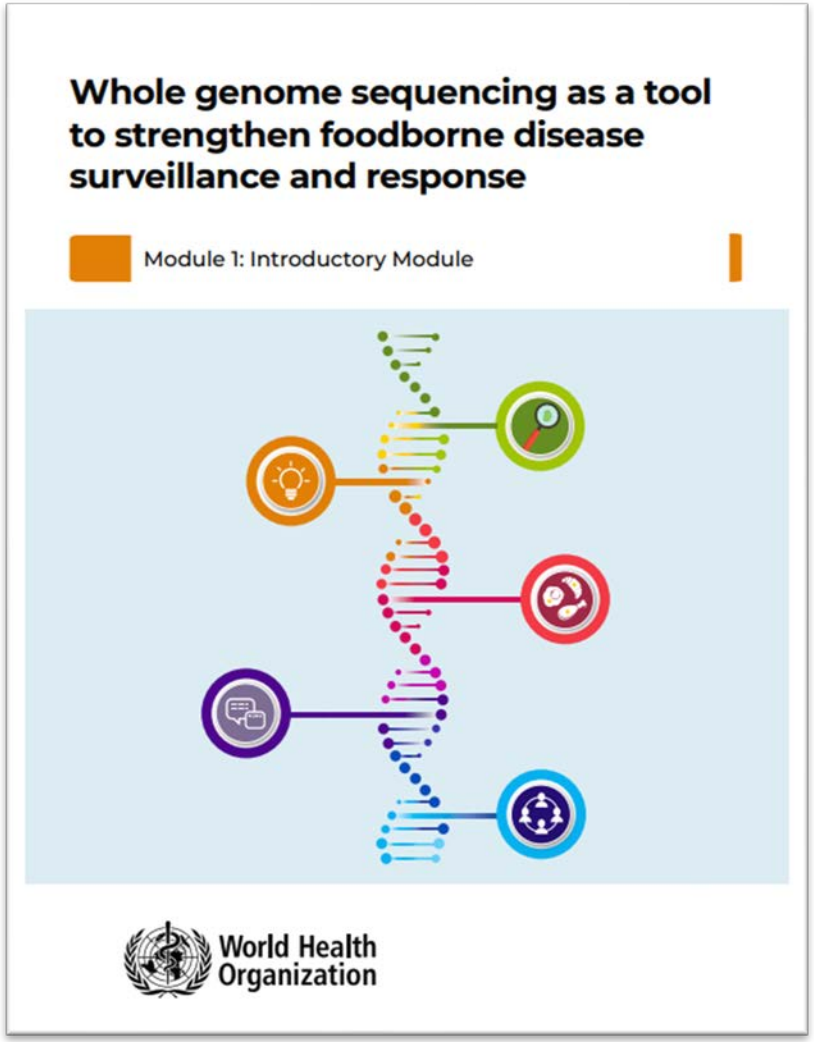
Whole genome sequencing as a tool to strengthen foodborne disease surveillance and response

