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VIRTUAL COURSE

26 March to 15 April 2021

Design of an Active Surveillance for Tilapia Lake Virus (TILV) Disease and Its Implementation

TCP/INT/3707: Strengthening biosecurity (policy and farm level) governance to deal with Tilapia lake virus



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INTRODUCTION

25 March 2021

Understanding aquatic diseases using epidemiological principles and tools

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TCP/INT/3707: Strengthening biosecurity (policy and farm level) governance to deal with Tilapia lake virus



Learning objectives

- Why do we need knowledge on epidemiology of aquatic diseases?
- Definitions of epidemiology and its approaches
- Purpose and aims of disease surveillance



Learning objectives

- Main principles of different types of surveillance
- Surveillance standards
- Surveillance planning



Case 1

- Country would like to enable investment /to invest in aquaculture sector
- What can happen if disease situation is unknown or in case of presence of disease such as TiLV?
- What competent authority needs to do before?





Case 2

- Country X would like to export live fish/products thereof to other countries/SADC/EU...
- Authority of importing countries is requesting Animal health certification in compliance with WTO/OIE or EU/OIE rules
- What does it mean for exporting country?
- What must be done before certification?



Case 3

- Country X import live fish from country Y
- What importing country will request from CA of exporting country?
- What can happen if disease X (TiLV) will enter into disease free zone or country)?



Case 4

- Country X has disease (TiLV) confirmed in several outbreaks
- Would like to start disease control program
- How?

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Marine life
Global salmon farming harming marine life and costing billions in damage

Report says pollution, parasites and fish mortality rates cost an estimated \$50bn globally from 2013 to 2019

Fiona Harvey *Environment correspondent*



Definitions of Epidemiology

- **Epidemiology offers insight** of knowledge necessary for finding the most effective ways to treat and prevent diseases
- The term “Epidemiology” springs directly from **epidemic, which originally referred to communicable disease outbreaks in a population** and in turn is derived from **the Greek roots “epi” (upon) and “demos” (population)**
- The third component of epidemiology, **the Greek root “logos”, means study**



Definitions of Epidemiology

- Epidemiology is the study of a disease patterns in populations in order to determine prevention and control strategies.
- Epidemiology is concerned with disease prevention and “succession of events which result in the exposure of specific types of individual to specific type of environment”
- To identify exposures and evaluate their associations with various outcomes of interests (health, welfare, production)
- Epidemiology is about association



Contributions of Epidemiology to health of aquatic animals

- Investigate epidemics (occurrence) of diseases.
- Study the biological spectrum of a disease.
- Systematically record disease occurrence.
- Prioritize disease control strategies.
- Develop disease detection strategies

What are some examples of epidemiology in the field of veterinary medicine?



The Epidemiological Approach

Collection, analysis and interpretation of data to determine:

- Distribution of diseases in time and space
- Presence or absence of disease

Tool for decision-making

- Directed at the control and eradication of diseases



The key components of epidemiological approach

- Focuses on populations
- Defines disease broadly
- Applies knowledge of interrelationships among host, agent, environment

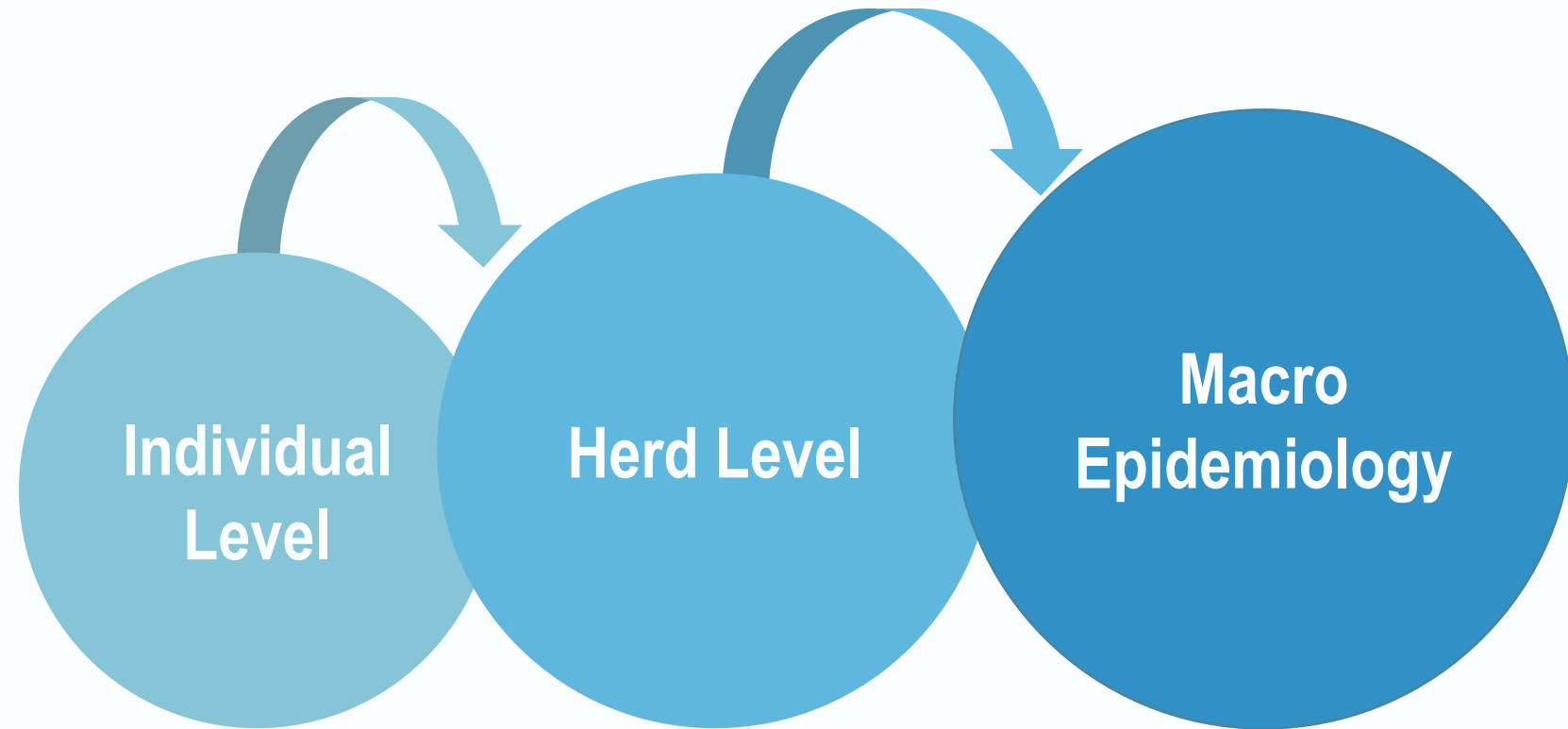


The key components of epidemiological approach

- Describes disease patterns
- Determines the role of chance in observed disease frequencies
- Provides observational and experimental approaches to study disease
- Incorporates systematic and critical evaluation of the scientific literature



