COHFE 01

Competencies for One Health field epidemiology (COHFE) framework

Food and Agriculture Organization of the United Nations

World Health Organization

World Organisation for Animal Health
Founded as OIE

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Contents

Foreword

Infectious diseases are emerging at a rapid rate and pose a severe threat to health security, the global economy, and food safety. Novel infectious diseases have been increasingly reported in the past 50 years, including severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), Ebola virus disease, avian influenza H5N1, pandemic influenza A (H1N1), Zika virus and COVID-19. As demonstrated by the COVID-19 pandemic, emerging infectious diseases can cause massive health and socio-economic impacts.

More than 60% of emerging infectious diseases are of animal origin.[1] Diseases emerge from a confluence of several drivers, including rapid population growth and urbanization, land-use change, encroachment on wild habitats, and changing global and local weather patterns. As the world population has grown from about 1.6 billion in the 1900s to 7.8 billion today, the demand for food and housing has increased concurrently. To meet this demand, we have resorted to intensive farming and clearing forests at the rate of 10 million hectares per annum. As a result, humans and domestic animals are coming into closer contact with wild animals, increasing the chances for spillover of pathogens from wildlife to domestic animals and humans. The risk is further exacerbated by climate change, antimicrobial resistance, and cross-border trade of livestock and wildlife.

The challenges to address emerging infectious diseases are multifactorial. The traditional siloed approach of working in isolation in the public health, animal health and environment sectors is not adequate to tackle them. Instead, we need a workforce that can function across all of these sectors using the One Health approach, defined recently as "an integrated, unifying approach that aims to sustainably balance and optimise the health of people, animals and ecosystems. It recognises the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent."[2]

The current field epidemiology workforce is not yet sufficiently prepared to work across the human-animal-environment interface. Field epidemiology training programmes (FETPs) are crucial for preparing the health workforce to prevent, detect and contain infectious diseases. Still, most programmes currently train either public health or animal health epidemiologists, with very few programmes working across both sectors and even fewer that include the environment sector or wildlife. It is only with this kind of collaboration and the ability of professionals in various sectors to work together that the emergence of new infections can be limited, preventing negative health outcomes and socio-economic disruptions.

The *Competencies for One Health field epidemiology (COHFE) framework* addresses the increasing and urgent need to strengthen collaboration among the public health, animal health and environment sectors to tackle health threats at the human-animal-environment interface**.** Developed jointly by the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO) and the World Organisation for Animal Health (WOAH), the *COHFE framework* defines the core One Health, optional One Health, and sector-specific knowledge, skills, and competencies for field epidemiologists. The framework can be used by existing public health and veterinary field epidemiology training programmes to design and update their curriculum, or by countries or regions to set up new One Health field epidemiology training programmes. A specifically designed prioritization tool allows programmes to rank optional One Health and sector-specific knowledge, skills, and competencies and create a framework to suit their context and needs. The adoption of this framework will ensure that training participants are able to work across multiple sectors to tackle emerging infectious diseases and other evolving challenges and apply the necessary systems thinking of the One Health approach.

1 Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, Daszak P. Global trends in emerging infectious diseases. Nature. 2008 Feb 21;451(7181):990-3. doi: 10.1038/nature06536. PMID: 18288193; PMCID: PMC5960580.

2 One Health High-Level Expert Panel (OHHLEP), Adisasmito WB, Almuhairi S, Behravesh CB, Bilivogui P, Bukachi SA, et al. (2022) One Health: A new definition for a sustainable and healthy future. PLoS Pathog 18(6): e1010537. https://doi.org/10.1371/journal.ppat.1010537

The *COHFE framework* is accompanied by four supplemental manuals:

- *Guidance for One Health field epidemiology curriculum development*
- *Guidance for One Health field epidemiology mentorship*
- *Guidance for One Health field epidemiology learning evaluation and certification*
- *Guidance for One Health field epidemiology continuing education programmes*

These manuals are meant to assist countries with implementation of the *COHFE framework*. We believe the framework and guidance documents present an innovative approach to strengthening field epidemiology capacity and health security. Together with other resources and tools, the *COHFE framework* and supplemental guidance will help governments and international organizations to effectively prevent and manage emerging infectious diseases and other evolving health challenges at the human-animal-environment interface.

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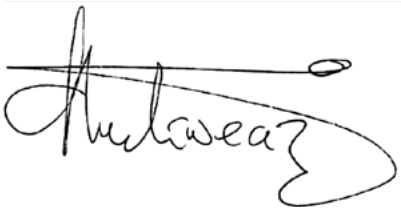

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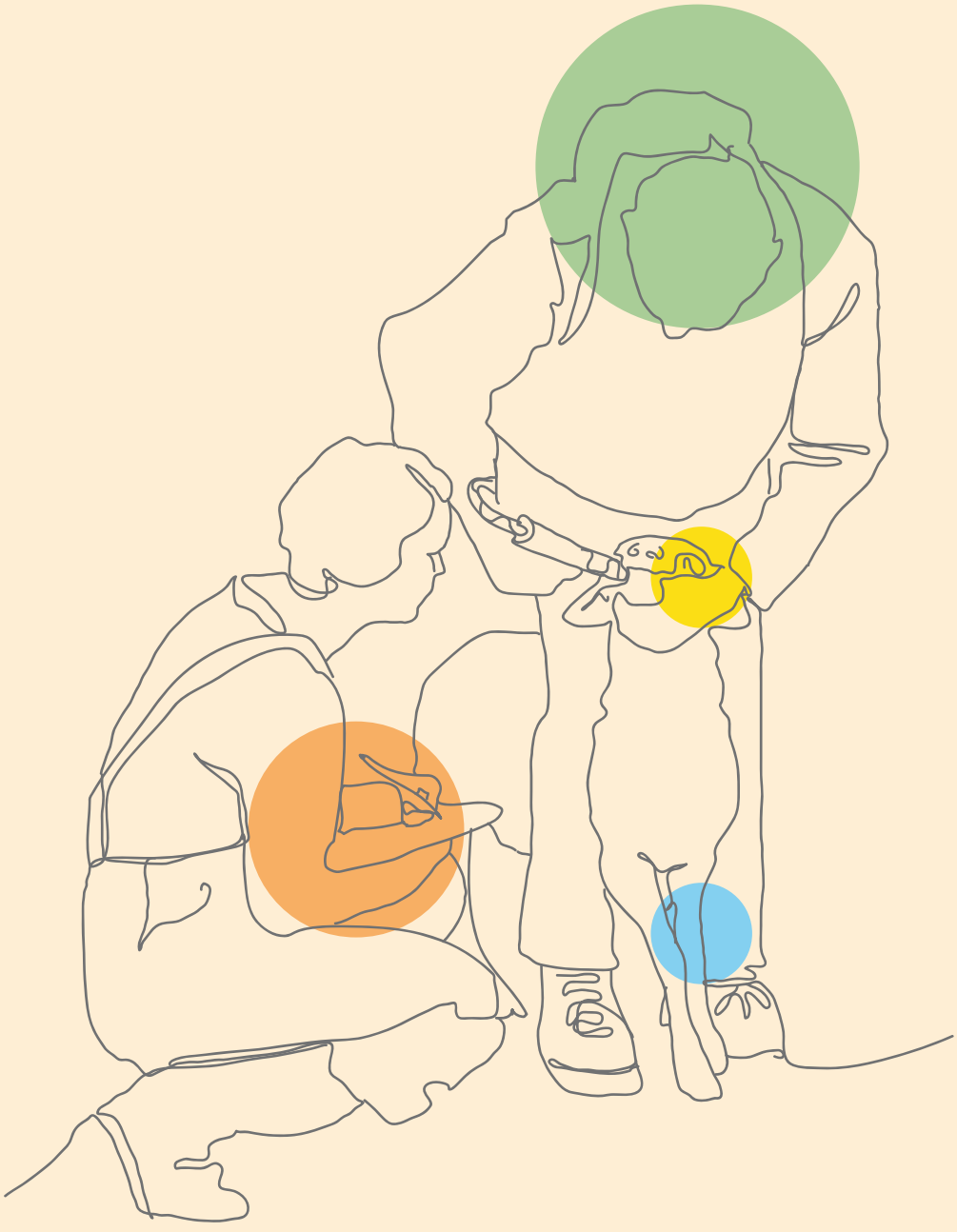
Acronyms

AMR	Antimicrobial Resistance
CBRN	Chemical, Biological, Radiological and Nuclear threats
CDC	Centers for Disease Control and Prevention
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
FAO	Food and Agriculture Organization of the United Nations
FETP	Field Epidemiology Training Program
FETPV	Field Epidemiology Training Program for Veterinarians
GEMP	Good Emergency Management Practice
IHR	International Health Regulations
IPC	Infection Prevention and Control
JEE	Joint External Evaluation
NCD	Noncommunicable Disease
PHC	Primary Health Care
PPE	Personal Protective Equipment
SOP	Standard Operating Procedure
TZG	Tripartite Zoonosis Guide
UNEP	United Nations Environment Programme
WHO	World Health Organization
WOAH	World Organisation for Animal Health

Introduction



Background

The need for properly trained epidemiologists to strengthen country capabilities in disease surveillance, epidemiological investigations, and outbreak response is a requirement recognized by the global public health community. Veterinary epidemiology is also recognized as a priority by the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (WOAH).
The presence of an applied epidemiology training programme has been included in the World Health Organization (WHO) Joint External Evaluation (JEE) tool since 2016, further motivating countries to develop and strengthen these capabilities. Although organizations such as the Centers for Disease Control and Prevention (CDC), WHO, FAO, WOAH, and the Training Programmes in Epidemiology and Public Health Interventions Network (TEPHINET) have established relevant curricula and accreditations, no internationally accepted One Health competencies exist for epidemiologists nor are there standardized curricula, evaluation and certification, or continuing education requirements for graduates. This results in graduates with varying competence and the dilution of the reputation of the Field Epidemiology Training Program (FETP) or Field Epidemiology Training Program for Veterinarians (FETPV) certificate. To fill this gap, FAO, WHO and WOAH (collectively called the Tripartite) have defined and developed this document on field epidemiology knowledge, skills and competencies in a One Health context for reference and use by countries and regions when planning and reviewing a One Health field epidemiology training programme. Participants in One Health training programmes may have experience in human, animal, or environmental health and enrol at the frontline, intermediate and advanced levels (Figure 1).

How the competency framework was developed

The initial draft of the Competencies for One Health field epidemiology (COHFE) framework was developed by a multisectoral team of subject matter experts from FAO, WHO and WOAH. This core technical team performed a desk review of existing literature and programme documents and performed a survey of existing FETP and FETPV programmes. The compiled information was used to develop a draft list of domains and subdomains. The experts then defined knowledge, skills and competencies at the subdomain level using an agreed template (Annex 2). The knowledge, skills and competencies were categorized as One Health or sector specific (public health, animal health or environment) and by training level (frontline, intermediate or advanced).

The competency framework was presented to a technical advisory group of global field epidemiology and One Health experts for feedback and validation (Annex 1). Members participated in a series of teleconference discussions and provided comments and revisions using a standard feedback form. The advisory group recommended strengthening the environment component of the framework. This resulted in a subgroup of environmental experts from the advisory group convening separately to advise the core technical team. The addition of Domain 10 on ecosystem health resulted from their specific feedback. Members of the advisory group were asked to vote on whether each knowledge, skill and competency should be considered core for all field epidemiology training programmes using the One Health approach. Based on the results, the core technical team divided the One Health knowledge, skills and competencies into core and optional categories.

Scope of work

The *COHFE framework* includes fourteen domains that cover technical and functional knowledge, skills, and competencies needed by One Health field epidemiologists working at all administrative levels, including district, regional, and national/international levels. This document is structured to cover the knowledge, skills and competencies needed for three levels of epidemiology training programmes, frontline, intermediate and advanced, which loosely correspond to the administrative levels mentioned previously. The subdomains and related competencies in this document are organized to create a link among the three administrative levels.

Figure 1.
Recommended background experience of candidates for One Health field epidemiology training programmes, across training levels and sectors

	Sectors		
	Frontline	**Intermediate**	**Advanced**
Human	• Community or district government public health professionals • Public health epidemiologists • Physicians, dentists, nurses • Other human health professionals or researchers	• District or provincial government public health professionals • Public health epidemiologists • Physicians, dentists, nurses • Other human health professionals or researchers with frontline level experience	• Provincial or national government public health professionals • Public health epidemiologists • Physicians, dentists, nurses • Other human health professionals or researchers with intermediate level experience
Animal	• Community or district government animal health professionals • Veterinarians • Para-veterinarians • Animal husbandry experts • Other animal health professionals or researchers	• District or provincial government animal health professionals • Veterinary epidemiologists • Veterinarians • Para-veterinarians or animal husbandry experts • Other animal health professionals or researchers with frontline level experience	• Provincial or national government animal health professionals • Veterinary epidemiologists • Veterinarians • Advanced para-veterinarians or animal husbandry experts • Other animal health professionals or researchers with intermediate level experience
Environment	• Community or district government environmental health professionals • Wildlife veterinarians • Environmental scientists, biologists, or ecologists • Environment, natural resource or forestry workers • Environmental engineers • Other ecosystem health professionals or researchers	• District or provincial government environmental health professionals • Wildlife veterinarians • Environmental scientists, biologists, or ecologists • Environment, natural resource or forestry managers • Environmental engineers • Other ecosystem health professionals or researchers with frontline level experience	• Provincial or national government environmental health professionals • Wildlife veterinarians • Environmental scientists, biologists, or ecologists • Environment, natural resource or forestry managers • Environmental engineers • Other ecosystem health professionals or researchers with intermediate level experience

How to use this document

This document is intended to be used by authorities in member countries and regions and by education or continuing education providers when planning or reviewing an existing curriculum for a field epidemiology training programme. It provides guidance for core and optional knowledge, skills and competencies for One Health field epidemiologists, divided into domains and subdomains. The knowledge, skills and competencies, labelled as K, S and C, respectively, follow a progression from frontline through intermediate to advanced, so users should assume that those core competencies required at lower levels are also required at the higher levels. Some overlap exists among the domains, and cross-references are made where appropriate. Optional knowledge, skills and competencies specific for the public health, animal health, or environment sectors are also included but are not comprehensive. These sector specific competencies are considered optional competencies to accompany the One Health competencies and may be used by programme managers to create sector specific training tracks within a One Health training programme. Optional competencies may also be considered for postgraduates as part of a continuing education programme. Training programmes should check the competency guidance document and customize them according to the targeted workforce needs.