Dr Kirsty Hope

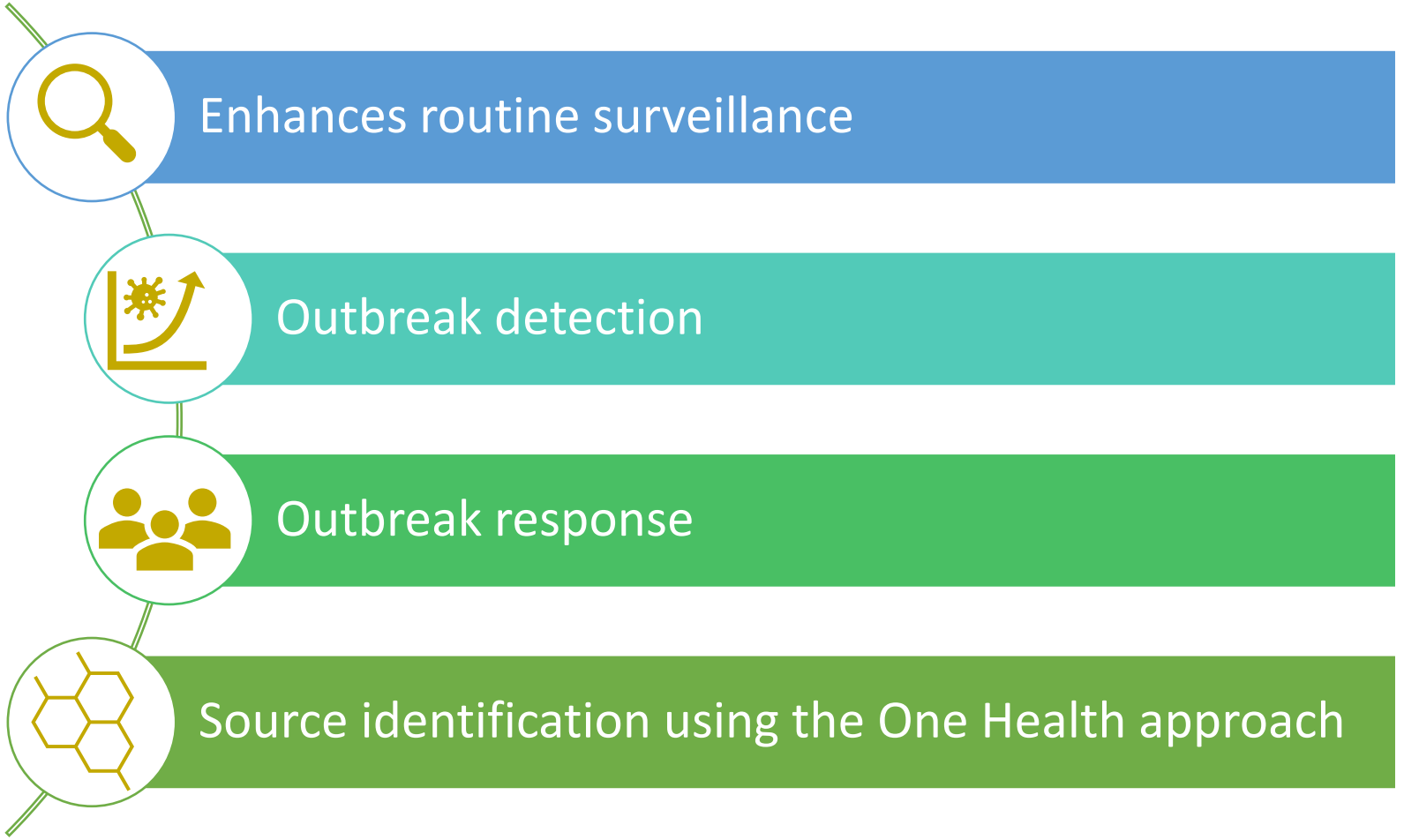
WHO Health Talks
Friday 9 June 2023

Whole genome sequencing (WGS) as a tool to strengthen foodborne disease surveillance and response

- Introduction and objectives
- Why is WGS for foodborne pathogens important?
- How the results from WGS be used for surveillance and outbreaks of foodborne diseases?