Population based approaches

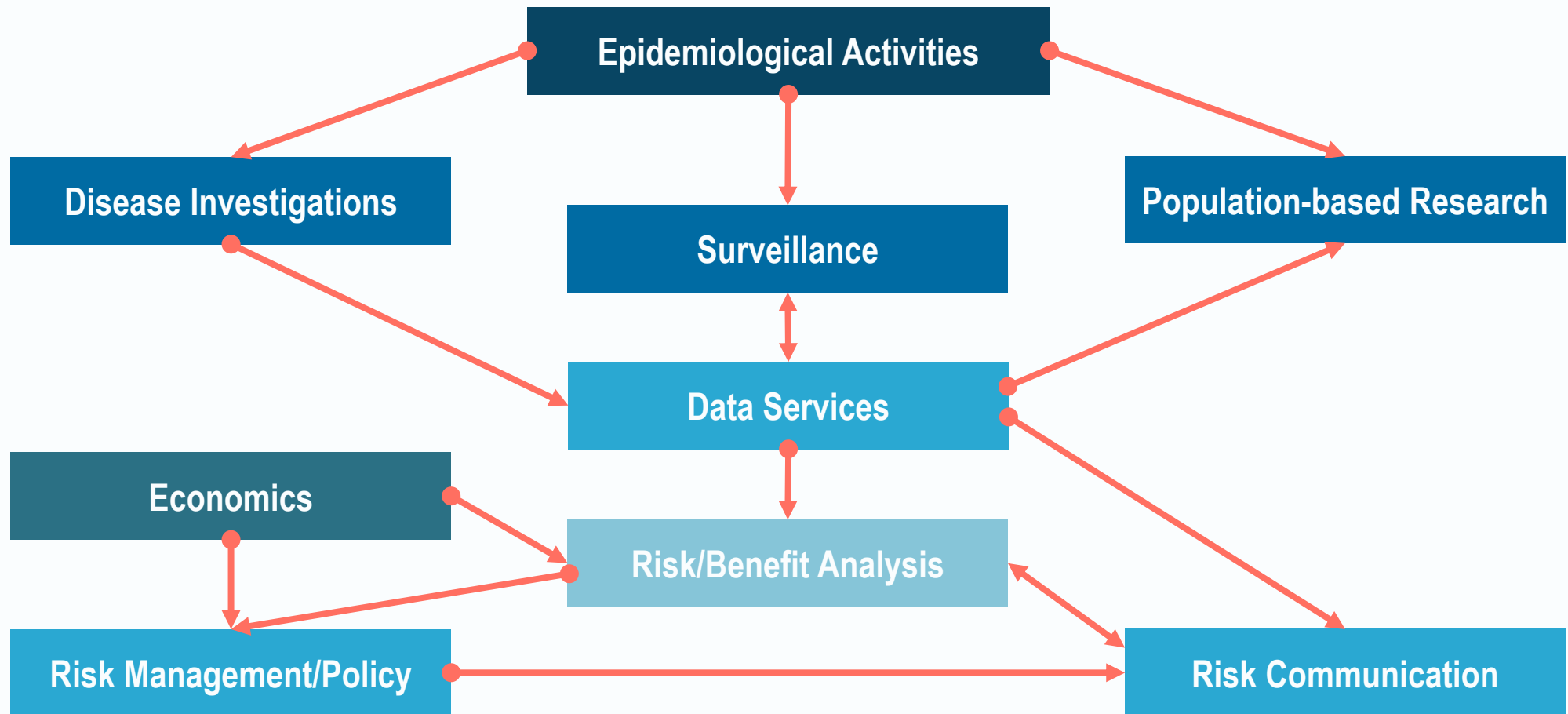




	CLINICAL	LABORATORY	EPIDEMIOLOGY
Scope of interest	Diseased animal	Dead animal or sample	Population (dead, moribund, diseased, healthy)
Location	Field or clinic	Laboratory	Field and office
Aim/objective	Treatment	Treatment and prevention	Disease mitigation (control and prevention)
Diagnosis	Symptoms/laboratory findings	Identification of agent	Measurement of frequency and association
Questions	What is that? How to treat?	What is disease mechanism? How that cause disease?	What, Who, When, Why...
Scope of interest	Diseased animal	Dead animal or sample	Population (dead, moribund, diseased, healthy)