The *COHFE framework* is accompanied by four supplemental manuals:

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Definitions

The following terms are used throughout the document with definitions specifically developed for use in the *Competencies for One Health field epidemiology (COHFE) framework* and supplemental guidance manuals (Figure 2). The terms may be used differently in other contexts or publications. Additional terms are defined in the One Health glossary in Annex 3.

Domain: A broad topic or subject area that is divided into subdomains.

Subdomain: A narrower topic or subject area than a domain; subdomains consist of knowledge, skills, and competencies

Knowledge (K): Assimilation of information through learning. Knowledge is the body of facts, principles, theories, and practices related to a field of work or study. It is described as theoretical and factual.

Skill (S): Ability to apply knowledge and to complete tasks and solve problems. Skills are described as cognitive (involving the use of logical, intuitive, and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools, and instruments)

Attitude: A person's feelings, values and beliefs, which influence their behaviour and the performance of tasks

Competency (C): Proven ability to apply knowledge, skills and personal, social and methodological abilities (attitudes and behaviours), in work or study situations and in professional and personal development in terms of responsibility and autonomy. It is not limited to cognitive elements (involving the use of theory, concepts, or knowledge), as it also requires interpersonal skills (e.g., social or organizational skills) and ethical values where relevant. A core competency is the minimum level of competency expected to be achieved by the participants in a training programme.

Core: A required knowledge, skill or competency for a specific level of training (Frontline, Intermediate or Advanced) for One Health field epidemiologists

Optional: A knowledge, skill, and competency that a country programme can choose to include in their Frontline, Intermediate or Advanced programmes based on a country needs assessment but which is not considered a required core competency for One Health field epidemiologists.

Training levels

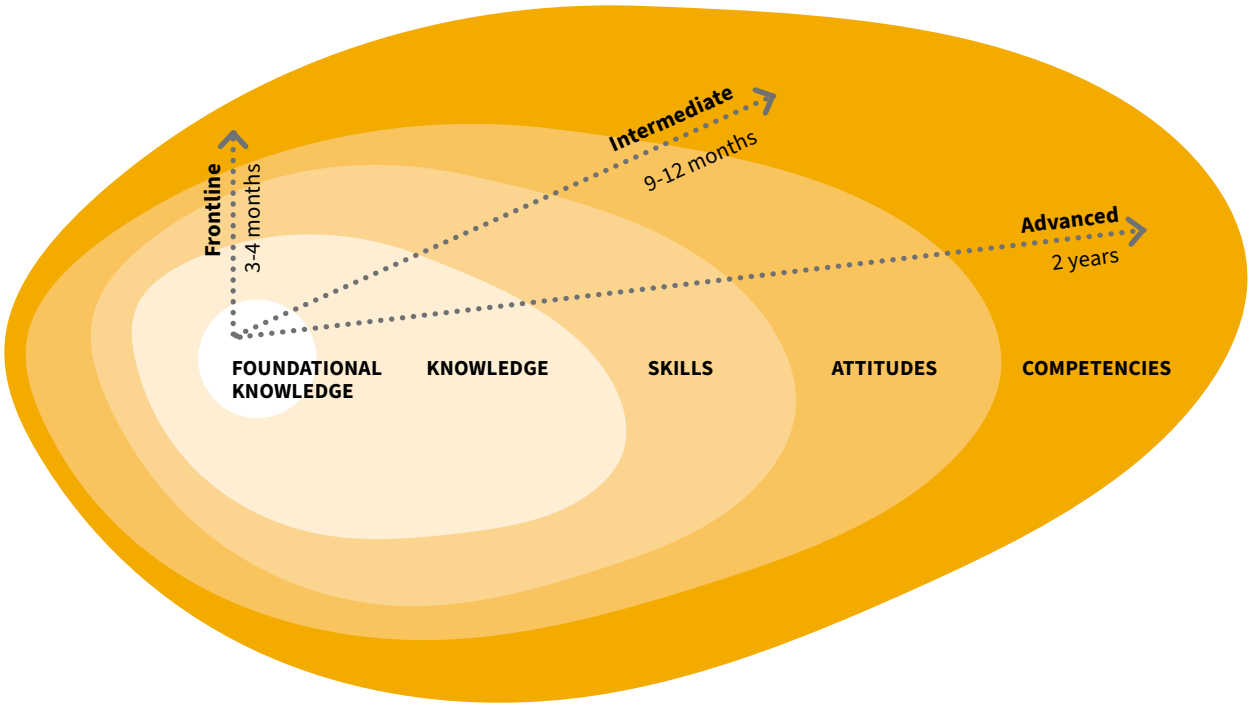
Frontline[3]**:** A 3–4 month mentored in-service applied training programme for field staff from human, animal or environmental health sectors to strengthen epidemiologic capacity at the community to the district level. It aims at improving competencies to conduct data collection, disease monitoring, and investigation and response to health events across the One Health spectrum.

Intermediate: A 9-12 months mentored in-service or fulltime applied training programme for staff from human, animal or environmental health sectors who provide epidemiologic services, usually at the district to provincial levels. It includes additional training in surveillance, data analysis and interpretation, and management of investigations and responses to health events, across the One Health spectrum.

Advanced: A two-year mentored fulltime intensive training programme for experienced staff from human, animal or environmental health sectors to prepare them for applied epidemiology leadership roles at provincial and national levels. It includes advanced training in designing and managing surveillance programmes, complex epidemiologic methods and management of investigations and responses to health events, across the One Health spectrum.

3 The term Frontline with regards to health workers is controversial because its meaning is unclear, may be unintentionally divisive or militaristic, and translates poorly in some languages. However, we use this term to align with structures and practices of existing training programmes.

Figure 2.
Training levels and timelines for acquiring knowledge, skills, attitudes and competencies in One Health field epidemiology training programmes



Section I
Technical domains

Domain 1
Foundational knowledge and skills

Introduction

Experts working in field epidemiology come from very diverse backgrounds and have different professional trajectories. In order to establish a common foundational knowledge relevant to human, animal, and environmental health, a set of topics have been identified that should provide a theoretical basis upon which subsequent domains are developed, in order to build the skills and competencies necessary to work in the field. Depending on the region or country, some of the listed topics might fall under a different section of the health system or be dealt with by a different professional group. In a global context however, theoretical knowledge of all these topics/subdomains constitutes a valuable foundation that enables the applied epidemiologist to fully engage in addressing global health priorities.

At the frontline level, field epidemiologists demonstrate good knowledge about diseases both communicable and non-communicable diseases with the basic knowledge of the causative organisms. They also calculate key indicators at the community level and report it to next admin levels.

At the intermediate level, field epidemiologists have the same knowledge as the frontline and also understand the prioritization of diseases for actions and the link to relevant stakeholders for better coordination of work.

At the advanced level, field epidemiologists guide the national and subnational system based on policies and standards and apply international standards when these exist.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
7. Preparedness and response;
8. Epidemiological studies;
10. Ecosystem health;
11. Leadership and management; and
12. Communication and community engagement.

Subdomains

1. History of epidemiology
2. Epidemiology of infectious diseases
3. Epidemiology of noncommunicable diseases
4. Prioritization of disease and disease burden
5. Policies and standards
6. Maternal and child health: key indicators
7. Demographic data and population dynamics
8. Primary health services: key indicators
9. Systems thinking

Subdomain 1.1
History of epidemiology

	Frontline	Intermediate	Advanced
One Health (Core)	1. Define epidemiology and field epidemiology (K)	1. Describe the added value of a One Health approach in epidemiology (S)	= Intermediate
One Health (Optional)		1. Summarize the Koch postulates (K) 2. Describe the genesis of the One Health concept (K)	1. Describe the Doll and Hill viewpoints on causality (K)
Human			1. Describe the work of William Farr and John Snow on Cholera (K) 2. Describe the history of smallpox eradication (K)
Animal			1. Describe the history of rinderpest eradication (K)
Environment			

Subdomain 1.2
Epidemiology of infectious diseases

	Frontline	Intermediate	Advanced
One Health (Core)	1. Define epidemiological terms including incubation period, infectious period, latency, immunity, vector, fomite, reservoir, etc. (K) 2. Explain important mechanisms for transmission of infectious diseases (K) 3. Define zoonosis and anthroponotic diseases and list important (anthropo-)zoonotic diseases with epidemic potential (K)	1. = Frontline + 2. Describe the factors driving the emergence and re-emergence of infectious diseases to focus on zoonoses (K) 3. Describe the disease intervention model in terms of the epidemiologic triad and how to break the chain of transmission (K) 4. Describe risk factors associated with the spread and persistence of zoonotic diseases, including social-cultural factors (K)	= Intermediate
One Health (Optional)	1. Characterize the difference between viruses, fungi, bacteria, parasites and prions (K) 2. Characterize relevant pathogen, host, environment/ecological features of important infectious diseases (K) 3. Describe the epidemiological characteristics of priority infectious diseases of humans and animals (K)	1. Describe basic epidemiologic models (susceptible, exposed, infected, recovered/removed) (K) 2. Explain host immunity to pathogens and discuss the strengths and weaknesses of different vaccines (K)	1. Assess the societal impact of (anthropo-)zoonotic diseases (C)
Human			
Animal	1. Advise stakeholders on good practices that contribute to zoonotic disease prevention and control, and subsequent impact on animal production (C)	= Frontline	= Intermediate
Environment			

Subdomain 1.3
Epidemiology of noncommunicable diseases

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the link between environmental factors and some noncommunicable diseases (NCDs) (K)	1. List NCDs that impact human and animal health and their associated environmental risk factors (K)	1. Elaborate on the relationship between environmental conditions and development of NCDs (K) 2. Demonstrate the importance of NCD surveillance in humans and animals and how it relates to surveillance of environmental factors (S)
One Health (Optional)			
Human			1. Identify epidemiological aspects of NCDs including injury; report on the epidemiology of chronic diseases that can occur over lifetime; explain the epidemiology of cancer (K) 2. Differentiate surveillance systems for noncommunicable and communicable diseases (K) 3. Describe the importance of NCD surveillance in humans and animals (K)
Animal	1. Advise stakeholders on animal breeding, nutrition, production and marketing (C)	= Frontline	= Intermediate + 1. Describe the role of genetics as it relates to animal production and nutrition (K)
Environment			1. Describe the role of the environment and climate change on noncommunicable diseases (K)

Subdomain 1.4
Prioritization of disease and disease burden

	Frontline	Intermediate	Advanced
One Health (Core)		1. Describe the concept of burden of disease in animals and humans (K) 2. Define simple ways to prioritize diseases according to their burden (S)	= Intermediate
One Health (Optional)		1. Describe the current burden of infectious diseases (K) 2. Characterize the historic and current burden of infectious diseases, and potential future trends (S) 3. Describe zoonotic diseases for which the control on the animal side is cost-effective (C) 4. Learn and apply the Basic Priority Rating System methodology to prioritize disease for One Health intervention (C)	= Intermediate
Human			1. Explain burden of disease metrics (e.g., DALYs and QALYs, cost-benefit and cost-effectiveness, hospitalization days, etc.) and how they are calculated (K)
Animal			
Environment			

Subdomain 1.5
Policies and standards

	Frontline	Intermediate	Advanced
One Health (Core)		1. Explain national legislation for public health and surveillance activities in the country (K) 2. Describe relevant international regulations (IHR, Performance of Veterinary Services) (K)	= Intermediate + 1. Outline the standards and standard operating procedures (SOPs) for public health in the country (K) 2. Articulate One Health coordination at the national level (C)
One Health (Optional)	1. Guide One Health coordination at the local level (K)	= Frontline	= Intermediate
Human	1. Apply national reporting requirements for human diseases (C) 2. Describe key points of the International Health Regulations (IHR) 2005 (K)	= Frontline	= Intermediate + 1. Apply Annex II of the IHR 2005 in day to day risk assessments (C) 2. Explain IHR 2005 core capacity requirements for countries (K) 3. Explain points of entry requirements under the IHR 2005 (C)
Animal	1. Apply national reporting requirements for animal diseases (C)	= Frontline	= Intermediate + 1. Make recommendations for national reporting requirements for animal diseases (C) 2. Know the WOAH listed diseases and reporting requirements for member countries, including when immediate notification and follow up reports are required (K)
Environment		1. Know the standard thresholds of exposure risk for the WHO 10 chemicals of public health concern 2. Describe key points of and linkages between the sanitary and phytosanitary measures agreement and the WOAH Terrestrial Animal Health Code (K) 3. Describe key points of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Nagoya protocol (K) 4. Describe key points of the Paris Climate Agreement, the MINAMATA Global Mercury Treaty, and the Millennium Ecosystem Assessment	= Intermediate

Subdomain 1.6
Maternal and child health: key indicators

	Frontline	Intermediate	Advanced
One Health (Core)			
One Health (Optional)		1. Describe risk factors, including zoonotic and food safety, that are specific to pregnant or nursing women and children (K)	= Intermediate
Human	1. Monitor maternal and child health indicators at primary health care units: • pregnancy follow up visits • child growth charts • child routine immunization (S) 2. Collect information on barriers to health access (S)	= Frontline + 1. Analyse reported data from primary health care units for previous indicators (C)	= Intermediate
Animal			
Environment			1. Work together with PHC units on recommendations to reduce environmental exposures that constitute a risk for the fetus (including food safety) (C)

Subdomain 1.7
Demographic data and population dynamics

	Frontline	Intermediate	Advanced
One Health (Core)			
One Health (Optional)	1. List sources of information for local animal and human population data (K)	1. Use demographic tools to guide planning decisions (C)	= Intermediate + 1. Explain techniques to measure changes in the total population (K) 2. Assess changes in the composition of the population (animal/human only) (C)
Human	1. Compare population pyramids (S) 2. Calculate population density for an area (i.e., district or region) (S) 3. Compute crude birth rates (S) 4. Evaluate access to family planning (S)	= Frontline + 1. Describe components of population change (e.g., fertility, mortality and migration) (K)	= Intermediate
Animal	1. Contribute to collection of animal population data/census (C)	= Frontline	= Intermediate + 1. Describe how the rates of population turnover for various animal species relates to immunity status (K)
Environment		1. Describe land use/land cover characteristics and how these patterns relate to human/animal interface and interactions (S)	= Intermediate

