

FORTIFYING INSTITUTIONAL RESILIENCE AGAINST BIOLOGICAL THREATS PROJECT

SAROVA PANAFRIC HOTEL

NAIROBI

14-16 MARCH 2023



Epidemiology, modelling and
surveillance in Africa

Misheck Mulumba



OUTLINE

Veterinary Epidemiology
Modelling
Surveillance

VETERINARY EPIDEMIOLOGY

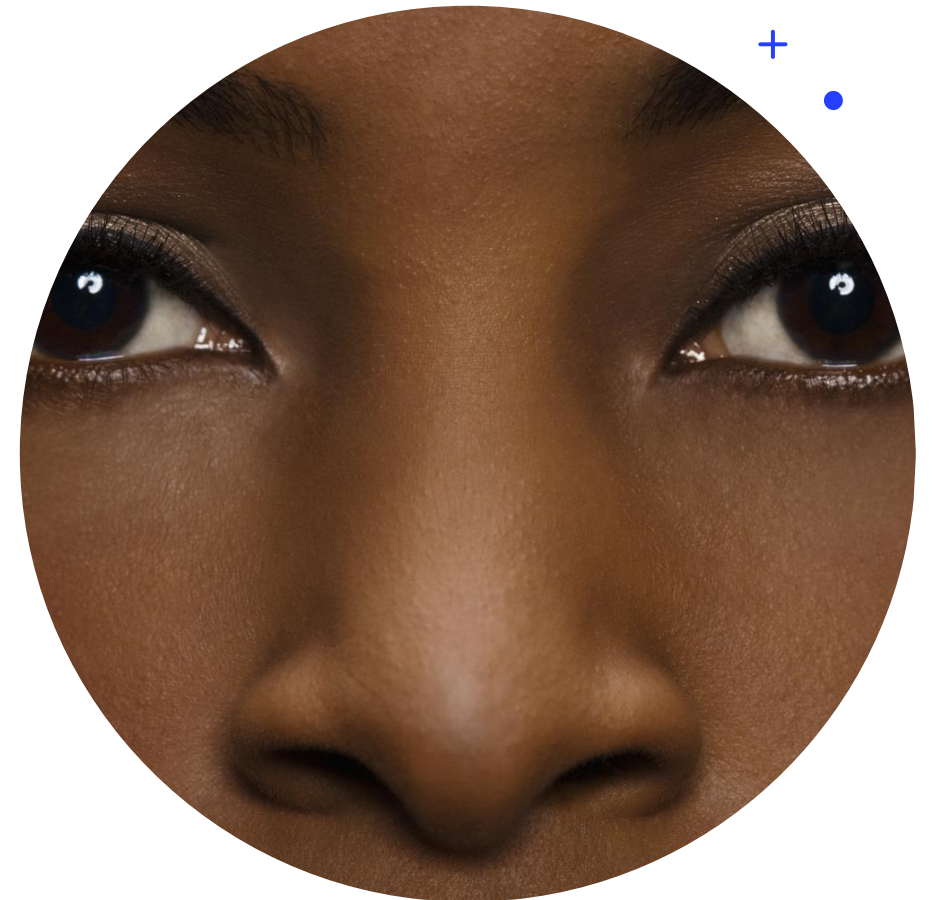


- ❖ Veterinary epidemiology focuses specifically on disease surveillance, response, and prevention.
- ❖ It involves data collection and analysis to develop and test hypotheses related to disease patterns



5 broad Objectives of epidemiology:

- The first three objectives deal with:
 - ❖ determination of the origin of a disease whose cause is known
 - ❖ investigation and control of a disease whose cause is either unknown or poorly understood;
 - ❖ and acquisition of information on the ecology and natural history of a disease
- The remaining two objectives include:
 - ❖ planning, monitoring and assessment of disease control programmes; and
 - ❖ assessment of the economic and other social effects of the disease and analysis of the costs and benefits of alternative control programmes



EPIDEMIOLOGICAL MODELLING



Modelling

- ❖ Applied epidemiological models are used in predicting future trends of diseases, for the basic understanding of disease and health dynamics, and to improve the measurement of health indicators.
- ❖ A lot of research goes into developing fit-for-purpose models to be applied in the field at less cost than actual disease surveys which are more costly
- ❖ Key is that these models must be accurate to realistically predict disease trends and develop effective prevention and control strategies
- ❖ Laboratory and field research constitute a major part of the modelling effort.
- ❖ Mapping the research outputs of epidemiological modelling studies concerned with transmission dynamics of (infectious) diseases and interventions in Africa are therefore critical to identifying the areas with:
 - ✓ substantial levels of research activities
 - ✓ areas with gaps and
 - ✓ research output trends across the continent.
- ❖ Unfortunately, trends show that the majority of research in this field is **not** evenly distributed across the continent but is dominated by researchers from South Africa and Kenya
- ❖ Worse still its only a fraction of the world research in the field. Clearly a lot more has to be done



MODELS(cont.)