Components of Veterinary Epidemiology



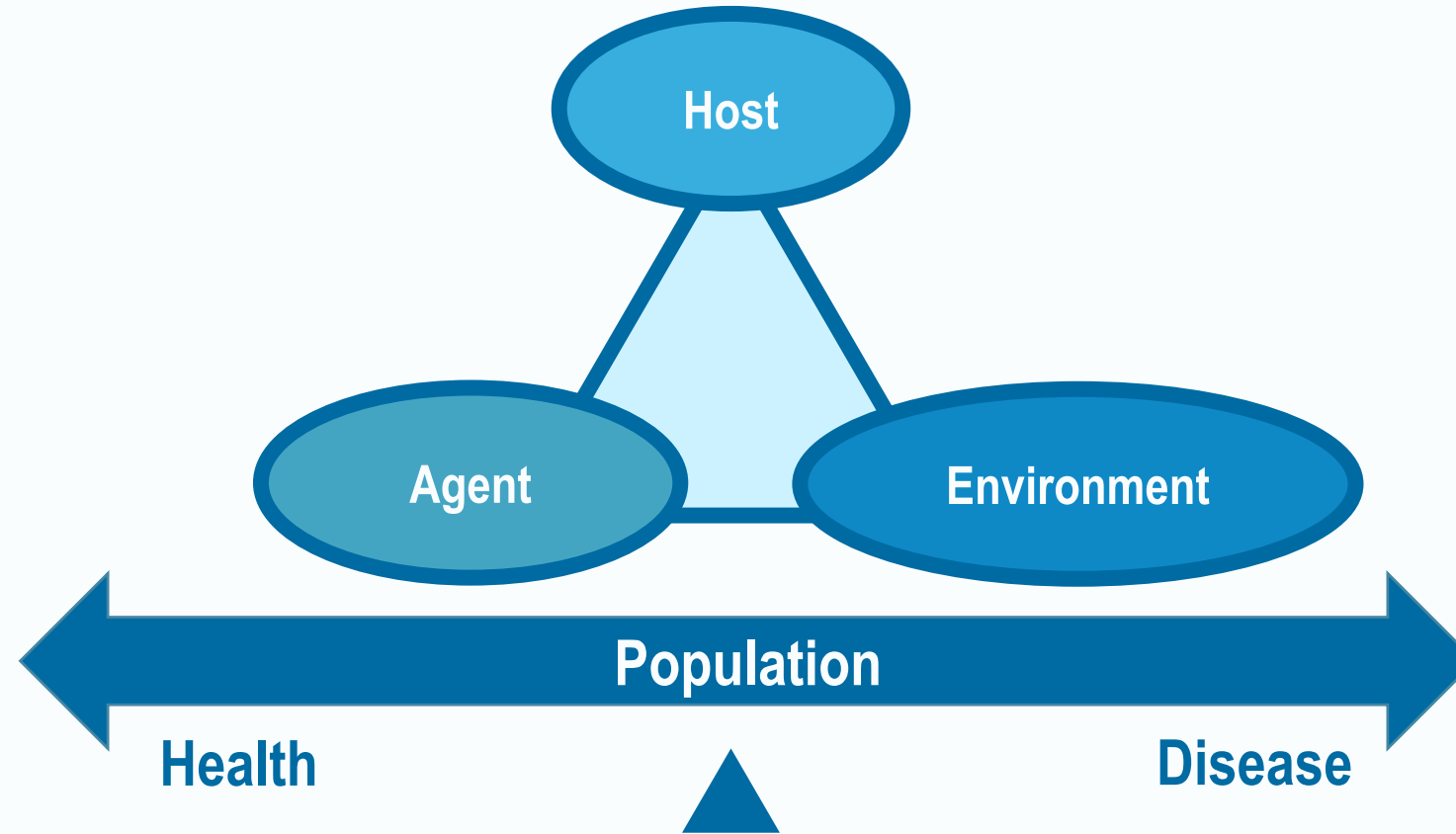


Importance of Appropriate Data

- What type of data would be collected using a “macro” approach? (country level)
- What type of data would be collected using a “micro” approach? (farm or pond/tank level)