Subdomain 1.8
Primary health services: key indicators

	Frontline	Intermediate	Advanced
One Health (Core)			1. Describe performance indicators for delivery of One Health services (K)
One Health (Optional)			
Human	1. Discuss social-economic determinants of health (K)	= Frontline + 1. Explain the Universal Health Coverage strategy (K)	= Intermediate
Animal	1. Describe methods for delivery of community animal health services (fixed vs mobile), including the role of veterinarians and para-vets (K)	= Frontline + 1. Implement and support frontline animal health services (C)	= Intermediate + 1. Describe and calculate performance indicators for the delivery of frontline animal health services (S) 2. Describe national animal health management systems and the related performance indicators (K)
Environment			1. Design and monitor changes in land use/land cover including fragmentation patterns (C) 2. Design and monitor biodiversity measures (transactional sampling) (C)

Subdomain 1.9
Systems thinking

	Frontline	Intermediate	Advanced
One Health (Core)	1. Explain the interaction between ecosystems change and human/animal health outcomes (C)	= Frontline + 1. Advocate to integrate multisectoral systems thinking into everyday work (C)	= Intermediate + 1. Incorporate systems thinking into policy design and development (S) 2. Apply systems-based thinking to surveillance, the design of epidemiological studies, and the practice of disease prevention and control (S)
One Health (Optional)	1. Provide stakeholders with basic knowledge of complex systems related to health at the human-animal-environmental interface (interconnectedness) and how they impact global health (C)	= Frontline +	= Intermediate + 1. Contribute to the development and implementation of One Health policies, plans and projects that integrate interconnections between ecosystem and animal/human/plant health (C)
Human			
Animal			
Environment			

Domain 2
Surveillance systems

Introduction

The continuous collection of data about the status of our environment and occurrences of specific events therein, including plants, animals and humans, is fundamental for the assessment of health in its broadest term. Epidemiological surveillance is therefore one of the main pillars of One Health. Well-running surveillance systems allow outbreaks to be defined and detected, and alert algorithms to be calculated. Public health and animal health interventions are implemented and evaluated based on surveillance data. It is therefore of utmost importance that a field epidemiologist is empowered to act within the surveillance systems of their area of work. Epidemiologists require good understanding of characteristics of surveillance systems in order to collect, analyse and report surveillance data from community level to national level. They require the competencies to implement, monitor and evaluate surveillance systems. Defined roles and responsibilities for each level with harmonization and collaboration between all levels and also between human and veterinary services is recommended and needs proper training and focus.

At the frontline level, a surveillance officer appreciates the importance of certain attributes of the system, like timeliness, completeness and data quality, describes how the flow of information is organized, applies algorithms for outbreak detection or alert thresholds, performs simple analysis of the data provided by the system at that level and reports results.

At the intermediate level, the responsible field epidemiologist describes the types of surveillance systems, how surveillance systems are run, and the stakeholders involved, and assesses the source of the data being analysed. Additionally, they perform more elaborate analyses, create visual displays of the results, and report the findings to higher levels within the system. Some of these responsibilities are also expected from a frontline epidemiologist at animal health.

At the advanced level, a field epidemiologist designs and implements a surveillance system, describes and assesses their attributes, and evaluates a surveillance system against its original objectives. At this level, a field epidemiologist creates actionable science (data for action) and can analyse surveillance data, draw conclusions and make recommendations based on this data, as well as write surveillance reports and publish the results and conclusion of their findings.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
3. Field investigations;
4. Disease management;
5. Laboratory capacity;
7. Preparedness and response;
8. Epidemiological studies;
9. Data management, biostatistics, and informatics;
10. Ecosystem health;
11. Leadership and management;
12. Communication and community engagement;
13. Training; and
14. Ethics.

Subdomains

1. Characteristics of a functional surveillance system
2. Epidemic intelligence
3. Detection and reporting of cases, clusters, and public health threats
4. Surveillance data collection, analysis and interpretation
5. Surveillance reporting
6. Monitor and assess the quality of surveillance data
7. Surveillance systems design and evaluation

Subdomain 2.1
Characteristics of a functional surveillance system

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the role and objectives of surveillance systems in public health, animal health and environmental health (K)	= Frontline + 1. Coordinate and integrate surveillance activities among multiple sectors (S)	= Intermediate + 1. Synthesize the objectives of surveillance systems in public health, animal health and wildlife health (C)
One Health (Optional)	1. Define what a surveillance system is including its structural and functional components and interactions. (K) 2. Describe the One Health aspects of surveillance systems (coordination and integration of surveillance activities between multiple sectors) (K) 3. Describe types of surveillance (e.g., indicator-based, event-based), and types of surveillance systems (e.g., sentinel, hospital, lab, risk-based etc.) (K) 4. Describe the characteristics (e.g., comprehensive vs sentinel surveillance, syndromic vs lab confirmed, case-based vs aggregate surveillance) (K) 5. Define attributes (e.g., timeliness, sensitivity) of a functional surveillance system (K) 6. Describe the roles and responsibilities of a surveillance system (K) 7. Describe the surveillance cycle, including administration levels and reporting flows (K)	= Frontline 1. Describe the characteristics of an early warning system (K)	= Intermediate + 1. Promote the interoperability of reporting systems across sectors (C)
Human	1. Describe case-based reporting (K) 2. Describe NCD surveillance systems (K)	= Frontline	= Intermediate
Animal		1. Describe risk-based surveillance methods (K)	= Intermediate
Environment		1. Describe how weather-related data is collected (K)	= Intermediate + 1. Differentiate between ground and satellite monitoring of hydrological parameters and how data can be related to human and animal health (K)

Subdomain 2.2
Detection and reporting of cases, clusters, and health threats

	Frontline	Intermediate	Advanced
One Health (Core)	1. Identify health threats (signals) from community and media sources (C) 2. Apply case definitions for priority diseases (S) 3. Differentiate between types of surveillance (e.g., indicator-based, event-based, etc.) and types of surveillance systems (e.g., sentinel, hospital, lab, risk-based, community-based, etc.) (K) 4. Perform signal detection from both indicator-based surveillance and event-based surveillance (C) 5. Verify signals using signal-alert-event logic (S)	= Frontline	= Intermediate + 1. Create or critique a surveillance case definition for a priority condition (C)
One Health (Optional)	1. Follow reporting channels to report cases and signals to appropriate administration level (S) 2. Use diverse sources of information for event-based surveillance (C)	= Frontline	= Intermediate
Human			
Animal	1. Apply risk-based surveillance methods along high-risk value chain nodes (S)	= Frontline	= Intermediate + 1. Design risk-based surveillance methods along high-risk value chain nodes (C)
Environment			

Subdomain 2.3
Surveillance data collection, analysis and interpretation

	Frontline	Intermediate	Advanced
One Health (Core)	1. Notify authorities of priority diseases that exceed thresholds (S) 2. Analyse surveillance data using descriptive epidemiological and simple statistical methods (S)	= Frontline + 1. Present data analysis using tables, graphs and maps (C)	= Intermediate + 1. Establish or review an outbreak threshold for diseases under surveillance (C)
One Health (Optional)	1. Describe the principles of data collection for surveillance and apply them in multiple sectors (S) 2. Describe and identify trends, patterns and thresholds of priority diseases (S)	= Frontline + 1. Interpret surveillance data both within an individual sector and across multiple sectors (C)	= Intermediate + 1. Perform advanced statistical and Geospatial analysis using surveillance data (S) 2. Perform basic Time Series Analysis (S)
Human			
Animal			
Environment			

Subdomain 2.4
Surveillance reporting

	Frontline	Intermediate	Advanced
One Health (Core)	1. Prepare basic situation reports for potential health threats (S)	= Frontline + 1. Interpret findings from the data analysis of priority conditions (C) 2. Provide recommendations for actions (C)	= Intermediate
One Health (Optional)	1. Produce surveillance summary bulletins and reports (C) 2. Report to next administration level (S) 3. Apply recommendations from the feedback of the higher administration levels (C)	= Frontline + 1. Prepare advanced situation reports for potential public health threats (C)	= Intermediate + 1. Prepare multisectoral summary report for decision-makers and community (C)
Human			1. Describe requirements for reporting of public health events under IHR (2005) (K)
Animal	1. Ensure timely reporting back to farmers to incentivize future participation in surveillance (S)	= Frontline + 1. Follow WOAH requirements for reporting (K)	= Intermediate + 1. Follow WOAH requirements for reporting (K)
Environment			

Subdomain 2.5
Monitor and assess the quality of surveillance data

	Frontline	Intermediate	Advanced
One Health (Core)	1. Ensure the timeliness, completeness and quality of reported data (S)	= Frontline + 1. Monitor the timeliness, completeness and quality of data reported from different sources (C) 2. Provide feedback to improve timeliness, completeness and quality of surveillance data (C)	= Intermediate
One Health (Optional)			
Human		1. Oversee regular quality checks and audits from healthcare facility level for surveillance data (S)	= Intermediate
Animal	1. Monitor surveillance data quality originating along animal value chains (C)	= Frontline	= Intermediate
Environment			

Subdomain 2.6
Surveillance systems design and evaluation

	Frontline	Intermediate	Advanced
One Health (Core)		1. Recommend appropriate actions for improvements (C) 2. Use available tools and guidelines (national and international) for evaluation (C)	1. Conduct a full evaluation of a surveillance system against its objectives (C) 2. Evaluate conclusions and interpretations from an evaluation of surveillance systems (i.e., validate key findings from the evaluation) (C) 3. Produce final evaluation report with justification and recommendations for improvement (C) 4. Select priority conditions and relevant surveillance systems (C) 5. Design reporting forms and flow (C) 6. Set alert thresholds (C) 7. Prepare reporting through electronic tools (C)
One Health (Optional)	1. Support the design of surveillance systems using knowledge of the local context, key stakeholders, human resource availability and field logistics (S)	1. Evaluate surveillance systems using proper attributes (C)	= Intermediate + 1. Assess need for special analysis and studies (e.g., survival analyses; cost effectiveness, cost benefit, cost utility analyses) (C) 2. Choose sites for surveillance (C) 3. Apply epidemic intelligence (C)
Human			
Animal			
Environment			

Domain 3
Field investigations

Introduction

Public, animal or ecosystem health threats can result from infectious (zoonotic, emerging or re-emerging) or non-infectious (natural disasters, chemicals, radiation, etc.) causes. These health threats or events may be reported as early warning signals, unusual case reports, or disease outbreaks that can cross national and international borders. Field investigations often begin without specific hypotheses about the cause of the disease, source or origin. Responding to these threats requires a range of competencies, including planning, leading, supervising, data collection, data analysis, modelling, forecasting, applying intervention methods, and post-investigation monitoring and evaluation.

At the frontline level, field epidemiologists understand the basic principles of field investigations to support and organize field activities, adhere to standard operating procedures, collect high quality data and samples for testing, support intervention strategies, analyse and interpret data, and communicate findings.

At the intermediate level, the field epidemiologist also plans, communicates, leads, and coordinates field investigations with other sectors; develops case definitions, coordinates data collection, conducts statistical analysis and interpretation of data; trains and supervises frontline staff; recommends and monitors interventions; and organizes regular briefings with supervisors and important stakeholders.

At the advanced level, field epidemiologists design, plan, and monitor field investigations, including joint investigations with other One Health sectors, lead multidisciplinary teams and coordinate with all sectors involved in the investigation. In addition, they write and evaluate SOPs, train field investigation teams and assess the epidemiological situation in light of existing national and international legislations. At this level, an epidemiologist manages complex data sets, uses advanced statistical and modelling methods, interprets results, evaluates intervention methods, and communicates results to the media and the scientific community.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
4. Disease management;
5. Laboratory capacity;
6. Infection prevention and control, biosafety and biosecurity;
7. Preparedness and response;
8. Epidemiological studies;
9. Data management, biostatistics, and informatics;
10. Ecosystem health;
11. Leadership and management;
12. Communication and community engagement;
13. Training; and
14. Ethics.

Subdomains

1. Field preparation
2. Investigation
3. Data management and analysis
4. Reporting and follow-up interventions

Subdomain 3.1
Field preparation

	Frontline	Intermediate	Advanced
One Health (Core)	1. Explain objectives of field investigation (K) 2. Apply ethics in field investigations (C) 3. Prepare logistics for field visits, interviews, and sample collection, including PPE and transport (S) 4. Apply SOPs (S) 5. Contribute to the design of data collection tools (S)	= Frontline + 1. Plan and lead field investigations (C) 2. Coordinate and communicate among experts involved in joint field investigations (C) 3. Establish an investigation team (C) 4. Create case definitions and adapt if needed (C)	= Intermediate + 1. Design, plan, supervise, lead/co-lead joint field investigations (C) 2. Formulate and recommend methods and measures for the investigation (C) 3. Develop and evaluate standard operating procedures for joint investigations (C) 4. Incorporate necessary infection, prevention and control (IPC) measures in the field (C) 5. Raise awareness on transmission risks and IPC measures (C)
One Health (Optional)	1. Support in the design of field investigations (C) 2. Explain the One Health approach (K) 3. Communicate with other stakeholders collecting other samples during the same outbreak (C) 4. Identify cultural practices and beliefs on approaches to disease management (K) 5. Contribute to the design of data collection tools for participatory investigations (C)	= Frontline + 1. Design and use complex data collection methods and tools (C) 2. Coordinate and communicate with the human, animal and environmental health experts in preparation for an outbreak investigation or field study (establish joint team, joint design of investigations, etc.) when needed (e.g., during a zoonotic disease outbreak, outbreak involving wildlife, a field study of health and pollutants (C) 3. Train frontline staff on SOPs and data collection tools (C)	= Intermediate + 1. Organize necessary coordination among all sectors involved in the investigation (C) 2. Develop and/or apply monitoring and evaluation methodology (C) 3. Manage and support multidisciplinary investigation teams in investigation planning phase (C) 4. Train field investigation team on IPC measures and precautions (C)
Human			
Animal	1. Prepare logistics for animal handling and examination including domesticated and wild (S)	= Frontline	= Intermediate
Environment			

