Principle of Epidemiology for AMR Surveillance in Livestock

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Food and Agriculture Organization of the United Nations

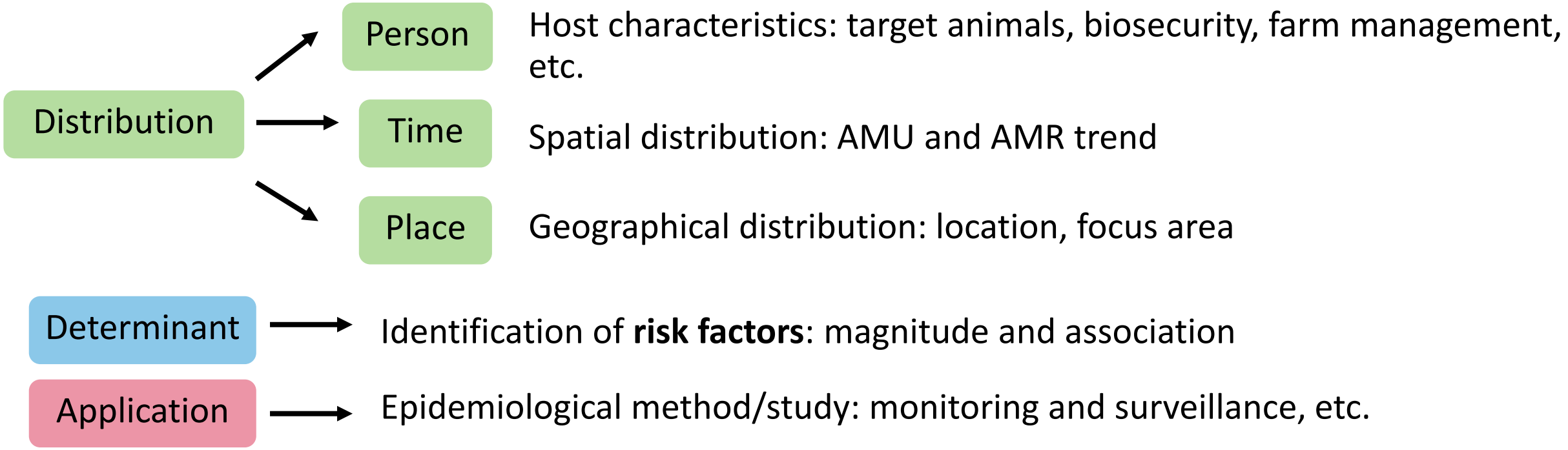
World Health Organization

World Organisation for Animal Health
Founded as OIE

Funded by the European Union

Definition and component of epidemiology

- The study of the **distribution** and **determinants** of health-related states or events in specified populations
- The **application** of this study to the control of health problems



AMR surveillance

Definition of AMR surveillance

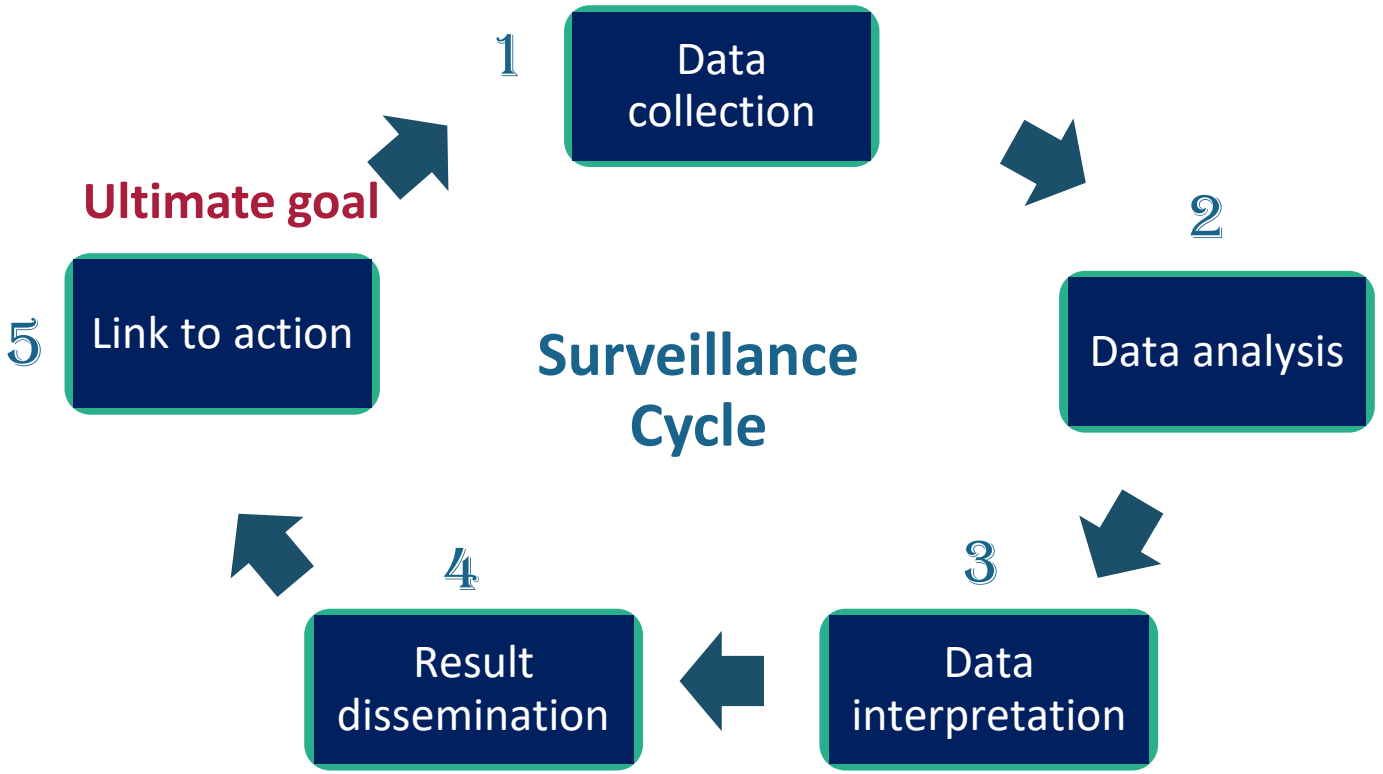
- Surveillance is a system to indicate prevalence and incidence of AMR in specific population

