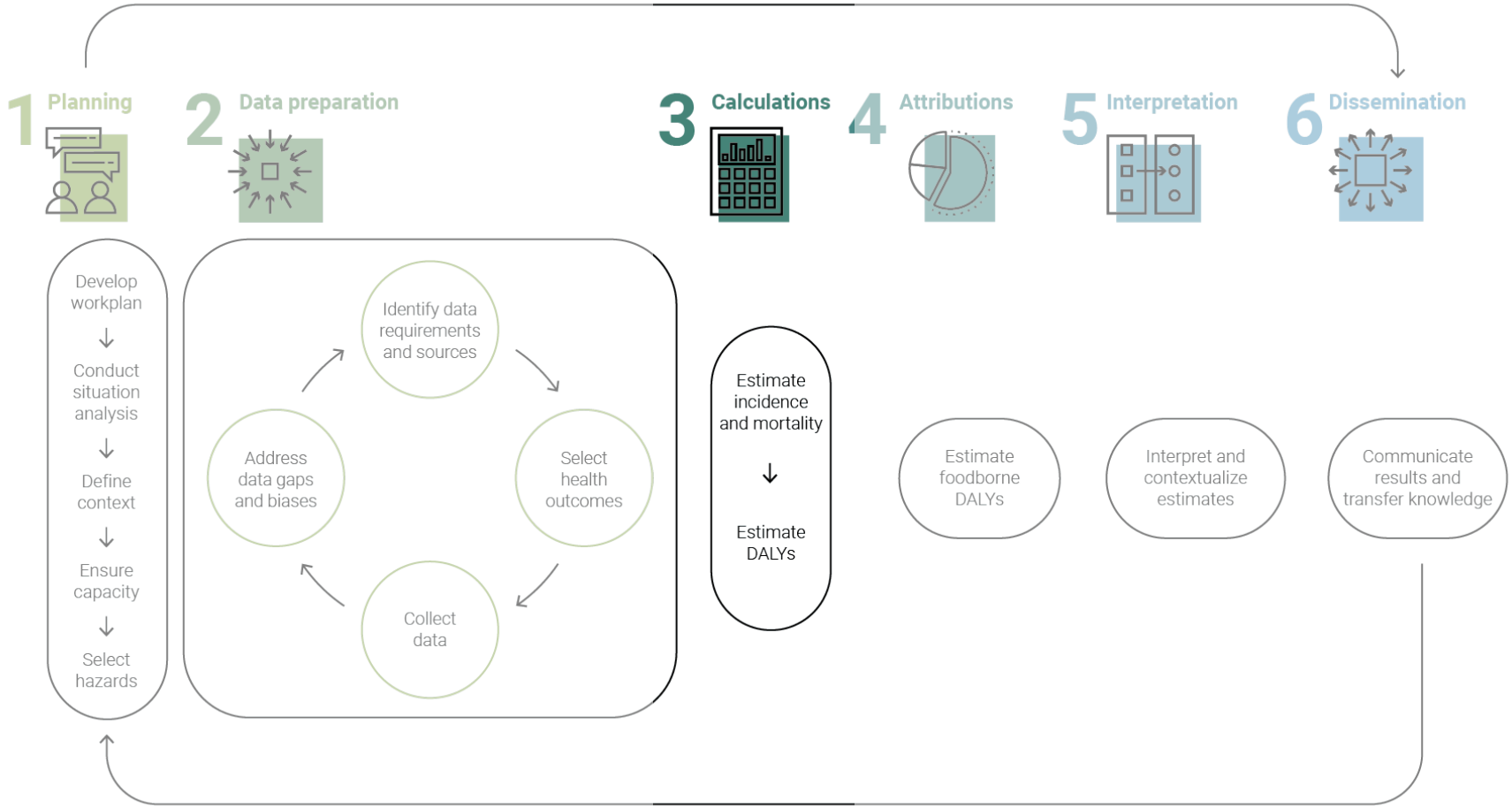
- DW represents severity of each health outcome
- Value between 0 (full health) and 1 (death)
- Option - recent set of DWs developed for the WHO global health estimates or GBD study