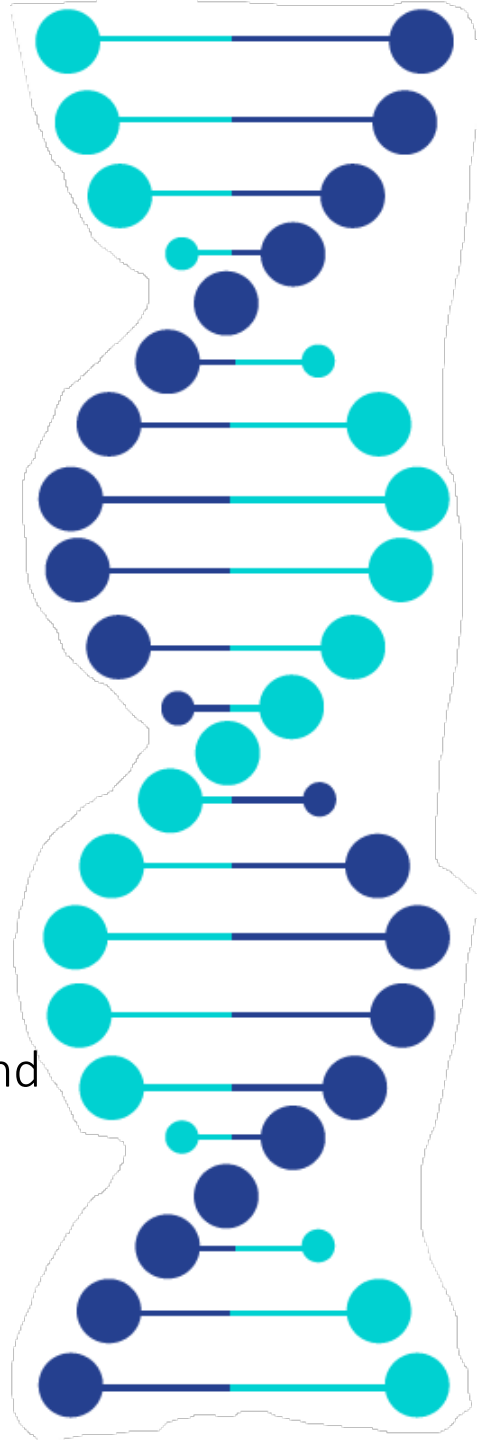


How is WGS useful for response to foodborne diseases?



Guiding principles

1. Focus is on building on existing national surveillance and response systems
2. Surveillance is needed to detect and respond effectively to acute public health events to minimize the adverse impact on public health and the economy.
3. National surveillance and response systems in countries are at different levels of development and complexity, with different requirements and priorities
4. Developments outside the health sector can strengthen foodborne disease surveillance and response systems
5. Commitment at the senior policy and decision maker-level to using WGS is vital
6. Introducing and using WGS requires sufficient human and financial resources
7. Existing international networks can have resources to strengthen national surveillance and response systems.

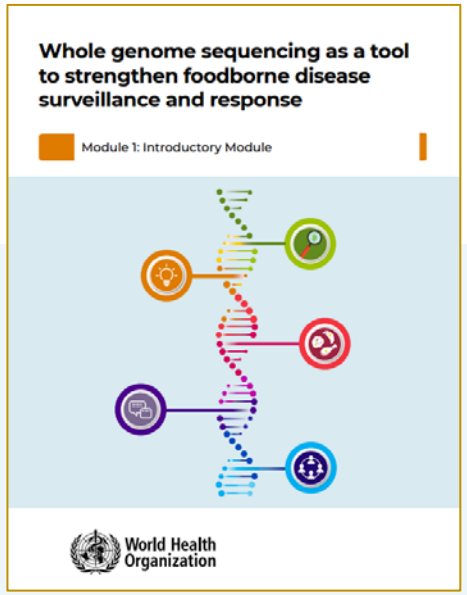


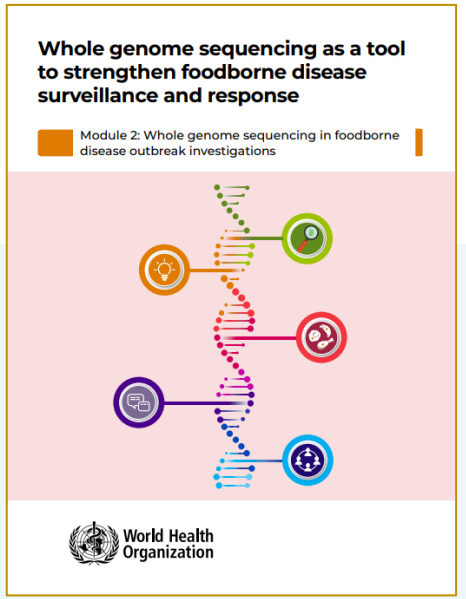
WHO's new guidance document:

Whole genome sequencing as a tool to strengthen foodborne disease surveillance and response