Subdomain 3.2
Investigation

	Frontline	Intermediate	Advanced
One Health (Core)	1. Apply basic biosafety and biosecurity methods (S) 2. Detect cases/ outbreaks working forward and backward (S) 3. Collect appropriate data (human/ animal, space and time data) to support the field investigation (S) 4. Conduct onsite interviews (e.g., explorative) (C) 5. Collect and submit laboratory specimens, following appropriate biosafety practices for sampling, packaging and transportation of sample (S) 6. Implement and monitor disease control intervention methods (S)	= Frontline + 1. Lead/ supervise a team, co-lead/ co-supervise multidisciplinary teams during outbreak investigation (C) 2. Adapt case definitions (C)	= Intermediate + 1. Assess the epidemiological situation on the ground in light of existing national and international legislation (such as IHR) and report immediately to a higher level when needed (C) 2. Review case definitions (C)
One Health (Optional)	1. Support coordination among all groups involved in investigations and share investigation progress (C) 2. Establish and report the existence of an outbreak (S) 3. Describe active/passive case findings during field investigations (K) 4. Conduct active/passive case finding/case investigation (C) 5. Use participatory methods for case finding and data collection (C) 6. Collect information on environmental factors (S) 7. Explain the use of value chains in an outbreak investigation (K)	= Frontline + 1. Organize regular briefings (C)	= Intermediate
Human	1. None at the frontline level	1. Recommend safe disposal methods for dead animals and manure when necessary (C)	= Intermediate + 1. Apply basic verbal autopsy principles (S) 2. Recognize when to apply basic principles of safe burial during exploratory phase of an outbreak investigation (S) 3. Describe basic protection measures for proven radio-nuclear environmental contamination at investigation team and community level (C)
Animal	1. Conduct postmortems to verify the diagnosis and to collect samples for testing (S) 2. Conduct case finding along the high-risk points of the value chain (markets, abattoirs, human-wildlife interface, etc.) (C) 3. Collect animal health-related data along the value chain (C) 4. Collect samples from livestock, companion animals, fish, and wild animals (S)	= Frontline	= Intermediate + 1. Apply basic interviewing principles (S) 2. Recognize when to apply basic principles of safe burial during exploratory phase of an outbreak investigation (S) 3. Describe basic protection measures for proven radio-nuclear environmental contamination at investigation team and community level (C)
Environment			

Subdomain 3.3
Data management and analysis

	Frontline	Intermediate	Advanced
One Health (Core)	1. Enter and validate data (S) 2. Conduct descriptive analyses of collected data (S)	= Frontline + 1. Use statistical/spatial analyses and interpret results (univariate) (C) 2. Generate hypotheses about cause/risk factors (C) 3. Apply analytical epidemiological investigation to identify the source, cause and or risk factor/ determinants (C)	= Intermediate + 1. Analyse and interpret human, animal and environmental data to determine the potential origin and spread of an outbreak (C)
One Health (Optional)	1. Interpret diagnostic test results of samples submitted to the laboratory (S) 2. Relate lab results to case categories (S)	= Frontline	= Intermediate + 1. Manage complex datasets and conduct multivariate analysis (C) 2. Use advanced statistical/ geographical analyses/modelling and forecasting and interpret results (C)
Human			1. Conduct data analysis with regard to vulnerable groups (S)
Animal	1. Collect value chain data and draw simplified value chain map to identify potential spread routes and characterize risk (S) 2. Explain the use of value chain mapping in an outbreak investigation (K)	= Frontline + 1. Draw and interpret a value chain map to identify potential spread routes and high-risk points of an animal disease outbreak (S)	= Intermediate + 1. Design value chain investigation and advanced analysis of data to characterize risk (S)
Environment			

Subdomain 3.4
Reporting and follow-up interventions

	Frontline	Intermediate	Advanced
One Health (Core)	1. Prepare a standard investigation report (S) 2. Communicate results and share recommendations with stakeholders (C)	= Frontline + 1. Recommend and monitor intervention methods (C)	= Intermediate + 1. Report results of an investigation (S) 2. Integrate key results from reports of other authorities involved in the investigation (C) 3. Recommend evidence-based technical advice to national authorities (C) 4. Differentiate reporting formats and styles according to the target audience (C) 5. Adapt communication strategy and message according to the target audience (C)
One Health (Optional)	1. Recommend disease prevention and control measures (C)	= Frontline + 1. Assess the effectiveness of intervention methods (C) 2. Promote joint reporting across sectors (C)	= Intermediate + 1. Communicate with the media (C) 2. Evaluate intervention methods (C) 3. Prepare manuscripts to publish results of outbreak investigations in peer-reviewed journals (C) 4. Present relevant findings orally at conferences (C)
Human			
Animal			
Environment			

Domain 4
Disease management

Introduction

Disease management is an important domain for field epidemiologists at all levels, as it relates to understanding and control of endemic diseases. Specific knowledge, skills and competencies for One Health in the sub-domains of health systems and health service delivery, antimicrobial stewardship, immunizations, infectious and zoonotic diseases, and disease management during travel, mobility and movement are required for epidemiologists trained in One Health principles. Programmes may add optional competencies depending on specialization and the results of a workforce needs assessment.

At the frontline level, local communities rely on epidemiologists for prevention and control of high priority endemic diseases. Competencies at this level focus on supporting local human and animal health services, promotion of antimicrobial stewardship, implementation of high quality local immunization programming, application of control programmes for infectious diseases, and managing disease risk in the face of mobility and movement.

At the intermediate level, field epidemiologists have a more developed understanding of antimicrobial resistance (AMR), promote antimicrobial stewardship and the design, implementation and evaluation of immunization activities at the regional level. They also conduct infectious disease surveillance and investigations and oversee control measures.

At the advanced level, field epidemiologists have a broader knowledge of the regulatory framework and gaps related to human and animal health service delivery. They contribute to developing the knowledge base for AMR. In addition, advanced field epidemiologists advise policy-makers on effective vaccination programming, build capacity for surveillance and investigation of infectious and zoonotic diseases, including food, waterborne and vector-borne diseases, and manage the health risks and mitigation strategies related to cross border movement of humans and animals.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
5. Laboratory capacity;
6. Infection prevention and control, biosafety and biosecurity;
7. Preparedness and response;
10. Ecosystem health;
11. Leadership and management; and
12. Communication and community engagement.

Subdomains

1. Health systems and health service delivery
2. Antimicrobial stewardship
3. Immunizations
4. Infectious and zoonotic diseases
5. Disease management during travel, mobility and movement

Subdomain 4.1
Health systems and health service delivery

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the role and responsibilities of frontline healthcare providers in prevention and early detection of diseases across the human-animal-environment sectors (K) 2. Describe the healthcare delivery system (governance, regulatory and finance) for both humans and animals in the local area (K)	= Frontline	= Intermediate + 1. Distinguish between the roles and responsibilities of different institutions and organizations involved in human, animal and environment health service delivery at the national level (K)
One Health (Optional)	1. Describe perspectives, responsibilities, obligations and roles of diverse healthcare providers and animal health professionals in the community (government, private, nongovernmental, volunteer, traditional healer) and communicate / coordinate with them in an open manner (C)	= Frontline + 1. Explain the components of a health record management system, including electronic medical records where relevant, and the principles of using health records for disease investigations (C)	= Intermediate + 1. Demonstrate an understanding of system structure, funding mechanisms and how healthcare and animal health/veterinary services are organized (K) 2. Describe the policy and regulatory framework within which human and animal health/veterinary services are provided and funded (K) 3. Identify gaps (geographical, financial, cultural, ethnic or other) in healthcare and animal health/ veterinary service delivery (C) 4. Establish vertical and horizontal coordination of disease prevention, intervention and control across the One Health interface (C)
Human	1. Describe the role of community health workers in health service delivery (K)	=Frontline	=Intermediate
Animal	1. Describe the respective roles of community animal health workers, veterinary paraprofessionals and veterinarians in animal health service delivery (K) 2. Relate the challenges faced by community animal health workers in animal health service delivery (K) 3. Describe animal health service availability along livestock value chains, including farms, markets and abattoirs, and note the nodes / critical control points (K) 4. Describe the importance of farmer and community engagement in animal health service delivery (K)	= Frontline	= Intermediate + 1. Describe options available to obtain stakeholder cooperation along the value chain (C)
Environment			

Subdomain 4.2
Antimicrobial stewardship

	Frontline	Intermediate	Advanced
One Health (Core)	1. Explain the importance of antimicrobial stewardship (K) 2. Promote antimicrobial stewardship at the local level (C) 3. Collect antimicrobial usage and AMR data from human, animal and environment sectors (S)	= Frontline + 1. Describe the factors contributing to emergence and spread of antimicrobial resistant bacteria in human, animal and environment sectors (K) 2. Explain the AMR surveillance system and respective roles to regional stakeholders (S) 3. Promote antimicrobial stewardship at the regional level (C)	= Intermediate + 1. Illustrate the emergence and global spread of drug resistant organisms in human, animal and environment sectors (K) 2. Describe the factors related to AMR spread and the impact of AMR on human, animal and environment health (K) 3. Assemble appropriate toolkits and materials for antimicrobial usage data collection and sampling for AMR (S) 4. Design and implement good practices behavior change to farmers/ communities (bottom-up approach) (C) 5. Support national and facility-based efforts to reduce antibiotic resistance, including diagnostic and antimicrobial stewardship initiatives and reporting and sharing of information on resistant 6. microorganisms (C) 7. Formulate recommendations on the local and national AMR surveillance system (C) 8. Develop sampling protocols and SOPs in accordance with the objectives for an AMR surveillance system (S)
One Health (Optional)	1. Define AMR and distinguish between intrinsic and acquired resistance (K) 1. Interpret common laboratory results for identification of antimicrobial susceptibility (S)	= Frontline + 1. Describe the role of animal production and health in the development of antimicrobial resistance (K) 2. Describe the role of the environment in AMR and the impact of AMR on the ecosystem and wildlife (K) 3. Demonstrate and train others to use clinical guidelines and judicious use principles when choosing appropriate empiric antimicrobial therapy (S) 4. Collect both antimicrobial usage and AMR data as per predetermined schedule (S)	= Intermediate + 1. Develop an AMR surveillance strategy aligned with the national action plan (C) 2. Evaluate the effectiveness of interventions to contain emergence and spread of resistant bacteria (C) 3. Coordinate AMR data sharing and analysis (C)
Human			1. Link with clinical focal points for antibiotic stewardship in healthcare facilities to implement training and technical guidance on prevention and investigation of nosocomial infections and promote evidence guided use of antibiotics (S)
Animal	1. Promote best practices for animal health (e.g., improved husbandry, biosecurity) that reduce farmer dependence on antimicrobials for disease prevention and growth promotion (C) 2. Promote reasoned and controlled use of antimicrobials (C)	= Frontline	= Intermediate + 1. Conduct socioeconomic studies (e.g., cost-benefit, efficiency, impact assessment) to evaluate the relationship between improved animal husbandry practices and reduced need for antimicrobials (C) 2. Describe best practices for waste disposal and animal feed production to avoid antimicrobial contamination and resistance (K)
Environment	1. Describe the role of the environment in antimicrobial resistance (K)	= Frontline	= Intermediate + 1. Conduct environmental studies on antimicrobial resistance (C)

Subdomain 4.3
Immunizations

	Frontline	Intermediate	Advanced
One Health (Core)	1. Explain the health benefits of vaccines for public health, animal health, food security and livelihoods (K) 2. Describe the principles and importance of proper vaccine storage (cold chain) and delivery to remote areas (K) 3. Ensure implementation of appropriate processes for vaccine cold chain management, storage and supply (S) 4. Demonstrate knowledge on appropriate vaccine administration and waste management (S) 5. Be able to communicate effectively in a context of vaccine hesitancy (C) 6. Explain vaccine adverse events (K) 7. Explain causes of vaccine failure (K) 8. Distinguish between routine/ preventive, emergency and supplementary immunization activities (K)	= Frontline + 1. Conduct postvaccination monitoring (S) 2. Illustrate when and how to conduct ring vaccination (K) 3. Plan and conduct an immunization campaign (S)	= Intermediate + 1. Describe the different types of vaccines and other immunizing agents (e.g., immunoglobulins) (K) 2. Explain different types of vaccine preventable diseases and their transmission dynamics (K) 3. Explain the difference between disease control, elimination, and eradication (K) 4. Identify at risk populations and propose adjusted immunization strategies and approaches (C)
One Health (Optional)	1. Summarize the basics of vaccine immunology (K) 2. Describe the difference between sterilizing and nonsterilizing immunity (K)	= Frontline + 1. Describe the basic principles of microplanning for immunization campaigns (K)	= Intermediate + 1. Advise governments on the cost-benefit of vaccines in the context of disease control (C) 2. Conduct applied research on specific vaccine preventable disease in the context of an outbreak (C)
Human			
Animal	1. Explain the cost-benefit of vaccines in the context of animal production (K) 2. Apply appropriate vaccine administration according to vaccine type and animal species (K)	= Frontline + 1. Demonstrate collection of blood samples from relevant animal species for post-vaccination monitoring (S)	=Intermediate + 1. Advise governments on the cost-benefit of animal vaccines in the context of disease control (C)
Environment	1. Describe different methods of vaccination for wildlife (K)	1. Describe potential effects of live vaccine residues in the environment (S)	= Intermediate

Subdomain 4.4
Infectious diseases

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe basic infectious disease transmission and terminology, including zoonotic diseases (K) 2. Participate in infectious disease surveillance and investigations, including food, waterborne and vector-borne diseases (S) 3. Apply infectious disease prevention and control measures (S) 4. Describe the principles of water, sanitation and hygiene (K) 5. Identify communities at risk for food, waterborne and vector-borne disease outbreaks (C)	= Frontline + 1. Conduct infectious disease surveillance and investigations, including food, waterborne and vector-borne diseases (S) 2. Describe the impact of infectious diseases (K) 3. Apply the principles of water, sanitation and hygiene in a real-life setting (S)	= Intermediate + 1. Develop a system for surveillance and investigation of infectious diseases, including food, waterborne and vector-borne diseases (S) 2. Collaborate with partners to investigate infectious disease outbreaks and implement systems to better detect, control and prevent them (C) 3. Distinguish between the roles of different organizations involved in food and water safety at the national level (K) 4. Design water, sanitation and hygiene interventions and evaluate their effectiveness (C)
One Health (Optional)	1. Describe local food customs including social and cultural practices (K)	= Frontline + 1. Describe the role of wildlife slaughter, trade and consumption in transmission of zoonotic diseases (K) 2. Develop and monitor case definition adherence and surveillance components for food, waterborne and vector-borne diseases (S)	= Intermediate + 1. Evaluate and revise infectious disease prevention strategies, including social and cultural aspects, according to data (C) 2. Link analysis of environmental (climate related) data to outbreak forecasting and enhanced surveillance of waterborne diseases (S)
Human			
Animal	= One Health + 1. Describe required withdrawal times for pharmaceuticals used in meat, egg and milk producing animals (K) 2. Describe the veterinarian's role in oversight of slaughterhouse facilities, meat inspection and inspection of animal products processing establishments (K) 3. Apply basic priority disease prevention and control measures (S)	= Frontline + 1. Describe monitoring of animal production, productivity and recording of health events (K) 2. Implement animal disease control measures, including culling animals, proper carcass disposal, and principles of biosecurity (C)	= Intermediate
Environment			