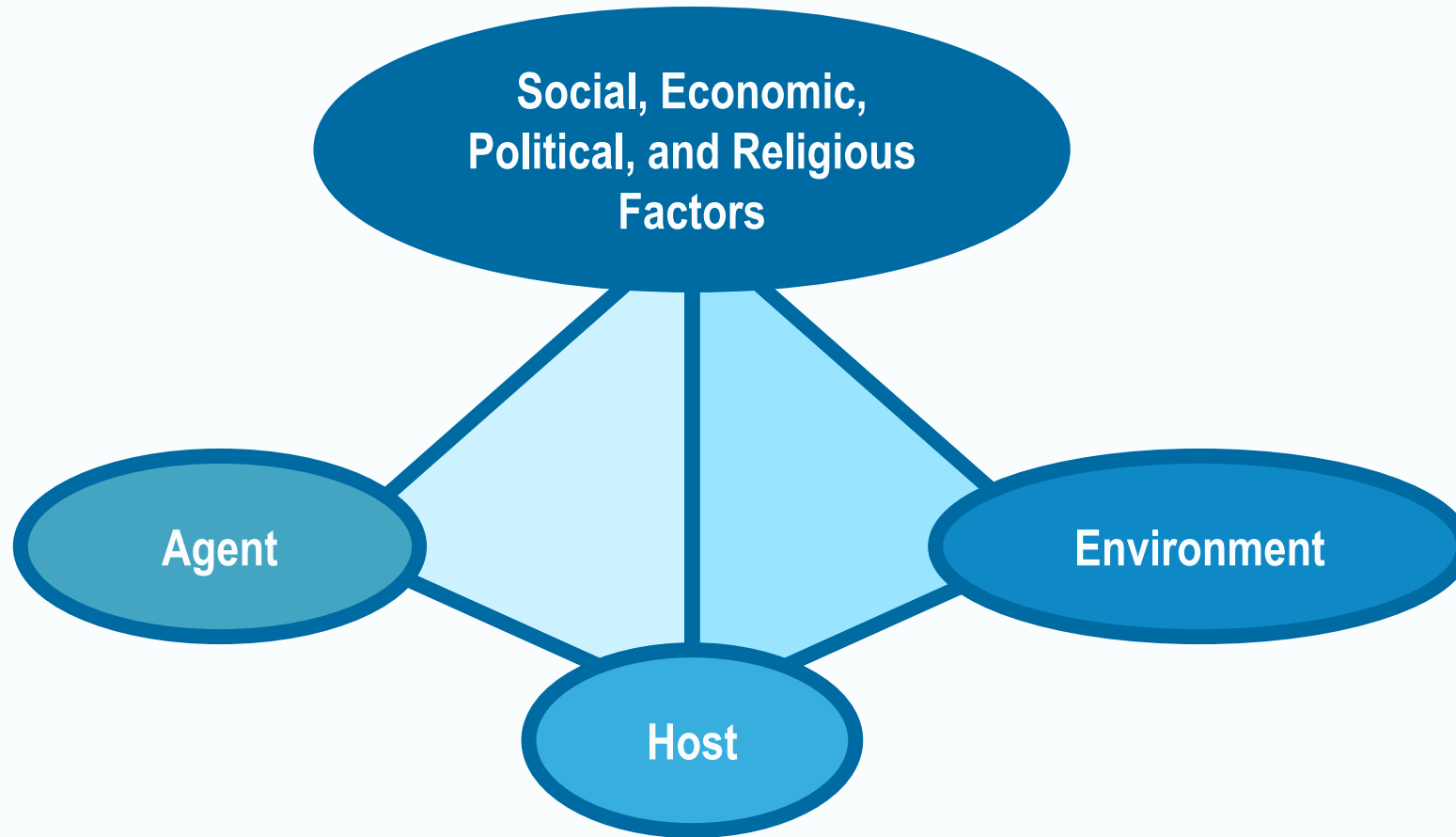


Epidemiological triad





Macro-epidemiology





Surveillance

- Membership in OIE promoted need for development of international standards
- SPS agreement of WTO gave importance and legal status (disputes) to international standards
- Surveillance – tools for decision making



Surveillance

- Surveillance system will produce/result in disease and health event reporting (international requirements and domestic need)
- Surveillance is an economic activity



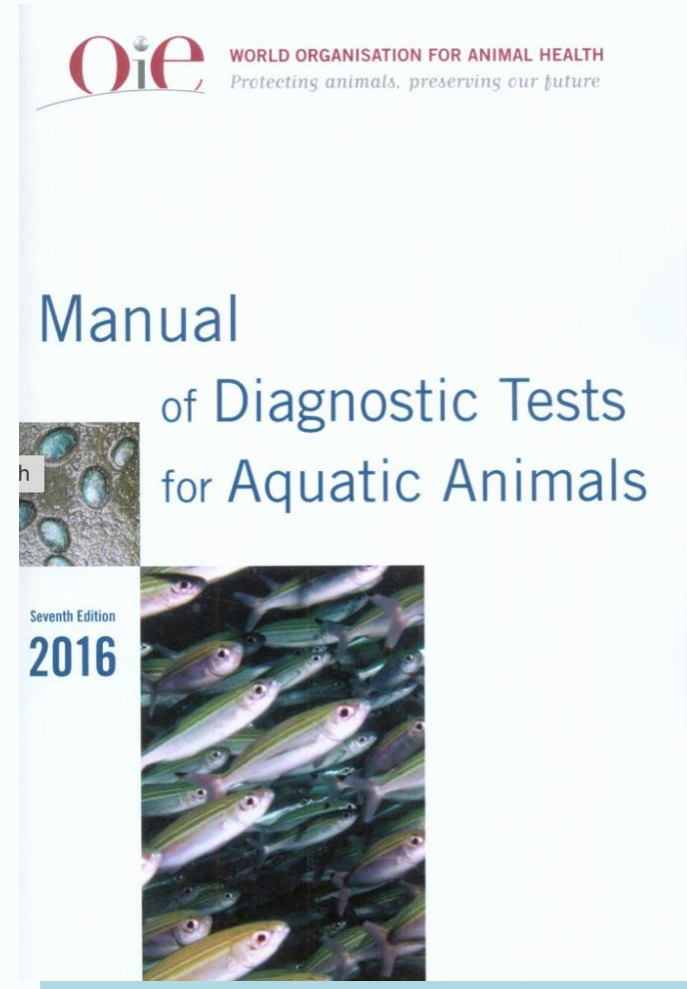
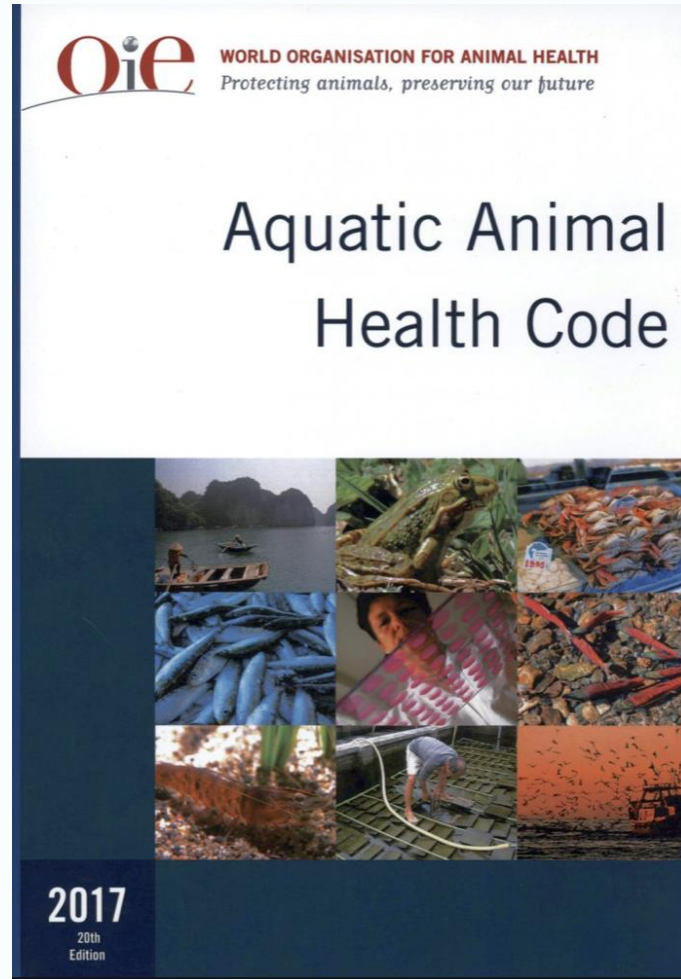
Link between OIE standards and the WTO SPS Agreement

- **World Trade Organization Sanitary and Phytosanitary Agreement (1995)**
- **SPS Agreement - Art 2: Basic right**
- Members have the right to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health, provided that such measures are not inconsistent with the provisions of this Agreement'



OIE standards

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Increased demands

- Disease freedom
 - Initial declaration
 - Maintenance
- Zoning and compartmentalization
 - Surveillance
- Outbreak investigation and mitigation
- Large number of samples
 - Increased loads on surveillance systems and Dx laboratories



- **Commodity** - means *aquatic animals, aquatic animal products, biological products and pathological material.*
- **Compartment** - means one or more *aquaculture establishments* under a common biosecurity management system containing an *aquatic animal* population with a distinct health status with respect to a specific *disease* or *diseases* for which required *surveillance* and control measures are applied and *basic biosecurity conditions* are met for the purpose of *international trade*. Such *compartments* must be clearly documented by the *Competent Authority(ies)*.
- **Competent Authority** - means the *Veterinary Authority* or other Governmental Authority of a Member Country having the responsibility and competence for ensuring or supervising the implementation of *aquatic animal* health and welfare measures, international health certification and other standards and recommendations in the *Aquatic Code* in the whole territory.