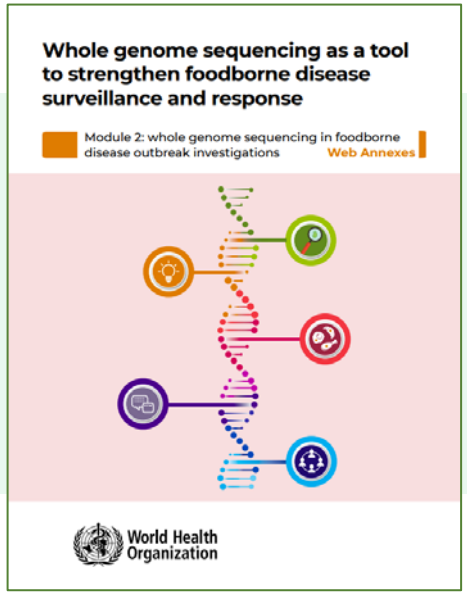
- Motivation
- Development

Modules 1, 2, and 3





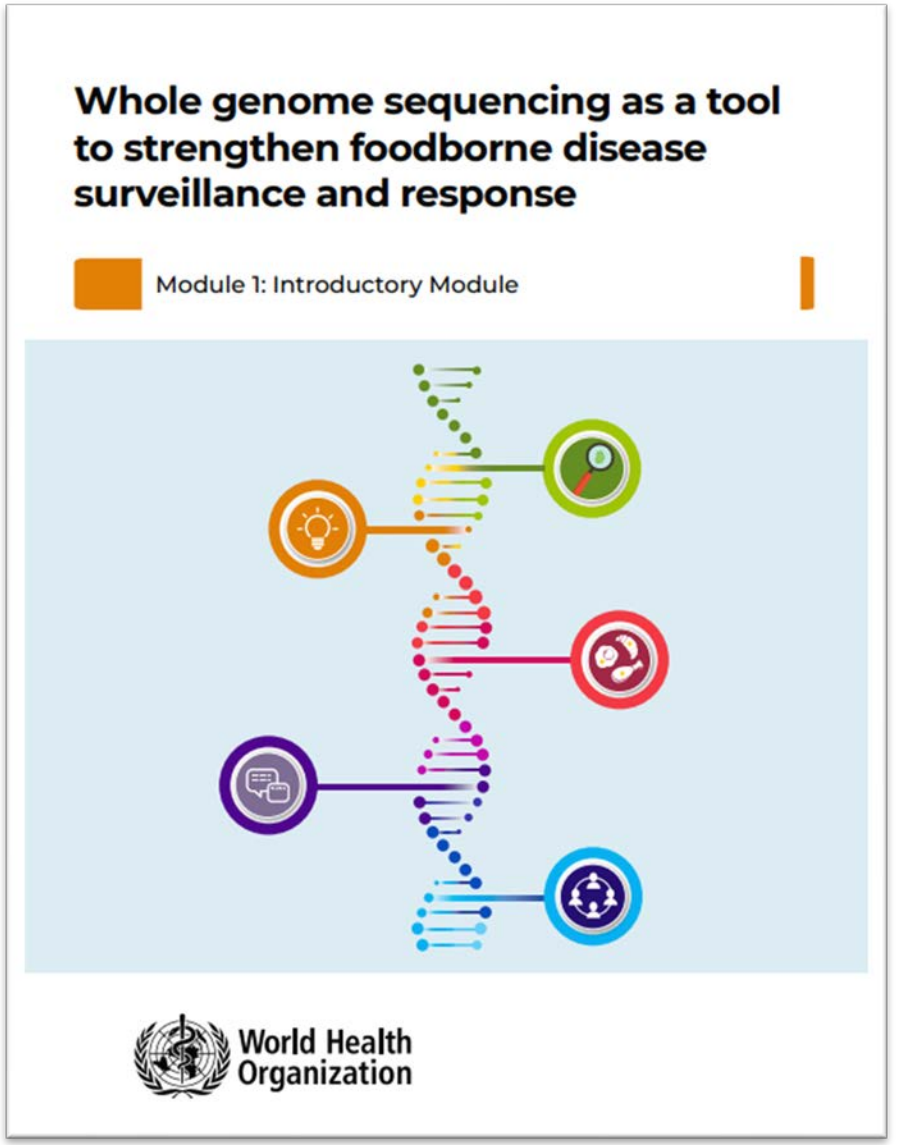
Web Annexes 1 and 2



1 Introductory module

It is not necessary to read all three modules. The purpose of the first module is to:

- introduce WGS and its relevance to foodborne diseases
- define the minimum capacities needed before a country can implement WGS for outbreak investigations and routine surveillance
- assist countries in selecting an option for implementing WGS within their existing surveillance and response system



2 Outbreak module

This module discusses how WGS can be used to support foodborne disease outbreak investigations.