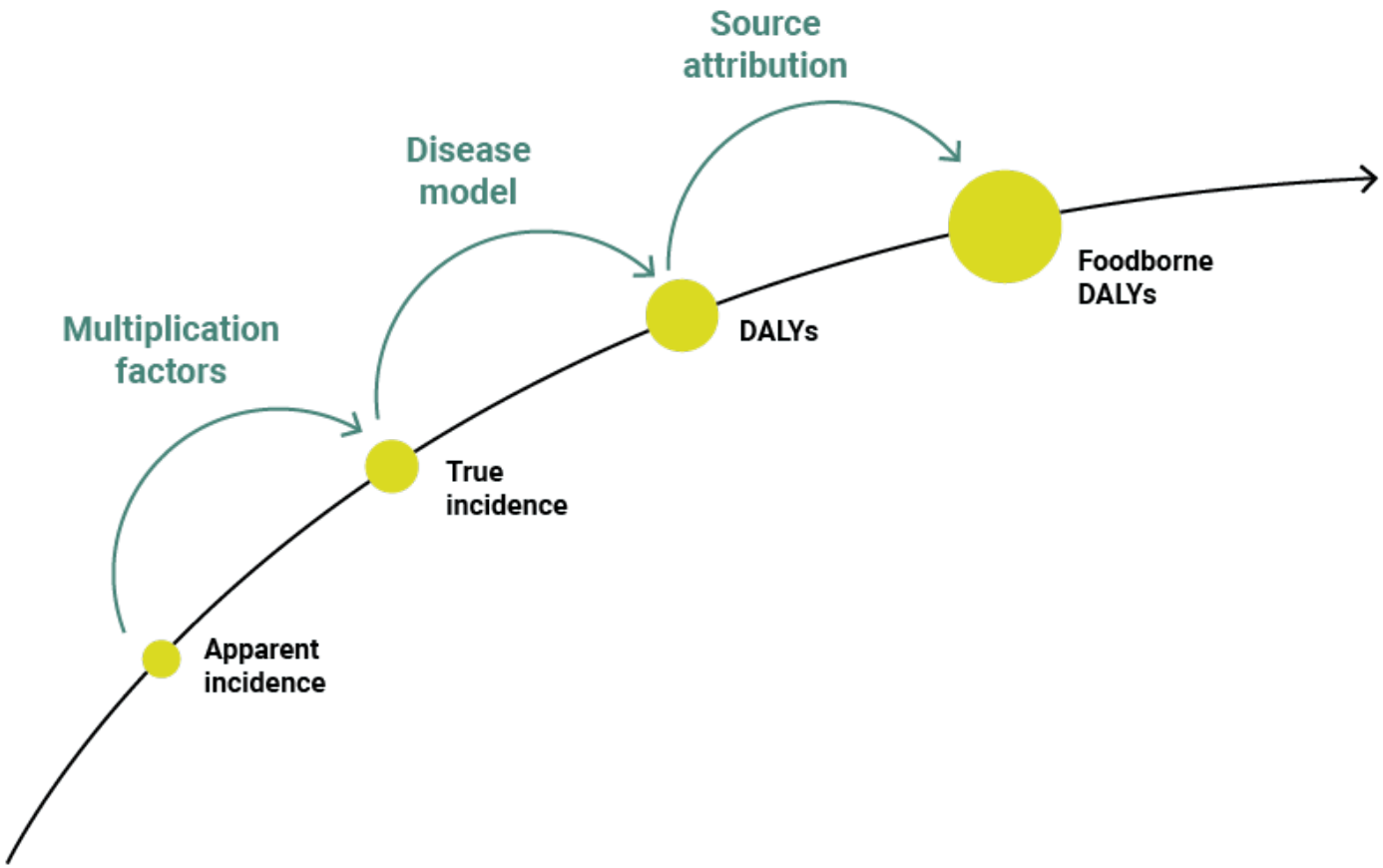
Addressing gaps and biases

- Identify data gaps at each step
- Document implications and assumptions
- Identify possible solutions