❖ The utility and accuracy of epidemiological models in decision-making on appropriate responses during disease emergencies, is a factor of

- ✓ their calibration to local data
- ✓ evidence informing model assumptions
- ✓ speed of obtaining and communicating their results
- ✓ ease of understanding and
- ✓ willingness by policymakers to use their insights



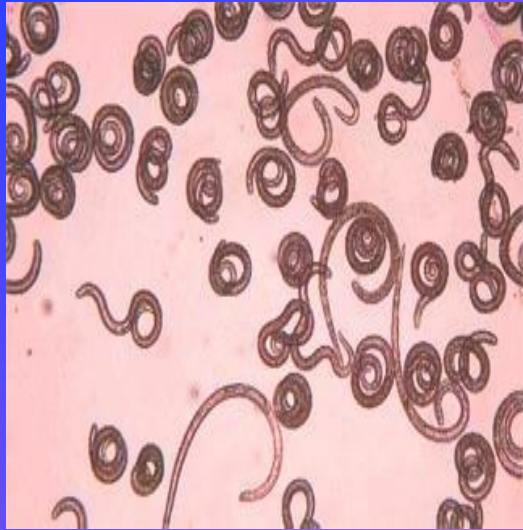
What is epidemiological modelling

- ❖ Epidemiological models are simplified representations of real-world processes expressed in mathematical language. In epidemiology, models are used to understand the way infectious diseases spread through populations.
- ❖ They combine basic principles of how a disease spreads – contact between an infectious subject and one that is susceptible – with characteristics of the population to estimate how many subjects will get infected over time.



Epidemiological models typically have inputs relating to:

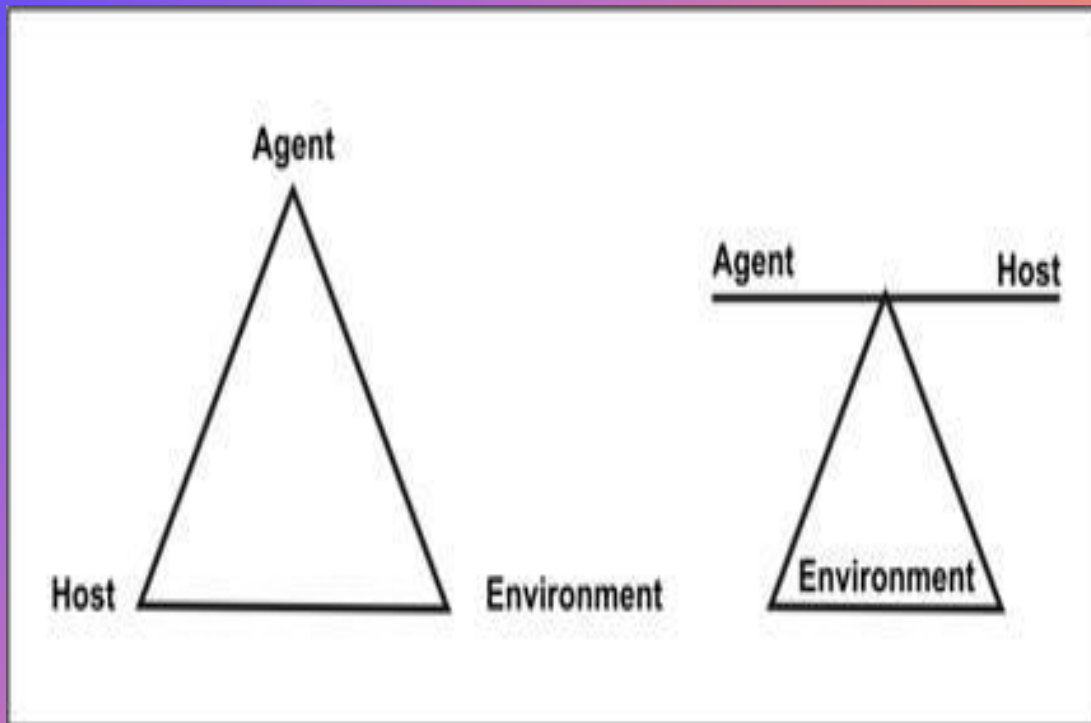
- Characteristics of the pathogen, such as the incubation period, infectiousness, and age-specific risk of symptoms, or death.
- Characteristics of the population, such as the age structure and the level of herd immunity either from vaccination or from previous infection.
- Some estimates of the rates of contact between subjects, including interaction patterns and social structure, and how these are affected by various public health interventions.