It is meant for countries in the initial stages of laboratory-based surveillance for selected foodborne pathogens.

The module describes how WGS can be used in the investigation of outbreaks detected by existing surveillance systems.

3 Surveillance module

This module is about using WGS in routine surveillance of foodborne diseases.

It is meant for countries experienced in laboratory-based surveillance of foodborne pathogens.

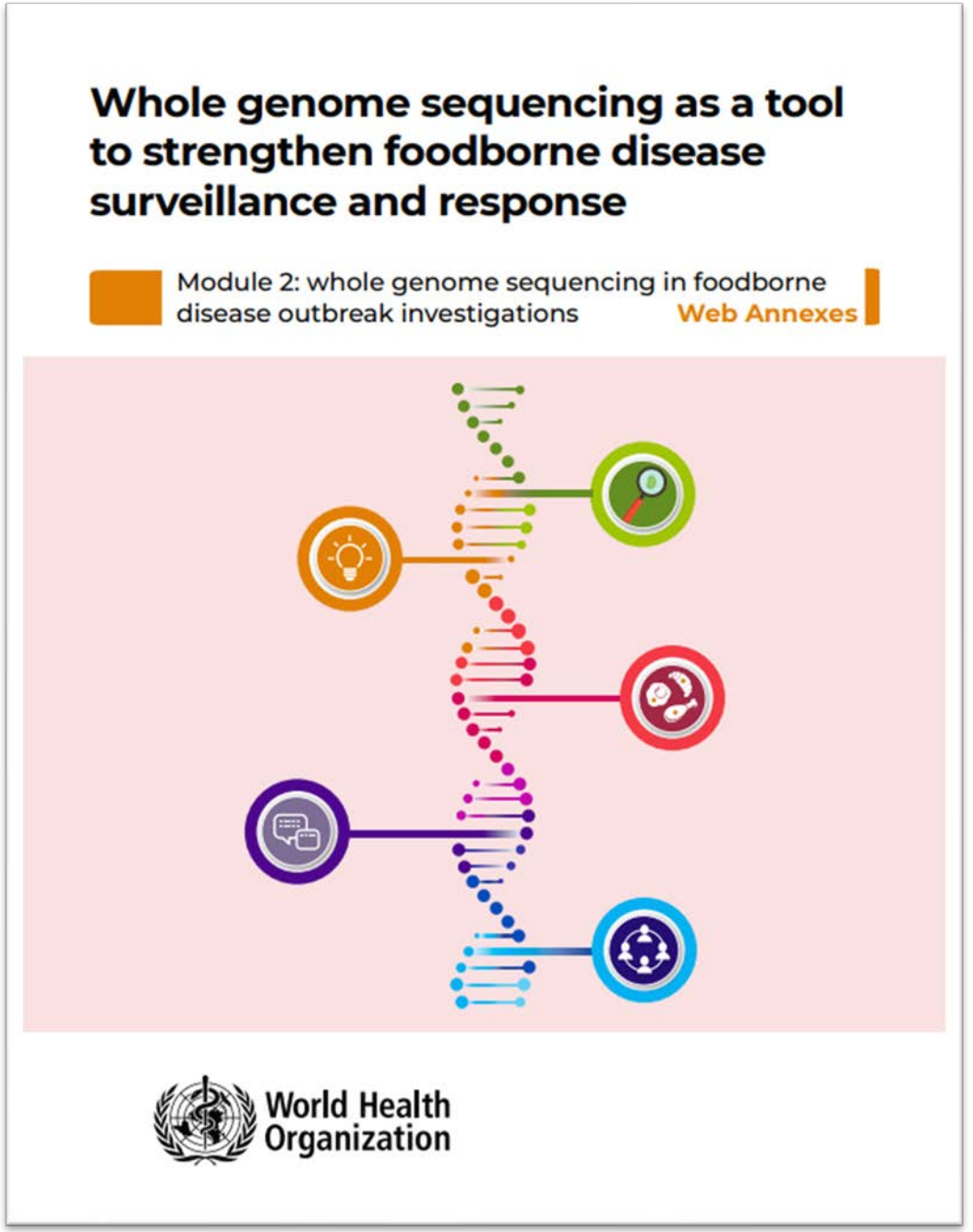
WGS can be implemented where subtyping foodborne pathogens or replacing traditional typing methods is being considered.