- **Emerging disease** - means a newly recognized *infection* resulting from the evolution or change of an existing *pathogenic agent*, a known *infection* spreading to a new geographic area or population, or a previously unrecognized *pathogenic agent* or a *disease* diagnosed for the first time and which has a significant impact on *aquatic animal* or public health.
- **Epidemiological unit** - means a group of animals that share approximately the same *risk* of exposure to a *pathogenic agent* with a defined location. This may be because they share a common aquatic environment (e.g. fish in a pond, caged fish in a lake), or because management practices make it likely that a *pathogenic agent* in one group of animals would quickly spread to other animals (e.g. all the ponds on a farm, all the ponds in a village system).



The challenges

- SPS measures under the spotlight
- Increasing demands on the animal and aquatic health infrastructure
- Need to demonstrate the animal health status
- Effective surveillance systems central to the process

However

- Reduction of public spending
- Veterinary and aquatic services often not priorities
- Decreasing budgets for aquatic animal health services
- Weak infrastructure and difficulties to obtain funds for surveillance



Common understanding of our tasks and activities

- Monitoring
- Surveillance
- Survey



Common understanding of our tasks and activities

- Disease control program (DCP)
- Disease eradication program (DEP)
- Disease notification and reporting



Definition of animal disease surveillance

- Often interchangeably with monitoring – NOT THE SAME
- Can use same tools
 - distinction more in objectives than techniques
- Monitoring can be part of surveillance (not visa versa)



Definition of animal disease surveillance

Surveillance is:

All regular activities aimed at ascertaining the health status of a given population with the aim of early detection and control of animal diseases of importance to national economies, food security and trade

FAO Manual of livestock disease surveillance and information system

<http://www.fao.org/docrep/004/x3331e/X3331E00.htm>



Definition of animal disease surveillance

Monitoring is:

All activities aimed at detecting changes in the epidemiological parameters of a specified disease

FAO Manual of livestock disease surveillance and information system

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Definitions

Textbook	Monitoring	Surveillance
Martin et al. 1986	Animal disease monitoring describes the ongoing efforts directed to assessing the health and disease status of a given population	The term "disease surveillance" is used to describe a more active system and implies that some form of directed action will be taken if the data indicate a disease level above a certain threshold.
Thrusfield, 1995	Monitoring is the making of routine observations on health, productivity, and environmental factors and the recording and transmission of those observations.	Surveillance is a more intensive form of data recording than monitoring



Definitions

Textbook	Monitoring	Surveillance
Thrusfield, 1995	The routine collection of information on disease, productivity, and other characteristics possibly related to them in population	An intensive form of monitoring. Designed so that action can be taken to improve the health status of a population; therefore, it is frequently used in disease control campaigns.
Noordhuizen et al.1997	Monitoring refers to a continuous, dynamic process of collecting data about health and disease and their determinants in a given population over a defined time period (descriptive epidemiology)	Surveillance refers to a specific extension of monitoring where obtained information is used and measures are taken if certain threshold values related to disease status have been passed. It, therefore, is part of disease control programs.



Surveillance versus monitoring

- Surveillance means the continuous investigation of a given population **to detect occurrence of disease for control purposes**, which may involve testing of a part of population
- Monitoring constitutes on-going programs directed at **detection of changes in the prevalence** of disease in a given population and its environment



Surveillance and surveys

- **Passive** surveillance is a system in which CA make no active efforts to collect disease information; they just wait for disease report to come to them. Statutory case reporting is the most broadly used passive surveillance.
- **Active** surveillance uses structured disease surveys to collect high quality disease information quickly and inexpensively. CA make active efforts to collect the information needed.



Surveillance and surveys

- Surveillance system typically involves a number of data collection approaches, and also incorporates data management, analysis and reporting system.
- Structured survey may be one component of a surveillance system.

Risk based surveillance

- **Risk based** surveillance: A surveillance program in the design of which exposure and risk assessment methods have been applied together with traditional design approaches in order to assure appropriate and cost effective data collection
- RBS similar with **targeted** surveillance (OIE: selected sections of the population in which disease is more likely to be introduced or found)



Surveillance in our case

The systematic, continuous or repeated, **measurement, collection, analysis, interpretation, and timely dissemination** of animal health and welfare related data from defined populations. These data are then used to describe health hazard occurrence and to contribute to the planning, implementation and evaluation of risk mitigation action. (Hoinville et al, 2013)



Interventions and Strategy

Type of intervention	Aims at control strategy
Slaughter	
Stamping out	Eradication
Therapeutic treatment	Eradication
Disinfection	Reduction
Pesticides	Reduction
Reduction of contact	
Quarantine	Prevention
Movement restriction	Prevention
All in all out (batch production)	Prevention



Interventions and Strategy

Type of intervention	Aims at control strategy
Chemical use	
Preventive of strategic treatment	Prevention
Depopulation/repopulation	Reduction
Test and slaughter	Reduction
Culling	Reduction
Modification of host resistance	
Vaccination	Prevention
Genetic resistance	Prevention