Subdomain 4.5
Disease management during travel, mobility, and movement

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the potential risk of spreading animal diseases posed by movement of people, animals, animal products, by-products and fomites (vehicles, equipment, etc.) (K)	= Frontline + 1. Evaluate the potential risk of spreading animal diseases posed by movement of people, animals, and animal products (S)	= Intermediate + 1. Recommend and execute policies for quarantine and movement restrictions at the national level (S) 2. Outline health policies for cross-border travel, including immunizations (K)
One Health (Optional)	1. Describe reasons for mobility of people and animals and potential impacts on spread of disease (K) 2. Propose ways to mitigate disease risk in the face of mobility and movement (C)	= Frontline 1. Explain both economic costs and health benefits related to border control and movement restrictions (S)	= Intermediate + 1. Use network analysis to design disease prevention and control plans according to high-risk areas/ hot spots (C)
Human		1. Explain the concept of social distancing and its role in preventing disease transmission (K)	= Intermediate + 1. Describe unique health considerations for refugees and internally displaced persons (K)
Animal	1. Describe the role of veterinary services in identification and traceability of live animals and animal products for human consumption (K) 2. Describe local transhumance and restrictions on animal movement for disease prevention (K) 3. Implement animal disease management plans (S) 4. Establish animal movement / quarantine measures according to SOPs in cases of suspected notifiable disease (S)	= Frontline + 1. Describe both legal and illegal cross-border and restrictions on animal movement (K) 2. Use value chain analysis to describe the movements of animals and animal products and their corresponding transmission pathways (C) 3. Describe regional and national value-chains and how they impact movement and subsequent risk of disease spread in an outbreak (S) 4. Describe regional transhumance (K)	= Intermediate + 1. Evaluate a system for animal identification, registration, and traceability, describing any necessary improvements (C) 2. Contribute to risk assessments and policy development for global trade of animal and animal products (S) 3. Develop and evaluate animal disease management plans for different purposes (control, elimination, demonstrate freedom from disease, etc.) (C) 4. Describe national and cross-border transhumance (K)
Environment			1. Contribute to risk assessments and policy development for global trade of wildlife and wildlife products (S)

Domain 5
Laboratory capacity

Introduction

Laboratory capacity supports the confirmation of disease with epidemiological data generated by field epidemiologists, enabling formulation of a case definition with corresponding confirmatory diagnosis and application of prevention and control measures. It includes four subdomains that encompass: 1) sample/specimen collection, labelling, storage and transport to the laboratory; 2) multisectoral planning and linking of diagnostic laboratory data with field epidemiology data across sectors; 3) multisectoral collaboration; and 4) analysis, interpretation, and reporting of laboratory data. This domain is foundational to a One Health approach for linking across the human-animal-environment interface.

At the frontline level, field epidemiologists should be able to describe and implement risk management plans and standard operating procedures (SOP) to maintain biosafety and biosecurity when implementing necropsies, sample and specimen collection, labelling, handling, transportation and delivery of field samples/specimens to the laboratory, and preserve the cold chain to maintain sample integrity.

At the intermediate level, field epidemiologists monitor and support the frontline level who implement risk management plans and standard operating procedures to maintain biosafety and biosecurity while performing the above-noted duties, in addition to coordinating field sample collection with subnational and national laboratories and across sectors. The intermediate level field epidemiologist is also responsible for assessing basic test performance characteristics for both antigen- and antibody-based tests in relation to gold standard tests.

At the advanced level, a field epidemiologist evaluates, trains and leads the development, implementation and evaluation of risk management plans and SOP for the frontline and intermediate levels. The advanced level also conducts higher level test performance assessments and ensures effective multisectoral collaboration that links laboratory and field epidemiology data. This level is also responsible for analyses of laboratory data (i.e., trend analysis and multivariable analysis of secondary data) and supporting laboratory quality assurance.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
4. Disease management;
6. Infection, prevention and control, biosafety and biosecurity;
7. Preparedness and response;
8. Epidemiological studies; and
9. Data management, biostatistics, and informatics.

Subdomains

1. Necropsies, sample/specimen collection, labelling, storage and transport
2. Multisectoral planning and data linking
3. Multisectoral coordination
4. Analysis, interpretation and reporting of laboratory data

Subdomain 5.1
Necropsies, sample/specimen collection, labelling, storage, and transport

	Frontline	Intermediate	Advanced
One Health (Core)	1. Implement universal biosafety and biosecurity precautions in specimen collection, handling, labelling, storage and transportation (S) 2. Implement IPC SOPs for biosafety and biosecurity including equipment for specimen collection, labelling, handling, storage, transportation and biological waste disposal (e.g., needles) (S) 3. Document the specimen collection, labelling, handling, storage, cold chain, transportation procedures and biological waste disposal (e.g., needles) applied (S)	= Frontline + 1. Monitor and support the application of universal biosafety and biosecurity precautions in specimen collection, handling, labelling, storage, transportation and biological waste disposal (e.g., needles) (S) 2. Coordinate the application of IPC SOPs for biosafety and biosecurity including equipment for specimen collection, labelling, handling, storage, transportation and biological waste disposal (e.g., needles) (C) 3. Monitor the documentation of specimen collection, labelling, handling, storage, cold chain, transportation procedures and biological waste disposal (e.g., needles) applied (S)	= Intermediate + 1. Formulate universal biosafety and biosecurity precautions in specimen collection, handling, labelling, storage, transportation and biological waste disposal (e.g., needles) (C) 2. Formulate the risk management plan and IPC SOPs for specimen collection, handling, labelling, cold chain, and protocols for packaging specimens for transport and biological waste disposal (e.g., needles) (C)
One Health (Optional)	1. Implement a risk management plan for safe and humane specimen collection, handling, labelling, storage, and transportation including cold chain and appropriate protocols for packaging specimens for transport and biological waste disposal (e.g., needles) (S)	= Frontline + 1. Monitor and support the risk management plan for safe and humane specimen collection, handling, labelling, storage, and transportation including specimen labelling, cold chain, appropriate protocols for packaging specimens for transport and biological waste disposal (e.g., needles) (S) 2. Contribute to the development of specimen collection SOPs (C)	= Intermediate + 1. Evaluate implementation of the risk management plan and SOP for biosafety, biosecurity and documentation for safe and humane specimen collection, labelling, cold chain, protocols for packaging specimens for transport and biological waste disposal (e.g., needles) (C) 2. Provide training for frontline and intermediate levels related to the risk management plan and SOP for biosafety, biosecurity and documentation for specimen collection, labelling, handling, storage, cold chain, protocols for packaging specimens for transport and biological waste disposal (e.g., needles) (C)
Human			

Subdomain 5.1 (cont.)
Necropsies, sample/specimen collection, labelling, storage, and transport

	Frontline	Intermediate	Advanced
Animal	1. Describe the risk of zoonotic and transboundary animal disease transmission when performing a necropsy and live animal specimen collection using SOPs (S) 2. Describe how the use of appropriate safe and humane restraint techniques for sample collection reduces the risk to animal health workers and prevents negative impact on the health, welfare, and productivity of the animal (K) 3. Apply appropriate restraint techniques (physical or chemical) and sampling procedures for priority species (S) 4. Demonstrate the appropriate use of personal protective equipment to prevent zoonotic and transboundary animal disease transmission for necropsy and sampling (S)	= Frontline + 1. Monitor the risk of zoonotic and transboundary animal disease transmission when performing a necropsy and live animal specimen collection using SOPs (S) 2. Monitor whether safe and humane restraint techniques are being used for sample collection for priority species (S) 3. Monitor whether appropriate personal protective equipment is being used during necropsy and live animal specimen collection to prevent the transmission of zoonotic and transboundary animal disease (S) 4. Monitor whether knowledge about the risk of zoonotic and transboundary animal disease transmission when performing a necropsy and live animal specimen collection is demonstrated (S)	= Intermediate + 1. Evaluate the risk of zoonotic and transboundary animal disease transmission when performing a necropsy and live animal specimen collection using SOPs (C) 2. Evaluate restraint techniques and make recommendations to improve humane animal techniques and animal health worker safety (C) 3. Evaluate the use of personal protective equipment and make recommendations for improving animal health worker safety through the prevention of zoonotic disease and transboundary animal transmission (C) 4. Evaluate knowledge about the risk of zoonotic and transboundary animal disease transmission when performing a necropsy and live animal specimen collection and make recommendations for training (C)
Environment	1. Describe the risk of zoonotic disease transmission when performing a necropsy and live animal specimen collection (S) 2. Describe basic principles of IPC for safe specimen handling for wildlife (C) 3. Use appropriate methods and equipment for wildlife sample/specimen collection (S) 4. Describe principles of animal restraint for sampling to prevent stress, injury, or death (K) 5. Describe and apply permit requirements to capture/restrain/handle/sample wildlife or to perform necropsies (S) 6. Demonstrate the appropriate use of personal protective equipment to prevent zoonotic or transboundary animal disease transmission/spread during sampling (S)	=Frontline + 1. Monitor the risk of zoonotic disease transmission when performing a necropsy and live animal specimen collection (S) 2. Monitor methods and equipment for wildlife sample/specimen collection for appropriateness (S) 3. Monitor animal restraint for sampling to prevent stress, injury, or death (C) 4. Monitor permit requirements to capture/restrain/handle/sample wildlife or to perform necropsies (S) 5. Monitor the use of personal protective equipment to prevent zoonotic or transboundary animal disease transmission/spread during sampling (S)	=Intermediate + 1. Evaluate the risk of zoonotic disease transmission when performing a necropsy and live animal specimen collection (C) 2. Evaluate if methods and equipment for wildlife sample/specimen collection are appropriately used (C) 3. Evaluate if animal restraint for sampling prevents stress, injury, or death (C) 4. Evaluate permit requirements and apply for permits to capture/restrain/handle/sample wildlife or to perform necropsies (C) 5. Evaluate the use of personal protective equipment to prevent zoonotic or transboundary animal disease transmission/spread during sampling (C)

Subdomain 5.2
Multisectoral planning and data linking

	Frontline	Intermediate	Advanced
One Health (Core)	1. Consult with laboratorians and field supervisors before, during and following field investigations (C)	= Frontline + 1. Coordinate with laboratorians to develop and carry out field investigations (C) 2. Describe the general characteristics and use of diagnostic tests and recognize specifications that may affect specimen collection, labelling, handling, transportation, storage, analysis and test results (S)	= Intermediate + 1. Lead the planning and implementation of field investigations and coordinate with laboratories (C) 2. Apply epidemiological sampling concepts and techniques (e.g., sample size calculation, representativeness) to design laboratory research studies (C) 3. Share assessment and evaluation reports with relevant stakeholders (S)
One Health (Optional)	1. Describe the advantages and disadvantages of different types of diagnostic tests and when they should be applied (K) 2. Describe the causes of false negative and false positive results and their impact on the interpretation of test results (K)	= Frontline + 1. Review the diagnostic tests available at the local level, confirm their legitimacy, and select those with the characteristics that meet the designated need for diagnosis and surveillance (C) 2. Calculate the geometric mean titer to assess population immune status (S) 3. Calculate estimates of sensitivity and specificity for all dichotomous diagnostic tests, including confidence intervals (S) 4. Explain precision and accuracy and how they are applied to field and laboratory diagnosis (S)	= Intermediate + 1. Evaluate the needs for joint training for epidemiologists and laboratory personnel to conduct joint field investigations (C) 2. Design a multiple testing approach including parallel and serial diagnostics, considering the effects on the sensitivity and specificity, positive predictive value and negative predictive value of a testing protocol (C) 3. Recommend statistical methods to estimate sensitivity and specificity with corresponding confidence intervals, criteria for determining sample size to evaluate a new diagnostic test, and statistical methods for evaluating a test when no gold standard is available (C) 4. Evaluate diagnostic tests, including enzyme-linked immunosorbent assay, using the Receiver Operating Characteristic curve system (S) 5. Conduct quality assurance of joint field and laboratory interactions, including reporting, across the interface (S)
Human			
Animal			
Environment			

Subdomain 5.3
Multisectoral coordination

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the importance of multisectoral linking of laboratory and field data (K) 2. Identify contact persons at central and local level laboratories for supplies, specimen collection, labelling, handling, submission and testing (S)	=Frontline + 1. Develop suspect, probable and confirmed case definitions (C) 2. Link laboratory with field data to support decision-makers across the interface (C) 3. Coordinate with the contact persons at central and local level laboratories for sample testing (C)	=Intermediate + 1. Lead and facilitate collaboration among clinical, laboratory, and public health institutions (C) 2. Integrate and analyse laboratory and field data to support decision-makers across the human-animal-environment interface (C) 3. Assess conflicting results (false positives, false negatives) from laboratory and field data for impact on data quality and decision-making (S)
One Health (Optional)	1. Explain the complementary contributions of field epidemiology and laboratory diagnostics to construct case definitions (C) 2. Describe the different organizational structures of field epidemiology and laboratory diagnostic services (K)	= Frontline + 1. Facilitate interactions between field epidemiologists and laboratory, across the interface at the subnational institutional level (C)	= Intermediate + 1. Manage and coordinate data sharing at the national level with all stakeholders (C)
Human			
Animal			
Environment			

Subdomain 5.4
Analysis, interpretation and reporting of laboratory data

	Frontline	Intermediate	Advanced
One Health (Core)	1. Collaborate with laboratory experts to describe the context of data being analysed (C) 2. Interpret results and make recommendations to improve data quality, including timeliness and completeness (C)	= Frontline + 1. Conduct descriptive and univariable and bivariable analysis and display of secondary laboratory data according to person/animal-place-time including spatial analysis tools (S) 2. Contribute to monthly, quarterly and annual laboratory summary reports (S) 3. Monitor and coordinate feedback to stakeholders (C)	= Intermediate + 1. Conduct univariable and bivariable and multivariable analyses and display secondary laboratory data according to person/animal-place-time to support joint risk assessments (S) 2. Evaluate, integrate and report field and laboratory data to conduct trend analysis (e.g., time series analysis) (C) 3. Provide quality assurance of laboratory data and provide guidance on the analysis of laboratory data for public health and animal health importance (C)
One Health (Optional)	1. Conduct univariable analysis and display of secondary laboratory data including basic spatial and temporal trends according to person/animal-place-time (S) 2. Incorporate laboratory data in epidemiological analysis (S) 3. Provide oral and written reports to important stakeholders (S) 4. Summarize the value of laboratory data and its impact on public health and animal health decisions (C)	= Frontline + 1. Calculate sensitivity, specificity, Positive Predictive Value and Negative Predictive Value (S) 2. Interpret the results accounting for factors, such as context, frequency of disease, sensitivity and specificity of the test, prevalence, and host relationship, that can affect the results (C) 3. Assess the quality of laboratory data and provide guidance on the analysis of laboratory data for public health and animal health importance (C)	= Intermediate +
Human			
Animal			
Environment			

Domain 6
Infection prevention and control, biosafety and biosecurity

Introduction

Infection prevention and control (IPC), biosafety and biosecurity are essential to prevent the transmission of disease pathogens within and among humans, animals and the environment. The health and safety of human and animal health workers includes field epidemiologists and laboratory personnel. IPC is a term adopted by the human health sector and considered equivalent in intent to biosafety and biosecurity, the terms most often used in animal health. However, there may be some differences in how IPC, biosafety and biosecurity are applied in the field or laboratory. For field personnel, effective implementation of IPC, biosafety and biosecurity are essential to incorporate while conducting daily field duties in order to protect human health and prevent transmission of disease pathogens. The field and laboratory worker will maintain awareness of preceding, current and proceeding activities during the course of daily activities to prevent and control unwanted human exposure and disease pathogen transmission. This mindset is referred to as 'situational awareness' and is used by firefighters and emergency responders during an emergency. It can be practised at the level of an individual, a team or a task force during an emergency.