Routine surveillance includes outbreak detection, monitoring trends over time, and using WGS for AMR and virulence factor monitoring.

Web annex 2

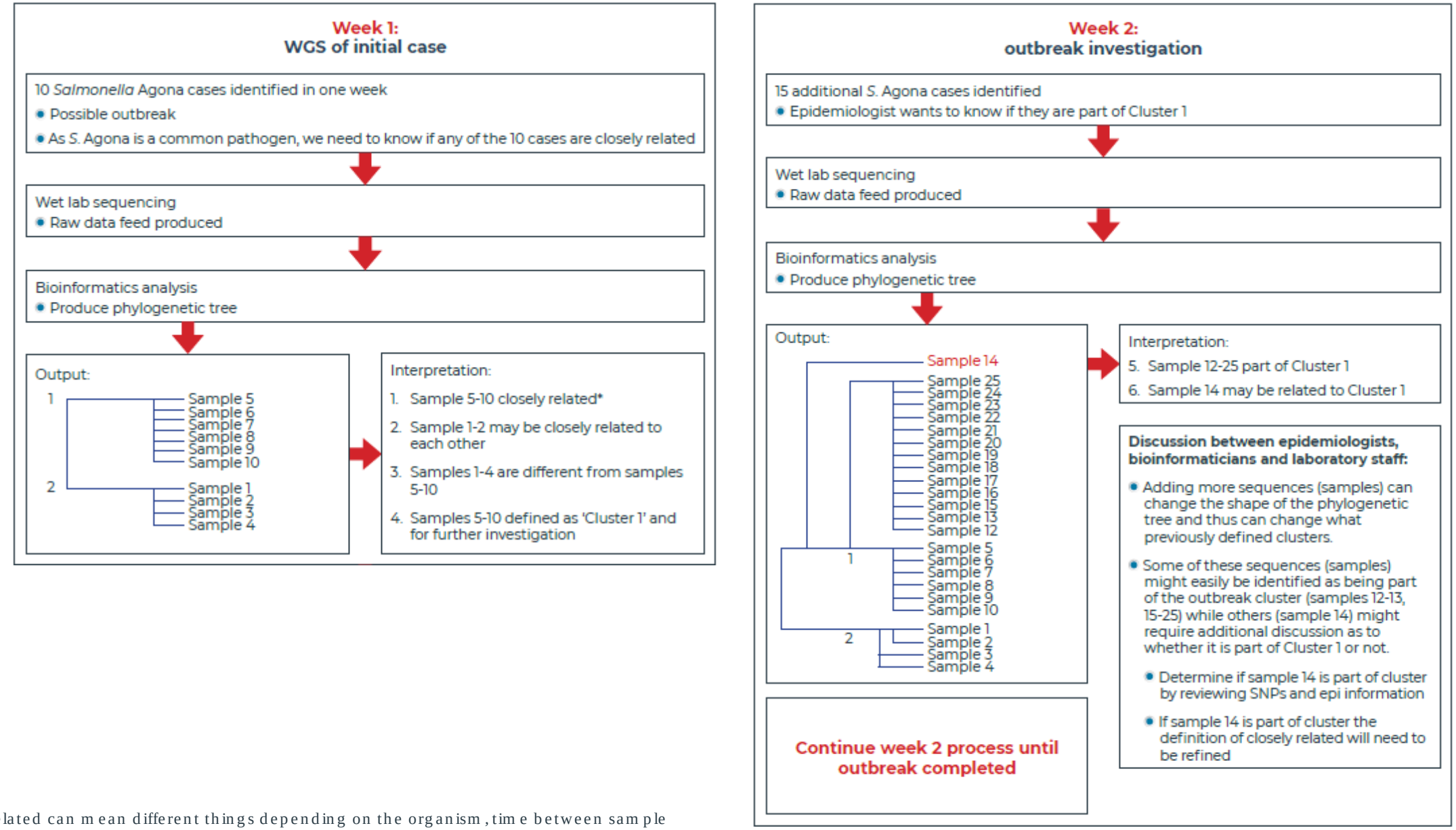
Annex 2: Outbreak investigations

- Working group terms of reference
- Mapping, outsourcing and establishing wet lab sequencing capabilities and the bioinformatics component in the public health laboratory
- Epidemiologists and WGS during outbreak investigations
- The role of key stakeholders
- Points to communicate to decision makers
- Templates:
  - System description
  - Requirements document
  - Mapping wet and dry lab sequencing capacities
  - Business case
  - Cost estimates
  - Pilot study plan
  - Managing implementation



Web annex 2

Illustration of the use of WGS in a *Salmonella* Agona outbreak investigation



*Closely related can mean different things depending on the organism, time between sample collection, and possible source, etc.

Web annex 3

Annex 3: Routine surveillance

- Working group terms of reference
- Establishing wet lab sequencing capabilities and the bioinformatics component in the public health laboratory
- Case studies
- The role of key stakeholders
- Points to communicate to decision makers
- Templates:
  - System description
  - Requirements document
  - Mapping wet and dry lab sequencing capacities
  - Business case
  - Cost estimates
  - Pilot study plan
  - Managing implementation

Web annex 3

Annex 3: Routine surveillance

- Case studies:
  - US Centers for Disease Control and Prevention
    - PulseNet USA
  - Public Health England (PHE)
  - Public Health Agency of Canada