What are epidemiological models (cont)?

- In an epidemiologic model, the population under consideration can be divided into different classes which change with time t .
- These are divided into:
 - ❖ susceptible ($S(t)$)
 - ❖ infective ($I(t)$) and
 - ❖ removed ($R(t)$)
- Infective classes of the population are those which are actively passing on the disease to others.

THE BASIC COMPONENTS OF AN EPIDEMIOLOGICAL MODEL (FOR INFECTIOUS DISEASES)



Concepts of Disease Occurrence

- A critical premise of epidemiology is that disease and other health events do not occur randomly in a population but are more likely to occur in some subjects of the population than others because of risk factors that may not be distributed randomly in the population.
- Thus, one important use of epidemiology is to identify the factors that place some members at greater risk than others.

EPIDEMIOLOGICAL SUREVEILLANCE





Epidemiological Surveillance

Defn:

An observational method based on:

- continuous recording to follow the animal health status or risk factors in a defined population
- particularly to detect the appearance of pathological processes and
- study their development over time and space,

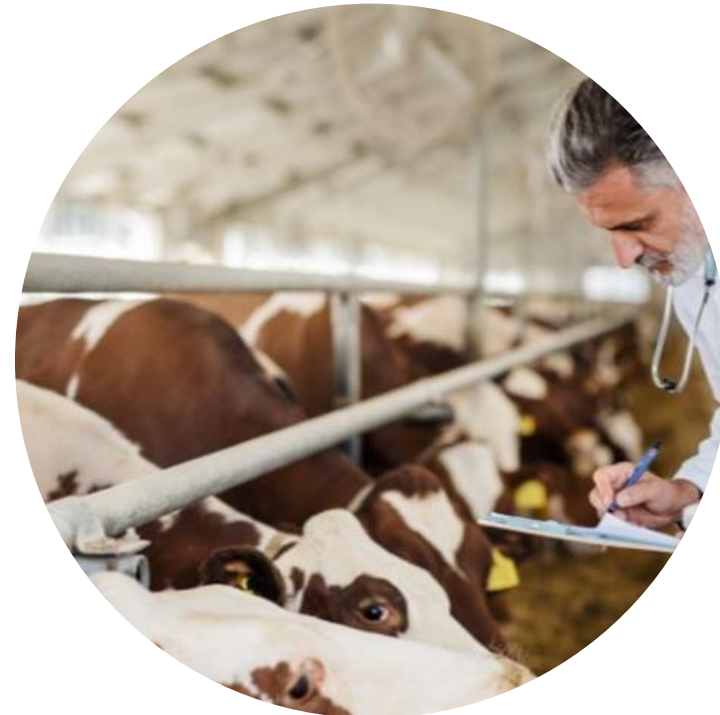
with a view to adopting appropriate control measures (B. Dafour and P. Hendrikx, 2009)

Epidemiological Surveillance

- **comprises 3 notions that must co-exist:**
 - Descriptive epidemiology
 - Long-term action
 - Perspectives for action