At the frontline level, field epidemiologists possess the necessary competencies and skills to apply IPC, biosafety and biosecurity in their daily work to protect human health and prevent transmission of disease pathogens.

At the intermediate level, field epidemiologists are responsible for applying, coordinating and supporting preparedness, and training on implementation and evaluation of IPC, biosafety and biosecurity to protect human health and prevent the transmission of disease pathogens, including those demonstrating antimicrobial resistance.

At the advanced level, a field epidemiologist is responsible for applying and leading on preparedness, training, implementation and evaluation of IPC, biosafety and biosecurity for the frontline and intermediate levels to protect human health and prevent the transmission of disease pathogens, including those demonstrating antimicrobial resistance.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

4. Disease management;
5. Laboratory capacity;
7. Preparedness and response; and
13. Training.

Subdomains

1. Infection prevention and control, biosecurity and biosafety preparedness
2. Infection prevention and control, biosecurity and biosafety implementation procedures
3. Continuous quality improvement evaluation

Subdomain 6.1
Infection prevention and control, biosecurity and biosafety preparedness

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe mechanisms for disease transmission and the Disease Interventions Model (K) 2. Describe basic definitions of IPC, biosafety and biosecurity and provide examples for laboratory and field procedures (K) 3. Define the principles of biosafety (K) 4. Describe the principles of biosecurity (K) 5. Describe the tools and methods applied for biosecurity and biosafety (K) 6. Describe best practices for donning and doffing personal protective equipment (PPE), safe collection, handling and submission of field samples and specimens, movement between disease zones and waste management (K) 7. Describe the roles and responsibilities of epidemiology field team members for suspect and positive premises (K) 8. Explain why is critical to separate so-called clean and dirty field teams (K) 9. Describe how to establish and maintain three containment zones (Green-Yellow-Red zones) (C) 10. Apply IPC, biosafety and biosecurity procedures in classroom and field training exercises to (C)	= Frontline + 1. Monitor the availability and application of SOPs and guidelines (S) 2. Monitor the availability of PPE (S) 3. Explain how to assess risk in the field or in the laboratory (C) 4. Monitor and train the frontline level on the use of PPE (C)	= Intermediate + 1. Formulate SOPs and guidelines (C) 2. Train and mentor frontline and intermediate level professionals (C) 3. Conduct risk assessments related to IPC, biosafety and biosecurity (C) 4. Evaluate the availability of and compliance to SOPs and guidelines (C) 5. Lead multisectoral collaboration with respect to preparedness (C) 6. Lead advocacy efforts to apply best practices for IPC, biosafety and biosecurity at all levels (C)
One Health (Optional)	1. Describe human health and safety principles under an all-hazards approach (K) 2. Describe standard operating procedures for safe entry and exit related to vehicles (mobile) and on premises (stationary) (K) 3. Describe best practices for situational awareness principles for biosafety and biosecurity at personal, field team and task force levels (S) 4. Describe IPC methods and SOPs to promote health and safety related to antimicrobial resistance (S)	= Frontline + 1. Monitor the availability of the necessary communication channels, resources and inventories (S)	= Intermediate + 1. Coordinate PPE procurement (C)

Subdomain 6.1 (cont.)
Infection prevention and control, biosecurity and biosafety preparedness

	Frontline	Intermediate	Advanced
Human			
Animal	1. Describe basic biosecurity principles provided in FAO's Good Emergency Management Practice (GEMP) Essentials Guide[4] (K) 2. Describe specific biosafety and biosecurity requirements and adaptations required for humane culling and disposal and along the value chains for farms, transportation, collection points, markets, abattoirs, retail sales, laboratories, border points of entry (S) 3. Describe SOPs of biosafety and biosecurity for farmers, marketers, etc. (K) 4. Describe basic methods of biosecurity assessment audits (C)	= Frontline + 1. Monitor the application of basic biosecurity principles provided in FAO's GEMP Essentials Guide (S) 2. Monitor conformance with specific biosafety and biosecurity requirements and adaptations required for humane culling and disposal and along the value chains (S) 3. Monitor conformance with SOPs of biosafety and biosecurity for farmers, marketers, etc. (S) 4. Monitor biosecurity assessment audits (S)	= Intermediate + 1. Evaluate the application of basic biosecurity principles provided in FAO's GEMP Essentials Guide (C) 2. Evaluate conformance with specific biosafety and biosecurity requirements and adaptations required for humane culling and disposal and along the value chains (C) 3. Evaluate conformance with SOPs of biosafety and biosecurity for farmers, marketers, etc. (C) 4. Conduct biosecurity assessment audits (C)
Environment			

4 https://www.fao.org/documents/card/en/c/68b14f27-5234-51f3-b46e-8ecea0029d9b/

Subdomain 6.2
Infection prevention and control, biosecurity and biosafety implementation procedures

	Frontline	Intermediate	Advanced
One Health (Core)	1. Maintain a PPE inventory (S) 2. Perform donning and doffing (S) 3. Apply a health and safety SOP (S)	= Frontline + 1. Monitor the application of SOP and guidelines (S) 2. Contribute to a risk assessment and apply corrective measures (C) 3. Implement a disease control and prevention plan (S) 4. Identify strengths and weaknesses in the application of SOP, guidelines and plans in the field (C) 5. Train the frontline level on IPC, biosafety and biosecurity (C)	= Intermediate + 1. Conduct an emergency situation risk assessment (C) 2. Formulate disease specific prevention and control plans (C) 3. Evaluate the efficiency of control measures (C)
One Health (Optional)	1. Maintain situational awareness and communication at personal, field team and task force levels (S) 2. Provide basic advocacy and community training (C) 3. Assist with coordinating field member assignments for biosafety and biosecurity (C) 4. Create three protective containment zones for suspect and positive premises (C) 5. Implement safe entry and exit and waste management SOP including sample and data collection, handling and shipping, and vehicles (S)	= Frontline + 1. Monitor the application of an emergency plan (C) 2. Coordinate field member assignments for biosafety and biosecurity (C) 3. Design community-based advocacy and awareness activities (C)	= Intermediate + 1. Formulate an infection prevention and control plan (C) 2. Identify context specific training needs and design relevant training programmes (C) 3. Deliver training activities (C) 4. Ensure multisectoral collaboration (C) 5. Design the activities to lead advocacy for following best practices for implementation IPC, biosafety and biosecurity procedures (C)
Human			
Animal	1. Implement specific biosafety and biosecurity requirements required for humane culling and disposal and along the value chains for farms, transportation, collection points, markets, abattoirs, retail sales, laboratories, border points of entry (C) 2. Implement SOPs of biosafety and biosecurity for farmers, marketers, etc. (S) 3. Implement basic methods of biosecurity assessment audits (S)	= Frontline + 1. Monitor implementation of specific biosafety and biosecurity requirements required for humane culling and disposal and along the value chains for farms, transportation, collection points, markets, abattoirs, retail sales, laboratories, border points of entry (C) 2. Monitor implementation of SOPs for biosafety and biosecurity for farmers, marketers, etc. (S) 3. Monitor implementation of basic methods of biosecurity assessment audits (S)	= Intermediate + 1. Evaluate implementation of specific biosafety and biosecurity requirements required for humane culling and disposal and along the value chains for farms, transportation, collection points, markets, abattoirs, retail sales, laboratories, border points of entry (C) 2. Evaluate implementation of SOPs for biosafety and biosecurity for farmers, marketers, etc. (C) 3. Evaluate implementation of basic methods of biosecurity assessment audits (C)
Environment			

Subdomain 6.3
Continuous quality improvement evaluation

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe IPC, biosafety and biosecurity procedures (K) 2. Describe complete IPC, biosafety and biosecurity information to evaluators (K)	= Frontline + 1. Document IPC, biosafety and biosecurity procedures, including challenges and successes in implementation (S) 2. Explain IPC, biosafety and biosafety information (S) 3. Administer basic biosafety and biosecurity evaluation tools (S)	= Intermediate + 1. Evaluate IPC, biosafety and biosecurity procedures (C) 2. Evaluate IPC, biosafety and biosecurity implementation successes and challenges and develop corrective actions (C)
One Health (Optional)	1. Describe challenges and successes in implementing biosafety and biosecurity procedures (C) 2. Apply basic biosafety and biosecurity evaluation tools (S) 3. Apply specific biosafety and biosecurity evaluation required at border points of entry (S)	= Frontline + 1. Monitor specific biosafety and biosecurity evaluation required at border points of entry (S)	= Intermediate + 1. Lead audits of IPC, biosafety and biosecurity practices (C) 2. Develop a biosecurity protocol to visit premises (C) 3. Lead evaluation of IPC, biosafety and biosecurity plan using appropriate tools (C) 4. Lead specific biosafety and biosecurity evaluation and adaptations required at border points of entry (C)
Human			
Animal	1. Apply evaluation principles provided in FAO's GEMP Essentials Guide (S) 2. Apply specific biosafety and biosecurity evaluation tools required for humane culling and disposal and along the value chains for farms, transportation, collection points, markets, abattoirs, retail sales, laboratories, border points of entry (S)	= Frontline + 1. Monitor the application of principles provided in FAO's GEMP Essentials Guide (S) 2. Monitor specific biosafety and biosecurity evaluation tools required for humane culling and disposal and along the value chains for farms, transportation, collection points, markets, abattoirs, retail sales, laboratories, border points of entry (S)	= Intermediate + 1. Evaluate the application of principles provided in FAO's GEMP Essentials Guide (C) 2. Evaluate specific biosafety and biosecurity evaluation tools and adaptations required for humane culling and disposal and along the value chains for farms, transportation, collection points, markets, abattoirs, retail sales, laboratories, border points of entry (C)
Environment			

Domain 7
Preparedness and response

Introduction

Epidemiologists play an integral role in preparing for and responding to emergency disease threats for both humans and animals. Epidemics of novel zoonotic viruses, including recently emergent viruses, such as SARS CoV-2, Ebola, Nipah virus, avian influenza and HIV, have been linked to human activities such as deforestation, agricultural expansion and intensification, urbanization, hunting, travel and wildlife trade. To minimize the impact of these incidents, epidemiologists trained in the One Health approach require competencies in the following areas: early detection of disease threats; performance of risk assessments; policy development, adaptation and implementation; cross-sectoral coordination and incident command; and emergency risk communication. They must be prepared to coordinate, cooperate, and collaborate with cross-sector partners and organizations when emergencies occur, regardless of the type, scale, or severity. In addition, some countries may choose to include training in specific types of preparedness and response for mass gatherings, humanitarian crises and natural disasters, or chemical, biological, radiological and nuclear threats (CBRN).

At the frontline level, field epidemiologists understand emergency threats and risks, are aware of policies and plans for emergency response, and follow up on reported events, contribute to cross-sectoral coordination at the local level and deliver emergency risk communication messages.

At the intermediate level, field epidemiologists critically appraise information about potential health threats, participate in risk assessments, provide scientific information for policy development, identify preparedness gaps and solutions, lead cross-sectoral coordination, understand the workings of an emergency operations center, and help develop emergency risk communication messages.

At the advanced level, field epidemiologists determine when and how to initiate a field investigation to assess a potential emergency health threat. In addition, can determine priority health risks by performing risk assessments, identify policy gaps and advocate for measures to address them, understand the structure and role of an emergency operation center, assume a leadership role in emergency simulation exercises, and engage appropriately for emergency risk communication to the media and the general public.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
3. Field investigations;
4. Disease management;
5. Laboratory capacity;
6. Infection, prevention and control, biosecurity, and biosafety;
10. Ecosystem health;
11. Leadership and management;
12. Communication and community engagement;
13. Training; and
14. Ethics.