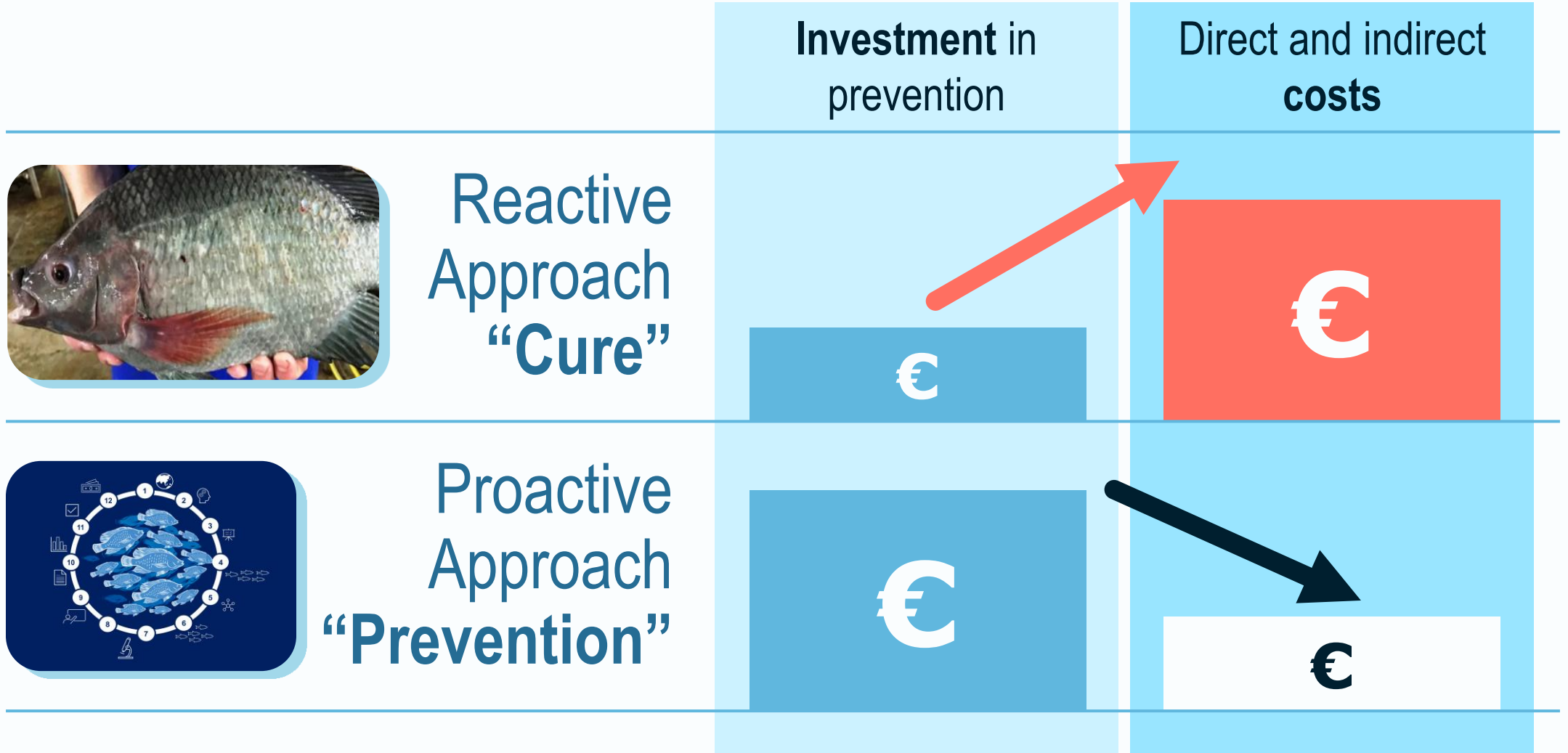


Interventions and Strategy

Type of intervention	Aims at control strategy
Environment and or management control	
Improved husbandry	Prevention or reduction
Feeding	Prevention or reduction
Education	Prevention or reduction
Biological control	Prevention or reduction
Doing nothing	



“Prevention is better than cure”



Purpose/objective of AAD surveillance

- The objective of a surveillance system is the most influential in determining suitable design, so it should be considered before planning
- The objective of surveillance is closely related with disease mitigation, and can be in one of three stages:
 - Sustainment (to sustain free or low prevalence status)
 - Investigation (estimation of the level of occurrence)
 - Implementation

Purpose/objective of AAD surveillance

- AAD surveillance objectives:

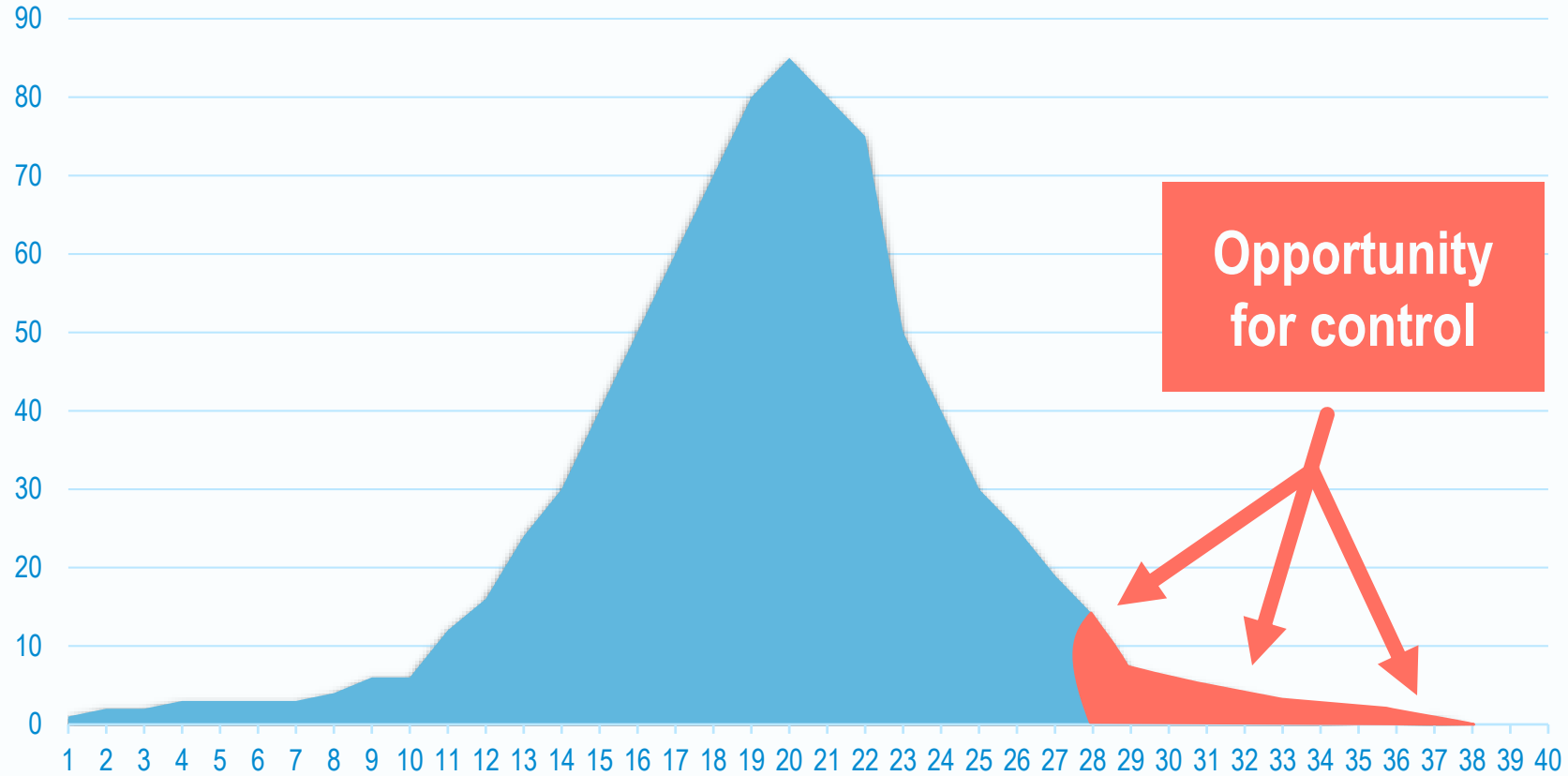
- Early detection of disease
 - Demonstrating freedom of disease
 - **Control/eradication of disease**
- DEALS with Exotic diseases