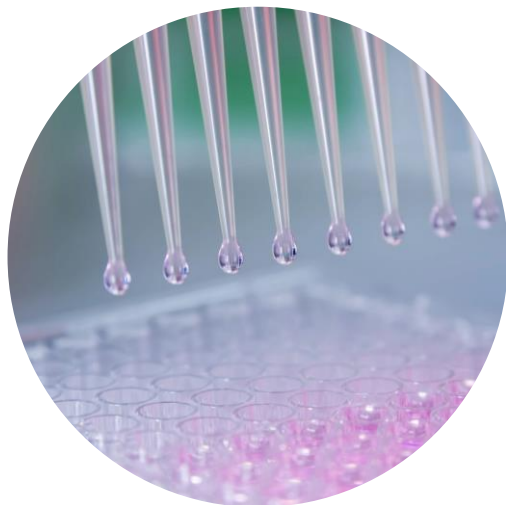
+

o



Epidemiological Surveillance systems

•



+

○



- **Laboratory disease diagnosis**

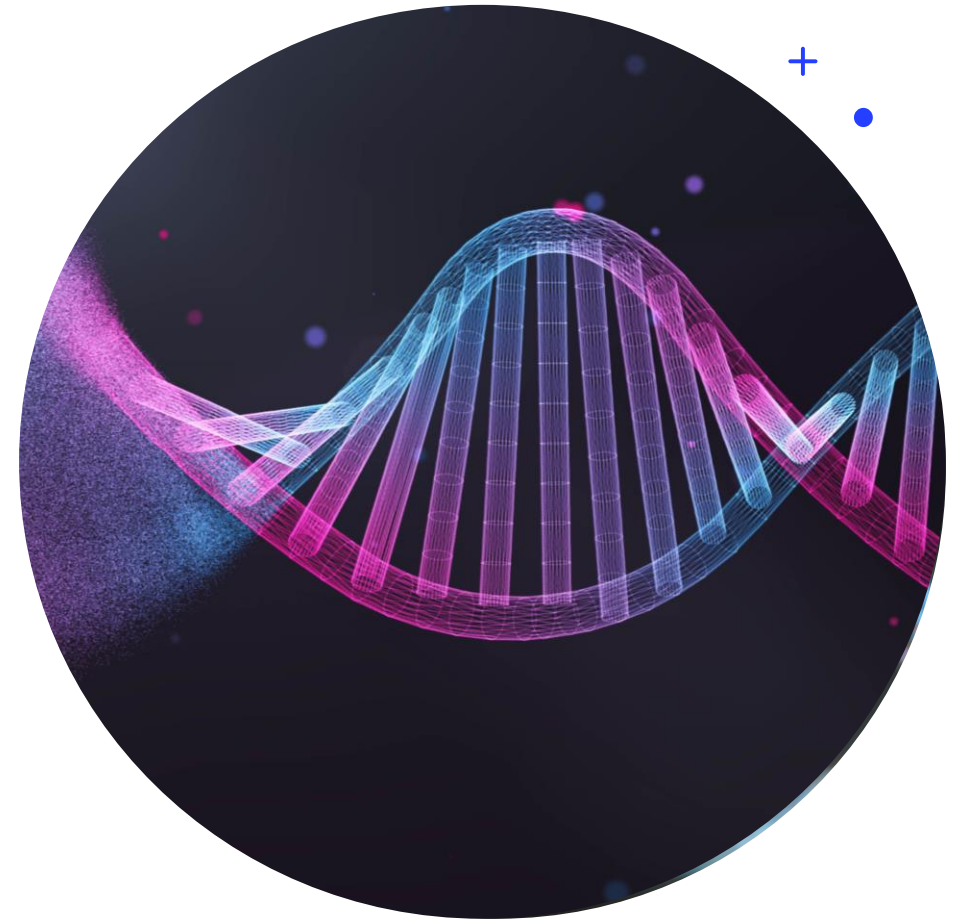
- Without the data and information supplied by the ARC-OVR diagnostic laboratories, animal disease detection, control and prevention would be significantly weakened
- ARC-OVR has aptly equipped laboratories utilizing latest technologies and internationally accredited test methods.
- The laboratories are fully SANAS ISO 17025 accredited
- ARC-OVR houses 8 WOAHA Reference laboratories and FAO collaborating centres on its campus
- It has a BSL3 facilities with capacity to hold experimental animals
- All laboratories comply with international practices on health and safety, biosafety and biosecurity

A BIT ABOUT THE ARC-OVI WORK IN:

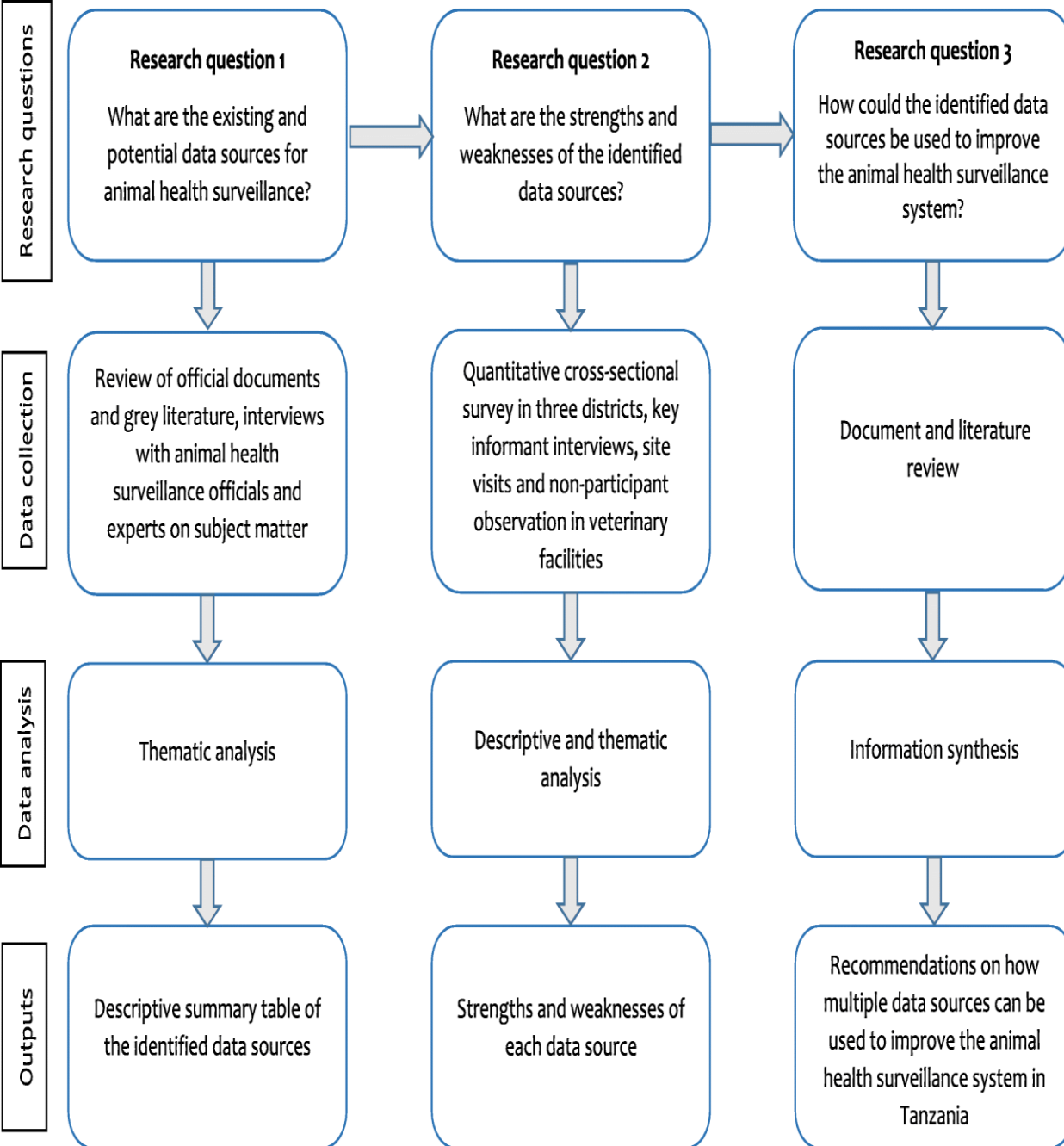
RESEARCH EPIDEMIOLOGY AND DIAGNOSTIC SYSTEMS

Sequencing and phylogenetics

- Deducing phenotypic properties or epidemiological linkages from sequence data helps field veterinarians establish proper disease control measures
- These systems are being increasingly incorporated into epidemiological systems
- OVI has appropriate expertise and well-equipped laboratories to conduct sequencing and phylogenetic analyses.
- The OVI has a Biotechnology Platform that creates high-throughput resources and technologies required in genomics, and quantitative genetics
- It also provides an ideal environment in which skilled researchers can be hosted and trained
- These technologies are assessable as services to the OVI, collaborators, companies, scientific communities and researchers across the globe



Epidemiological Surveillance



Roles of epidemiological surveillance:

- Is essential in protecting animal populations against exotic and new diseases
- Is essential to the implementation of and evaluation of animal disease control programmes
- Is of value to protecting public health as it enables collection and processing of data on zoonoses whether endemic or emerging
- Allows permanent access to markets for animals and animal products

+



o



•



THANK YOU