  - Malbran Institute in Argentina
  - PulseNet international

Thank you

For questions, please email
fbd-burden@who.int

Editorial guidance

Editorial Committee
Amy Cawthorne, Kirsty Hope, Kaouri Koume, Charlee Law, Megge Miller, Enrique Pérez Gutiérrez, Eric Stevens

Executive Editor
Amy Cawthorne (2017-2018), Jorge Matheu (2018-2021), Yuki Minato (2022), Charlee Law (2023)

Other members of the WHO secretariat
Jean Marc Gabastou, Marcelo Fabian Galas, Dhamari Naidoo, Christopher Oxenford

Authors and reviewers

Module 1: Introductory Module

Authors
Kirsty Hope, Megge Miller, Eric Stevens

Peer reviewers:
Marc W. Allard, Timothy Dallman, Xiangyu Deng, Rita Finley, Rene S. Hendriksen, Daneeta Henessey, William Hsiao, Kari Irvin, Claire Jenkins, Hilde Kruse, Ernesto Liebana, Patrick Munk, Stefano Pongolini, Valentina Rizzi, Nick Thomson, Moon Tay Yue Feng

Module 2: Outbreak investigations

Authors
Kirsty Hope, Megge Miller, Eric Stevens

Other authors
Claire Jenkins, Celine A. Nadon, Eric Device Ng'eno, Stefano Pongolini, Nick Thomson, Caterina Guzman Verri

Peer reviewers
Marc W. Allard, Jennifer Beal, Timothy Dallman, Peter Gerner-Smidt, Rene S. Hendriksen, William Hsiao, Kari Irvin, Hilde Kruse, Pimlapas Leekitcharoenphon, Valentina Rizzi

Module 3: Routine surveillance

Authors
Kirsty Hope, Megge Miller, Eric Stevens

Other authors
Philippe Belanger, Peter Gerner-Smidt, Caterina Guzman Verri, Claire Jenkins, Celine A. Nadon, Eric Device Ng'eno, Stefano Pongolini, Nick Thomson

Peer reviewers:
Marc W. Allard, Timothy Dallman, Ria Finley, Daneeta Hennessey, William Hsiao, Hilde Kruse, Patrick Munk, Valentina Rizzi