Prevalence	Magnitude of problem
Incidence	Probability or likelihood

Purposes of AMR surveillance

- To strengthen capacity and laboratory network to **collect, analyze and report** on AMR
- AMR information will contribute to shaping actions at the local, national, regional, and international levels.

Surveillance cycle



Surveillance structure for AMR

Surveillance context

Surveillance components

Design
- Target bacteria, AMR indicator, animal species, type of sample, and point of data collection

Sampling
- Population size, sample size, sampling strategy, sampling schedule, and risk factors

Outcome
- Actual sample size, laboratory results, and other relevant information

Component of AMR surveillance

Are you ready for national AMR surveillance?

1. Surveillance component
2. Target population
3. Testing protocol
4. Study design
5. Sampling strategy
6. Timeliness
7. Results and interpretation

1. Component of AMR surveillance

Surveillance method	Active and passive surveillance
Data collection	Sampling location from farm, slaughterhouse, and retail
Type of hazard indicator	AMR bacteria: indicator or pathogenic bacteria
Type of material collected	Specimen: cloacal swab, caecum, meat, etc.
Case definition	AMR positive/negative, standard protocol, laboratory finding, etc.

AMR Surveillance

Surveillance
- Active (sick animals and healthy animals)
- Passive (sick animals)

Farm

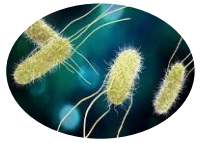
Slaughterhouse

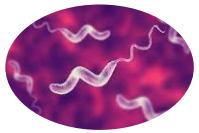
Retail
- Fresh market
- Supermarket

Target bacteria
- Indicator bacteria
- Pathogenic bacteria

Indicator bacteria
- *Escherichia coli*
- *Enterococcus faecium* and *E. faecalis*

Pathogenic bacteria
- *Salmonella* spp.
- *Campylobacter coli* and *C. jejuni*





Specimen
- Farm
- Slaughterhouse
- Retail

Farm
- booth swab
- cloacal swab

Slaughterhouse
- cecum
- whole carcass

Retail
- meat

2. Target population

- ***Target animal***
  - High production
  - High consumption (import and export)
  - Farm management (different farm type)
- ***Population coverage***
  - Update information (farm: animal population, slaughterhouse: production, retail: selling data)

3. Testing protocol

- ***Standard protocol for AMR detection***
  - Update
  - Homogeneity between and within laborat
- ***Laboratory detection***
  - Screening and confirmatory test
  - Accuracy of the test
  - Standard protocol

4. Study design

- ***Sampling strategy***
  - ***Non-probability sampling***
    - Convenient sampling
    - Purposive sampling
  - ***Probability sampling***
    - Simple random sampling
    - Stratified sampling
    - Cluster sampling
    - Systematic sampling
  - ***Frequency of sampling*** (season- prevalence of bacteria; laboratory capacity)
- ***Number of target population***
  - Updated data
  - Sampling frame

5. Sampling strategy

- ***Sample size calculation***
  - Prevalence of bacteria
  - Prevalence of AMR
  - Error (1-10%)
  - Confidence interval (90-99%)
  - Tool for sample size calculation
- ***Sample allocation***
  - Number of specimens per farm, slaughterhouse, or retail
  - Epidemiological unit (individual level or farm level)

6. Timeliness

- ***Time from sampling to laboratory***
  - Reliability of the test
- ***Time from lab detection to report***
  - Process of data dissemination
- ***Time from confirmation to action***

7. Result and interpretation

- ***Statistical analysis***
  - Descriptive statistics (prevalence, trend, etc.)
  - Analytic statistics (association, prediction, etc.)
- ***Surveillance outcome***
  - Phenotypic resistance
  - Genotypic resistance
  - Virulent factor
  - Plasmid
  - AMR emergence
- ***Risk factor analysis***
  - Factors influence on the occurrence/control of AMR

Summary surveillance for AMR in livestock

Surveillance systems

Surveillance components

- **Context**
  - objectives, target population, pattern, geographical distribution
- **Design**
  - Type of sample, target animal, representativeness, data collection
- **Sampling**
  - Sampling design, sample size, risk factors, etc.
- **Outcome**
  - Actual sample size, laboratory test, other relevant information

Drawings: FAO/Khin Nyein Chan Oo

Working together to fight antimicrobial resistance