Calculating DALYs



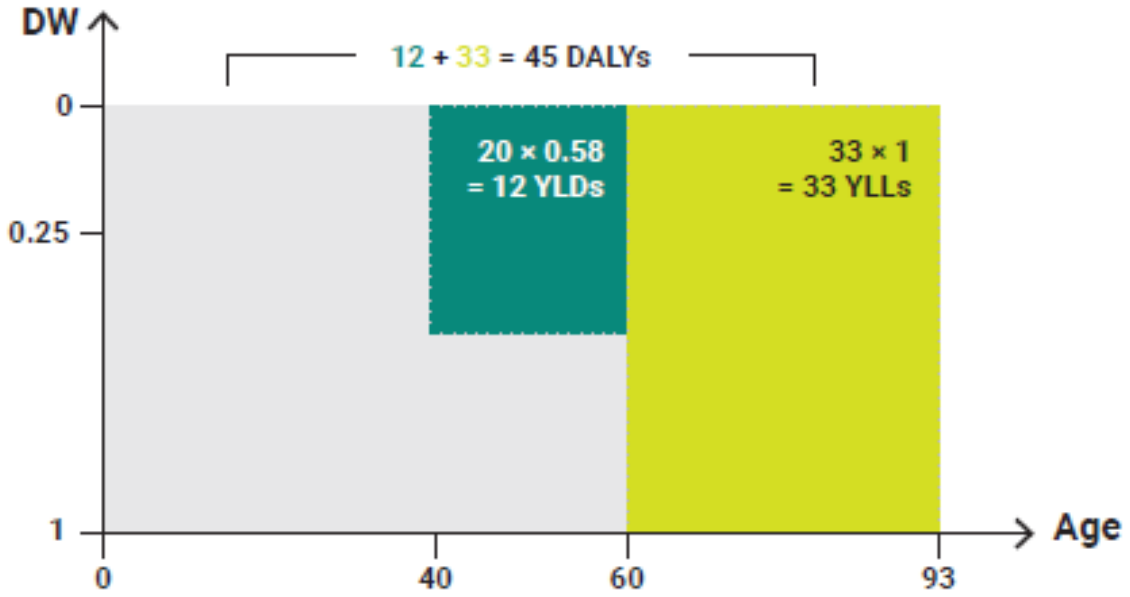
Main steps of the foodborne disease calculation



Calculating DALYs (1)

Example

Consider a female patient who lives in a perfect state of health until she develops mild rheumatoid arthritis at age 40



Calculating DALYs (2)

$$DALY=YLL+YLD$$

YLL is the product of the number of deaths (M) and average remaining life expectancy (RLE) at the time of death:

$$YLL=M \times RLE$$

YLD is the product of the number of cases (N), duration (D), and the disability weight (DW):

$$YLD=N \times D \times DW$$

Uncertainty

- Linked to the quality and representativeness of the data, and to disease model assumptions
- Important to identify and address, to
  - demonstrate strength of evidence
  - allow comparisons between studies
  - facilitate knowledge translation
  - help to identify knowledge gaps
- When possible, identify, quantify, analyze, report sources of uncertainty

Estimating foodborne DALYs
Source attribution

- Attribution of the total disease burden to foodborne transmission
  - Some pathogens are exclusively foodborne (e.g. *Listeria monocytogenes, Taenia solium*)
  - Many foodborne pathogens also use other routes (e.g. environmental, direct contact)
- Variety of approaches, including epidemiological studies, studies using data from human and animal or food surveillanc
- Primary steps to the source attribution pro
  - Attribution to ”foods”
  - Attribution to specific foods

- Countries without national estimates are encouraged to use the FERG estimates for their subregion as a proxy

Interpreting national burden of disease results

Pathogen	Reported cases	Estimated cases	Estimated deaths	YLD	YLL	DALY	DALYs per 100 000 population	Proportion foodborne (%)	Foodborne DALYs
Campylobacter	4231	58 141 (49 617 – 71 781)	56	1013 (969–1060)	696	1709 (1665–1755)	29.7 (29.0–30.5)	76	1299
Norovirus	-	185 060 (156 506 – 212 627)	25.9 (20.4–31.7)	128.6 (106.3–153.4)	356.3 (280.4–435.8)	485 (398–573.1)	8.6 (7.0–10.1)	18	86
Listeriosis	58	58	12	14.2 (11.4–16.9)	186.4	196 (193.5–198.5)	3.4 (3.4–3.5)	100	196
Congenital toxoplasmosis	-	10 (8–12)	1 (1–2)	53 (32–77)	112 (81–153)	165 (126–222)	-	61	100

Burden of foodborne diseases in Denmark, 2017

Knowledge translation and risk communication

- Presentation and communication of results is essential
- Consider target audiences, e.g.
  - Policy-makers
  - Food business operators
  - Media
  - Community, general public, consumers
  - Scientific community
- Consider the purpose of the message
- Decide on dissemination strategy early

Final considerations (1)

- Burden of foodborne disease estimates - inform food safety policy and help establish priorities
- National studies are critical to:
  - focus efforts on the national context
  - deliver estimates that are as accurate as possible and build on local data
  - fill data gaps identified in global and regional efforts

Final considerations (2)

- Start estimating National BoFD to the extent that expertise and resources allow
- Promote further development of surveillance programmes and encourage further investments
- Early inclusion of stakeholders - support knowledge translation and science-based policies

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Further learning

Steps 1-4: module 1
Steps 5-6: module 2
Steps 7-9: module 3

Multisectoral Actions in Food Systems

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