Subdomains

1. Detection of health threats
2. Risk assessments
3. Policy development, adaptation and implementation
4. Preparedness and response planning
5. Cross-sectoral coordination and incident management
6. Emergency risk communication
7. Mass gatherings
8. Humanitarian crises and natural disasters
9. Chemical, biological, radiological and nuclear emergencies

Subdomain 7.1
Detection of health threats

	Frontline	Intermediate	Advanced
One Health (Core)	1. List priority emerging infectious diseases relevant to the area and their likely modes of transmission (K) 2. List sources of information about potential health threats (S) 3. Describe the microbiological and epidemiological characteristics of pathogens of epidemic potential (K)	= Frontline + 1. Apply knowledge of the microbiological and epidemiological characteristics of pathogens of epidemic potential to interpret information on emerging threats (S) 2. Describe and critically appraise information from surveillance systems and other sources to identify potential health threats (S) 3. Interpret the results and implications of existing environmental monitoring systems (S)	= Intermediate + 1. Engage with laboratories to ensure capacities and proficiency for testing for pathogens of epidemic potential (C) 2. Use event-based, indicator-based and innovative (novel) surveillance to detect health threats (C) 3. Identify when case reports or clusters require further investigation and know how to initiate field investigations (C) 4. Evaluate the implications of national or international health alerts (C) 5. Identify organism responsible for a disease outbreak and its epidemiological characteristics (C) 6. Describe protocols for notifying WHO or WOAH of a potential health threat (K) 7. Advise the delegate responsible for reporting (S) 8. Evaluate whether a potential health threat is notifiable under the IHR (C)
One Health (Optional)	1. List sources of international health alerts (K) 2. Describe existing environmental monitoring systems (S) 3. Evaluate whether a health threat is potentially deliberate and requires collaboration with security forces (C) 4. Describe how to notify and collaborate with security forces about a potentially deliberate health threat (K)	= Frontline + 1. Critically appraise international health alerts to assess their local implications (S) 2. Identify the use and limitations of diagnostic methods and their interpretation to characterize health risks (S)	= Intermediate + 1. Design new or adapt existing environmental monitoring systems for emerging concerns about environmental contamination (C) 2. Identify environmental, climate anomalies or thresholds associated with the health threats (C)
Human			
Animal			
Environment			1. Describe how environmental or climate anomalies are cumulative and their persistence over time (S) 2. Map areas of exceedance for environmental or climate anomalies to identify at risk areas (S)

Subdomain 7.2
Risk assessments

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe how to identify hazards (K)	= Frontline + 1. Describe the steps for conducting quantitative risk assessments (K) 2. Describe the components of risk analysis (K) 3. Identify gaps in data and knowledge that could help clarify risk (S)	= Intermediate + 1. Determine priority health risks by performing a risk assessment (C) 2. Prepare a risk assessment report with recommended management approaches for identified risks (C) 3. Incorporate the results and implications of risk assessments in emergency risk communication (C) 4. Use risk assessment results to inform risk-based surveillance (C)
One Health (Optional)	1. Define risk and describe the risk assessment process (K) 2. Describe the steps for conducting qualitative risk assessments (K) 3. Characterize the current and potential risk pathways of population exposure to biological, chemical, radiological and nuclear threats (S) 4. Contribute to a risk assessment (S)	= Frontline + 1. Describe risk assessment tools, such as the Tripartite Joint Risk Assessment Operational Tool (K) 2. Participate in a risk assessment (C) 3. Perform joint risk assessments for One Health (C) 4. Communicate the results and implications of risk assessments to policymakers with different backgrounds (S)	= Intermediate + 1. Develop national all-hazards plan and mitigation plans (C)
Human			
Animal			1. Use risk assessments to establish risk-based surveillance for demonstration of disease freedom or elimination (C) 2. Describe WOAH import risk analysis (K)
Environment			

Subdomain 7.3
Policy development, adaptation and implementation

	Frontline	Intermediate	Advanced
One Health (Core)			1. Assess emergency response policies and communicate them to relevant stakeholders (C)
One Health (Optional)	1. Describe the policies, plans, and frameworks relevant to emergency response (K) 2. Describe the different levels and triggers for border restrictions during an emergency (K) 3. Describe how trade and travel restrictions can be used as a tool for disease control (S	= Frontline + 1. Synthesize scientific information and recognize implications for policy frameworks (C)	= Intermediate + 1. Participate in assessments of legal frameworks and policies and propose/advocate measures to address gaps based on current or potential health events (C) 2. Communicate policies/guidelines, weigh benefits and costs, describe concerns about implementation and adapt policies related to border control, trade and movement restrictions (C)
Human			
Animal			1. Use risk assessments to establish risk-based surveillance for demonstration of disease freedom or elimination (C) 2. Describe WOAH import risk analysis (K)
Environment			

Subdomain 7.4
Preparedness and response planning

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the principles of disease prevention, control and treatment (K) 2. Describe the basic principles of responder safety and health, including PPE (K) 3. Describe the roles and responsibilities of rapid response teams and participate in a response activity (S)	= Frontline + 1. Identify potential control strategies for emerging pathogens (S) 2. Document vaccine distribution channels and plan for vaccination of high risk and other target groups (S) 3. Solicit input from human and animal healthcare workers when developing emergency response plans (S) 4. Educate health professionals about safety measures, medical countermeasures, and vaccines, including how to mitigate personal risk (S) 5. Identify preparedness gaps and propose solutions (C)	= Intermediate + 1. Develop protocols and test and exercise processes for health emergency operations and their activation (C) 2. Assess implementation of preparedness plans for necessary changes (C) 3. Identify thresholds that trigger each phase of an outbreak response (C) 4. Coordinate vaccination plans and criteria for vaccination of target groups (C) 5. Establish reliable systems for dissemination of case definitions to standardize diagnosis and reporting of case numbers (e.g., confirmed, suspected, probable and possible cases) (C) 6. Play a leadership role in development of an emergency preparedness and response plan consistent with published guidelines (C)
One Health (Optional)	1. Describe published guidelines for emergency preparedness, including WHO's Emergency Response Framework and FAO's Good Emergency Management Practices (K) 2. Describe the main aspects of emergency plans (resources, personnel, material, etc.) and any existing emergency preparedness and response plans relevant to the area (national, regional or local) (K)	= Frontline + 1. Share appropriate countermeasure information with decision-makers (S) 2. Describe the plans for medical surge at the national level (K) 3. Describe tools that assess emergency planning and preparedness (e.g., JEE, GEMP) (K) 4. Participate in an emergency response simulation (S) 5. Participate in the development of an emergency preparedness and response plan consistent with published guidelines (S) 6. Describe major cost factors during response activities (K)	= Intermediate + 1. Demonstrate the ability to make decisions under uncertainty (C) 2. Identify key assumptions behind plans, identify untenable assumptions, and advocate changes as needed (C) 3. Plan for the storage and stockpiling of vaccines and prepare for medical and non-medical countermeasures (C) 4. Play a supervisory role in an emergency response simulation (C) 5. Lead an emergency response simulation (C) 6. Develop a plan for financing an emergency response (C)
Human			1. Work with clinicians to develop medical surge plans for various threats (C) 2. Communicate continuum of care plans to clinical staff to effectively manage surge needs (C)
Animal			
Environment			

Subdomain 7.5
Cross-sectoral coordination and incident management

	Frontline	Intermediate	Advanced
One Health (Core)	1. List the relevant partners and their roles and responsibilities in an emergency response (K) 2. Describe incident command structures (K) 3. Communicate with response partners about key roles, responsibilities and risks (C) 4. Maintain ongoing relationships with relevant partners (C)	= Frontline + 1. Use designated channels for efficiently communicating with relevant decision-makers (S) 2. Implement agreed strategies, policies and procedures (S) 3. Organize meetings and facilitate communication between partners across different disciplines and organizations (C)	= Intermediate + 1. Communicate with international partners and report emergencies as required by the IHR (C) 2. Share information with relevant partners across disciplines according to data sharing policies and restrictions (C) 3. Share information with response managers and decision-makers to support decisions on appropriate countermeasures (C)
One Health (Optional)		1. Describe the legal frameworks related to incident command structures (K) 2. Describe the structure and functions of the emergency operations center and task force, if applicable (K) 3. Describe roles and responsibility of emergency operations center officers (K)	= Intermediate + 1. Create and update an incident management plan that adapts existing policies to the situation at hand (C) 2. Ensure adequate preparations for implementing health screening at borders (C) 3. Review, test and update the SOPs for establishing a multiunit task force for coordination and integration of relevant sectors during response operations (C) 4. Integrate business continuity into preparedness and response plans for infectious disease pandemics (C)
Human			1. Coordinate with clinicians to evaluate evidence on patient treatment and infection control during an outbreak (C)
Animal			= Intermediate + 1. Communicate and collaborate with farmers and the private sector in the detection and control of animal health threats (C)
Environment			

Subdomain 7.6
Emergency risk communication

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe social mobilization, health promotion and other population engagement mechanisms that could be leveraged for emergency risk communication strategy (S)	= Frontline + 1. Identify communication mechanisms that are trusted by the public, partners and community influencers (C)	= Intermediate + 1. Prevent and counter misinformation (C) 2. Assess and address the needs of the news media and the general public (C) 3. Use various data gathering methods such as surveys, focus groups, interviews, media and social media monitoring to assess the effectiveness of the emergency risk communication strategy (C)
One Health (Optional)	1. Describe the principles of risk communication (K) 2. Explain economic, political, social and cultural barriers to emergency risk communication (S)	= Frontline + 1. Explain the placement of emergency risk communication functions in the organizational leadership function and response cycle of emergency preparedness and response (K)	= Intermediate
Human			
Animal			
Environment			

Subdomain 7.7
Mass gatherings

	Frontline	Intermediate	Advanced
One Health (Core)	1. Define mass gathering (K) 2. List types of planned and spontaneous mass gatherings that involve people or animals (K) 3. Participate in monitoring and surveillance of mass gatherings involving people or animals (S)	= Frontline + 1. Describe the impact of mass gatherings on the health of humans, animals and the environment (K) 2. Participate in health preparedness planning for mass gathering events (S) 3. Engage with stakeholders, including event organizers, to build relationships and trust (C)	= Intermediate + 1. Use risk assessment and risk management for health threats to guide preparedness planning for mass gatherings (C)
One Health (Optional)			1. Include health promotion and public information when planning for mass gatherings (C) 2. Develop a clear, well tested operational plan for a mass gathering, including surveillance and laboratory testing, describing the roles and responsibilities of stakeholders (C) 3. Adapt risk communication to the specific cultural, social, political and economic context of the event (C) 4. Monitor and ensure the safety of food and water sources at the mass gathering event (C) 5. Evaluate preparedness for disasters at mass gatherings including crowd management, event access and evacuation points, fire safety measures, environmental risks, medical preparedness and emergency response (C)
Human			1. Train and equip those involved in the health planning for the mass gathering to meet reporting obligations under the IHR (C) 2. Develop a strategy to provide and coordinate event specific medical services that can handle minor injuries or illness and have scalability and triage capacity to handle a large surge in cases (C)
Animal			1. Use risk assessment and risk management for animal health threats to guide preparedness planning for animal exhibits (C)
Environment			

Subdomain 7.8
Humanitarian crises and natural disasters

	Frontline	Intermediate	Advanced
One Health (Core)	1. Participate in the planning and response to humanitarian crises and natural disasters (S)	= Frontline + 1. Describe the phases of humanitarian response, including preparedness and contingency, disaster risk reduction, response and recovery (K) 4. Participate in a human or animal health assessment as part of a humanitarian response (S)	= Intermediate + 1. Conduct an initial rapid assessment and more detailed follow-up human and animal assessments (C) 2. Contribute to interagency coordination (e.g., through participation in the health, food security and agriculture or other relevant cluster) (C)
One Health (Optional)		1. Contribute to development of the response plan (C) 2. Facilitate the personal safety and security of team members during the response (C)	1. Describe the political and cultural contexts underlying humanitarian crises (S) 2. Determine the scale of a crisis and assess gaps (C) 3. Establish surveillance and a health information management system during a crisis or disaster (C) 4. Develop and implement a health sector response and recovery plan (C) 5. Identify gaps in health service provision and make recommendations to fill them (C) 6. Contribute to rebuilding of human and animal health system capacities, One Health coordination and ecosystem sustainability during recovery (C)
Human			
Animal	1. Describe the importance of considering animals during disasters (K)	= Frontline + 1. Describe the role of livestock in the nutrition and livelihoods of people affected by humanitarian crises and natural disasters (K)	= Intermediate + 1. Explain the special considerations for animals during each phase of a crisis or disaster (K) 2. Describe the specific considerations for each high priority animal species during a crisis or disaster (K) 3. Develop and implement an animal health response and recovery plan (C)
Environment	1. Describe the environmental impact of disasters (K)	= Frontline	= Intermediate + 1. Describe the FAO Livestock Emergency Guidelines and Standards (K)

Subdomain 7.9
Chemical, biological, radiological and nuclear emergencies

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe basic characteristics of critical CBRN threats (K)	= Frontline + 1. Coordinate and collaborate with professionals investigating a CBRN threat (S)	= Intermediate + 1. Identify CBRN priorities, problems and available resources, to include health infrastructure, medical countermeasures and protective equipment (S) 2. Collaborate with partners, including military or armed forces, to prepare for CBRN events through desktop or simulation exercises (C)
One Health (Optional)		1. Detect a CBRN related health event (S)	= Intermediate + 1. Explain planning, logistics and operational plans as part of the CBRN defense efforts (S) 2. Anticipate CBRN threats and develop new capabilities to counter emerging threats (C)
Human			
Animal			
Environment			

Domain 8:
Epidemiologic studies

Introduction

Epidemiological studies include cross-sectional, case control and cohort studies as well as field trials and intervention studies. Epidemiological studies can be applied in two ways. They can be conducted as part of normative public health and animal health observational and experimental field epidemiology studies using a traditional linear hypothesis driven approach, respectively. Alternatively, epidemiological studies may be incorporated as a part of more expansive One Health research across the human-animal-environment interface. Application of epidemiological studies under One Health includes the incorporation of multidisciplinary, systems-based, and mixed-methods (qualitative and quantitative) approaches that include epidemiological, social and economic inputs. Related sector specific studies are also included and can be classified as special studies.

Epidemiologists at the frontline level assist in generating high quality descriptive field data to contribute to observational (cross-sectional, case control, cohort) and experimental studies (field trials and other intervention studies). They also contribute to the development and implementation of case studies and case series. The frontline is a key point of contact with communities through local advocacy and communication to support epidemiological field study, planning, implementation, and reporting.

An intermediate level epidemiologist monitors the quality of descriptive field data and provides preliminary analysis for observational and experimental studies. The intermediate level contributes to and facilitates development and implementation of epidemiological studies horizontally along sectoral lines and vertically between frontline and advanced levels under a One Health approach.

An advanced epidemiologist leads the design, planning, and implementation of traditional observational and experimental studies, including secondary data analysis. In addition, they lead the design and planning of transdisciplinary One Health studies that also include the environmental sector, social scientists and economists. This level evaluates and coordinates study design, implementation and reporting across the human-animal-environment interface.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
3. Field investigations;
5. Laboratory capacity;
9. Data management, biostatistics, and informatics;
11. Leadership and management;
12. Communication and community engagement; and
14. Ethics.