- AAD monitoring – detection of disease trends

- DEALS with endemic diseases

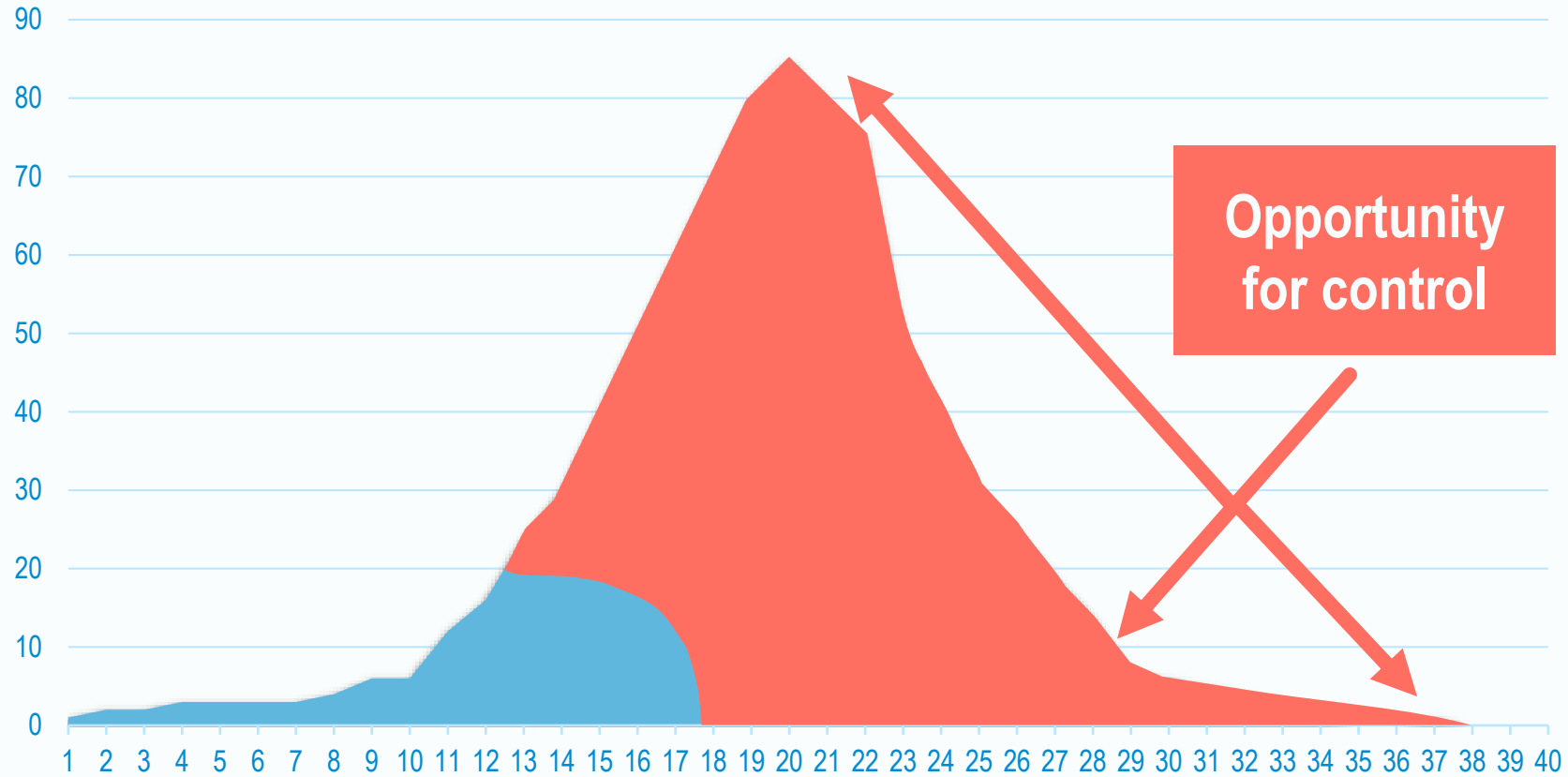


Outbreak of disease (without surveillance)



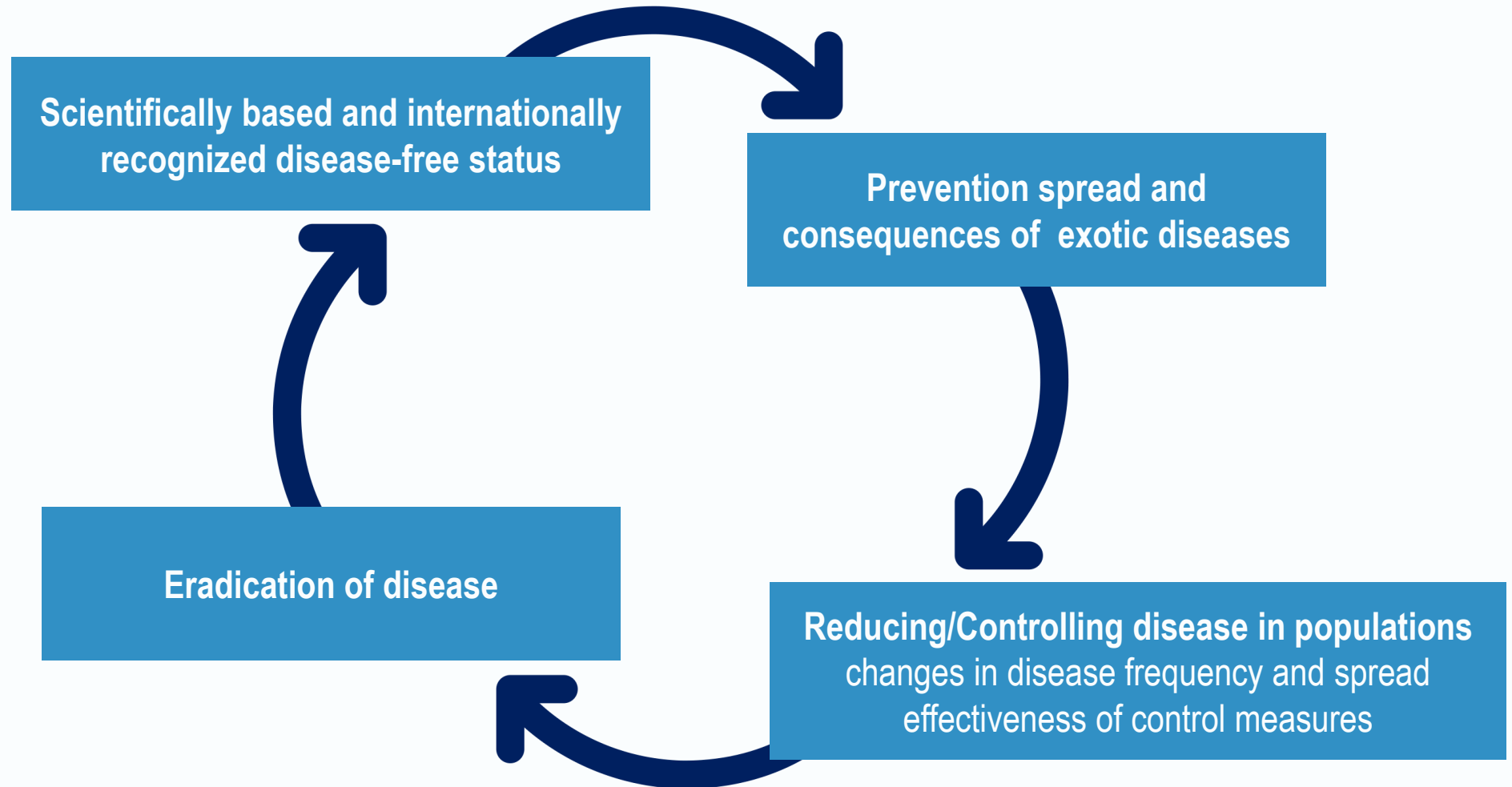


Outbreak of disease (without surveillance)





Purpose and aims of disease surveillance





Main principles of different types of surveillance

- Clear purpose/aims
- Justification – priority diseases, scientifically based, international standards
- Population definition
- Methodology



Main principles of different types of surveillance

- Administrative structure/hierarchy
- Financial support
- Timeframe
- Output orientated

Main principles of different types of surveillance

- **Passive surveillance???**

- Routine reporting of disease
- No investigation efforts
- Difference between passive surveillance and monitoring???

- **Active surveillance**

- Purposeful collection data on disease
- Mainly through structured and scientifically valid surveys

Uses of passive surveillance data

- Not reliable enough to be used to calculate rates and proportions
- However, can be used to:
 - Identify which diseases are in the country
 - Identify location
 - Respond to disease outbreak
 - Meet the basic disease reporting to OIE



Uses of passive surveillance data

- However, can not be used to:
 - Determine the level and geographic pattern of disease
 - Determine the importance of disease
 - Set priorities for the use of resources for disease control activities
 - Plan, implement and monitor disease control program
 - Demonstrate disease status to trading program



Active surveillance





Surveillance standards

- National requirements
- International standards
 - OIE, EU, other
- Defining appropriate level of protection – ALOP
 - Minimum level - international requirement
 - Higher than – for exotic diseases + scientific justification



Surveillance standards

- Consistent
- Transparent
- Equivalency



Surveillance standards

- Move from input to output based standards
- Ideally, country is free from diseases if every member of the population is examined simultaneously with a perfect test with both S_n and S_p equal to 100 %
- Demonstration of freedom from disease meet a defined level of confidence (95%)



Surveillance planning

- Planned and managed activities
 - **Not hap-hazard action**
- Transparency
- Agreed objectives



Surveillance planning

- Targets and responsibilities
- Human resources and time frames



Key answers needed for planning monitoring and surveillance system (MOSS)

- Why are disease surveillance and monitoring needed?
- Which diseases should be considered?
- What type of data should be collected?
- Who is going to use the information?
- What will be the uses of that information?



Key answers needed for planning monitoring and surveillance system (MOSS)

- Will the system have national or local coverage?
- How is the system going to be financed?
- Is the existing infrastructure adequate?
- How will the system's efficacy be assessed?
- What is the legal basis for implementing such a system?



Our objectives

- To satisfy/balance international standards and requirements for AAH (TiLV) with national needs and available resources
- Planning and implementation of scientifically based monitoring and surveillance systems (MOSSs) for TiLV
- To support decision making processes



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Thank you for your attention!

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