Subdomains

1. Types of epidemiological studies
2. Designing and planning epidemiological studies
3. Conducting epidemiological field studies
4. Reporting and publication of study findings

Subdomain 8.1
Types of epidemiological studies

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the types of data (primary and secondary; quantitative and qualitative) (K) 2. Describe a descriptive field study for zoonotic or animal-specific disease events (K)	= Frontline + 1. Describe the basic kinds of epidemiological studies: secondary data analysis, observational studies, environmental studies (K) 2. Describe the types, principles and use of epidemiology observational studies: cross-sectional study, cohort study, and case-control study (K)	= Intermediate
One Health (Optional)	1. Describe the basic differences between descriptive and analytical studies (K) 2. Describe the importance of random sampling and how it differs from non-random sampling (K) 3. Describe field studies related to zoonotic disease events: • Descriptive case study • Survey or knowledge, attitudes and practices study • Secondary data analysis (e.g., existing field or laboratory data) (K) 4. Describe the players, drivers, and interactions among sectors contributing to disease occurrence (K)	= Frontline + 1. Select the most appropriate observational study in a given situation (S) 2. Monitor the critical prerequisites to collaborate, coordinate and communicate across sectoral lines (C)	= Intermediate + 1. Describe how to develop a meaningful epidemiological study to address gaps and challenges of health services (C) 2. Describe traditional linear hypothesis driven and systems based approaches for epidemiology observational study design to: • Improve data management • Refine and update risk estimates • Characterize the epidemiology of the disease agent • Generate hypotheses applying observational field studies and secondary data analysis • Collaborate on environmental health studies • Collaborate in mixed methods research with environment experts using predictive, multidisciplinary, systems-based approaches (S) 3. Describe national legislation on development of standards for and monitoring and supervision of basic principles of medical data protection, data anonymization, necessary documentation for and management of the ethical approval process and informed consent during field investigation (K)
Human	1. Describe the common types of descriptive studies, e.g., case reports, case series, cross-sectional studies / surveys, ecologic studies (K)	= Frontline	= Intermediate
Animal	1. Describe value chain mapping (K)	= Frontline + 1. Describe value chain analysis including data collection of movement frequency, volume and directionality (K)	= Intermediate + 1. Collaborate with mapping experts to generate risk maps (S)
Environment	1. Describe the community role in multidisciplinary and systems based research studies related to biodiversity, ecosystems and wildlife (K)	= Frontline + 1. Implement multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (K)	= Intermediate + 1. Lead the development of surveillance and monitoring research studies related to biodiversity, ecosystems and wildlife (K)

Subdomain 8.2
Designing and planning epidemiological studies

	Frontline	Intermediate	Advanced
One Health (Core)	1. Prepare the list of data, collection tools, PPE, public outreach, communication, and other logistic requirements needed during the epidemiological study (S) 2. Ensure basic principles of medical personal data protection, necessary data anonymization, ethical approval and informed consent for epidemiological studies (S) 3. List local critical players and plan to collect information to understand disease drivers and interactions among players for a given disease situation (S)	= Frontline + 1. Contribute to the design and planning of epidemiology observational studies (cross-sectional, case-control, cohort, field trials) (S) 2. Contribute to design and planning of statistics used for data analysis (S)	= Intermediate + 1. Lead the design and planning of epidemiology observational studies using analytic principles and methods (C) 2. Seek formal approval to conduct the study (C) 3. Define the problem and study objective (C) 4. State the null hypothesis (S) 5. Review existing knowledge and data (C) 6. Conduct a review of relevant literature (C) 7. Identify study population (C) 8. Define the target population(s) and sample frame(s) (C) 9. Calculate sample size requirements (C) 10. Define required epidemiological and statistical analytical methods e.g., sample size, etc. (C) 11. Develop a questionnaire or data entry form to collect the required data (C) 12. Develop an analysis plan (C) 13. Identify and communicate with primary and secondary study stakeholders (C) 14. Review and adhere to ethical guidelines (C) 15. Plan for reporting the study results to stakeholders (C)
One Health (Optional)	1. Contribute to local design and planning of epidemiological studies (S) 2. Apply knowledge of data types (S) 3. Apply knowledge of sampling methods (S) 4. Describe and plan how to collect high quality data to investigators including data collection tools and other field materials (S) 5. Describe the critical prerequisites to collaborate, coordinate and communicate across sectoral lines at local level (K)	= Frontline + 1. Contribute to the design and planning of epidemiology observational studies by suggesting the most suitable design, type of data needed, method of data collection (C) 2. Contribute to the design and planning of collaboration, coordination and communication among sectoral investigators and the community (S) 3. Monitor the critical prerequisites to collaborate, coordinate and communicate across sectoral lines (C) 4. Monitor and supervise basic principles of medical data protection, data anonymization, ethical approval and informed consent during field investigation (C)	= Intermediate + 1. Lead the design and planning of both traditional linear hypothesis driven and systems based approaches for epidemiological studies (C) 2. Lead the design and planning of collaboration, coordination and communication with critical stakeholders across sectoral lines (C)

Subdomain 8.2
Designing and planning epidemiological studies

	Frontline	Intermediate	Advanced
Human			
Animal	1. Participate in the design of a brief descriptive study for one of the following disease events: • Field investigation • Survey or knowledge, attitudes and practices study • Secondary data analysis (S) 2. Assist in the design and planning of a brief descriptive field study for zoonotic or animal-specific disease events (S) 3. Provide local livestock value chain maps (C) 4. Provide feedback on data collection and sampling methods based on local context and feasibility (S)	= Frontline + 1. Describe tools facilitating field epidemiological studies such as value chain analysis and participatory disease search (K)	= Intermediate + 1. Incorporate epidemiological tools into field epidemiological studies such as value chain analysis, participatory disease search and application of economics for animal production and health (C)
Environment	1. Assist with planning the community role in multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (S)	= Frontline + 1. Contribute to multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (C)	= Intermediate + 1. Lead the design and planning of surveillance, monitoring and multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (C)

Subdomain 8.3
Conducting epidemiological field studies

	Frontline	Intermediate	Advanced
One Health (Core)	1. Conduct data collection based on training related to collection tools, SOP, public outreach, and field logistics (S) 2. Provide data and information on gaps and challenges faced during data collection to intermediate and advanced levels (C) 3. Participate in data analysis and provide urgent intervention when needed (C)	= Frontline + 1. Monitor the critical prerequisites to collaborate, coordinate and communicate across sectoral lines (C) 2. Contribute to data collection and compile data from different sources (S) 3. Clean, validate, and analyse data based on the planning (C) 4. Interpret the analysis result and provide scientifically sound evidence to guide control and prevention measures (C)	= Intermediate + 1. Lead study implementation by following the approved protocol, ensuring unbiased data collection, using appropriate data management, analysis, and interpretation methods (C) 2. Lead the implementation of both linear hypothesis driven and systems based approaches for epidemiological study design to: . Improve data management . Refine and update risk estimates . Characterize the epidemiology of the disease agent . Generate hypotheses applying observational field studies . Collaborate on environmental health studies . Collaborate in mixed methods research using multidisciplinary, system based approaches (C) 3. Lead the implementation of collaboration, coordination and communication with critical stakeholders across sectoral lines (C)
One Health (Optional)	1. Apply sampling methods to collect data based on local context and feasibility (S) 2. Describe the critical prerequisites to collaborate, coordinate and communicate across sectoral lines at local level (K) 3. Describe the potential impact from any intervention recommended or made following the epidemiological study across the sectors (S)	= Frontline + 1. Conduct analytic epidemiological studies (cross-sectional, case-control, cohort, field trials) (C) 2. Conduct data analysis in collaboration, coordination with sectoral investigators and the community (C) 3. Monitor the potential impact from any intervention recommended or made following the epidemiological study across the sectors (S)	= Intermediate + 1. Lead the implementation of operational research (C) 2. Evaluate the potential impact from any intervention recommended or made following the epidemiological study across the sectors (C)
Human			1. Apply all necessary precautions around informed consent, personal data protection, data security and patient privacy when implementing epidemiological studies (S)
Animal		1. Apply tools facilitating field epidemiological studies such as value chain analysis and participatory disease search (S)	= Intermediate + 1. Lead the implementation of epidemiological tools such as value chain study and cost/benefit study to understand risk along the value chain and feasibility of control and prevention measures. (C)
Environment	1. Assist the community with implementation of multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (S)	= Frontline + 1. Contribute to the implementation of multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (S)	= Intermediate + 1. Lead the implementation of multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (C)

Subdomain 8.4
Reporting and publication of study findings

	Frontline	Intermediate	Advanced
One Health (Core)	1. Develop a Brief Descriptive Field Study report for zoonotic or animal specific disease events in the local context by using basic descriptive statistics (C) 2. Communicate written and oral reports to technical and nontechnical audiences (S)	= Frontline + 1. Design and write appropriate audience specific oral and written reports for stakeholders with key findings (C) 2. Monitor reporting and dissemination of relevant study findings at early stage to central level health care stakeholders and other local stakeholders involved in response, including community leaders (C)	= Intermediate + 1. Lead the production of oral and written reports and publications of epidemiologic studies using scientific writing skills, analytic principles and methods: • Review and adhere to ethical guidelines • Plan for reporting the study results to stakeholders (C) 2. Lead the implementation of collaboration, coordination and communication with sectoral stakeholders including decision-makers (C) 3. Lead the reporting and dissemination of relevant study findings at early stage to local level health care stakeholders and other local stakeholders involved in response, including community leaders (C)
One Health (Optional)	1. Share data in collaboration, coordination and communication among sectoral investigators and the community to initiate urgent intervention at local level when needed (S)	= Frontline	= Intermediate + 1. Lead the writing of reports and publications of both reductionistic and systems based approaches for epidemiological study design (C)
Human			1. Apply all necessary precautions around informed consent, personal data protection, data security and patient privacy when implementing epidemiological studies (S)
Animal		1. Contribute to reports and publications including value chain analysis (C)	= Intermediate + 1. Lead the writing of reports and publications of zoonotic and animal specific disease events and value chain studies and collaborate with risk mapping expert to generate risk maps (C)
Environment	1. Assist with reporting results to the community related to multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (S)	= Frontline + 1. Contribute to the reports and publications of multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (S)	= Intermediate + 1. Lead the writing of reports and publications of multidisciplinary and systems based research studies: biodiversity, ecosystems and wildlife (C)

Domain 9:
Data management, biostatistics, and informatics

Introduction

Field epidemiologists at all three levels are expected to handle data in a professional way through the data life cycle: from collection to analysis, presentation, and interpretation for action. Each level also has a role in ensuring that high quality data collected in the field are reported to the higher administration levels. Data standardization and application of internationally accepted standards is required to facilitate better data analysis and exchange at national or international levels. To be competent at performing analysis, biostatistics skills and the use of statistical methods and tests are also needed at each level. Health information systems and new digital tools support better data collection and automated analysis. These tools are a persistent need for early detection and rapid response in both public health and animal health. Coordination is critical among all levels to collect, analyse and interpret data in a standardized way through the data management cycle. Trainees need to know how to successfully implement health informatics interventions and how to choose the best digital tool as a solution for informatics problems to support decision-making through data retrieval and analysis. This will support countries to generate and use high-quality data to improve their surveillance systems and health information systems to achieve better outcomes.

At the frontline level, field epidemiologists collect and report quality data using paper forms and electronic tools without bias. Knowledge of data standards helps achieve interoperability between systems (e.g., human and animal surveillance systems). Frontline workers also summarize data using simple statistical methods like mean and median. They understand principles of stratification, such as by age or gender.

At the intermediate level, epidemiologists evaluate data coming from lower administration levels and conduct more advanced data analysis. They also use statistical software and create basic maps. The intermediate level understands informatics in order to advocate for better data collection and the acceptance and use of electronic tools.

At the advanced level, epidemiologists perform more complicated biostatistical tasks such as multivariate and time series analysis. They are comfortable using statistical and geospatial analysis software to perform required statistical tests and create graphs, tables and maps. Advanced level epidemiologists also calculate a sample size for epidemiologic studies according to study design. They also understand internationally available standards for One Health sectors to ensure the local systems adapt these standards to achieve easy and smooth interoperability and information exchange inside the country and with neighboring countries.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
5. Laboratory capacity;
8. Epidemiological studies; and
14. Ethics.

Subdomains

1. Planning for data collection and analysis
2. Data collection
3. Data analysis
4. Data interpretation and presentation
5. Digital tools

Subdomain 9.1
Planning for data collection and analysis

	Frontline	Intermediate	Advanced
One Health (Core)	1. Review data collection plans (questionnaires, forms, sampling strategies) before beginning data collection (S) 2. Differentiate between quantitative and qualitative data, explain mixed-method approaches (K) 3. Describe the uses and limitations of aggregated data (K)	= Frontline + 1. Develop a data analysis plan (variables, coding, dummy tables, etc.) (C) 2. Explain when a map can be useful for descriptive analysis (S)	= Intermediate + 1. Develop presentation plans and templates for regular reports and infographics (C) 2. Develop and evaluate sampling strategies for surveys and epidemiologic studies (C) 3. Calculate sample size for surveys and epidemiological studies (S)
One Health (Optional)	1. Use basic principles of file versioning (C)	= Frontline	= Intermediate
Human			
Animal			1. Calculate within-herd and between-herd sample sizes according to study objective (define prevalence, determine presence of or freedom from disease or infection) (S)
Environment			

Subdomain 9.2
Data collection

	Frontline	Intermediate	Advanced
One Health (Core)	1. Collect data in a consistent and standardized way (S) 2. Describe minimum variables for a line list (S) 3. Use appropriate data quality standards for data collection for surveillance, laboratory, epidemiological studies, etc. (S)	= Frontline + 1. Review, monitor and evaluate data quality according to attributes such as consistency, completeness, timeliness, etc. (C) 2. Apply basic data checking procedures within at least one data collection application: • data consistency • data cleaning, duplicate entry • coding (C) 3. Train and supervise frontline data collectors (C) 4. Explain basic principles of data exchange between applications, such as data export/import of .csv files (S)	= Intermediate + 1. Develop questionnaires for field investigations (e.g., outbreak investigations and epidemiological studies (C) 2. Create a data dictionary to explain coding, types of variables (C) 3. Develop and review SOPs for data checks and data quality assurance (C) 4. Advocate for implementation of standards for data collection using electronic tools (C) 5. Verify that data security and data protection requirements are met (C)
One Health (Optional)	1. Describe how health data can be collected, assessed, coded, and reported through paper and electronic system (S) 2. Use a data dictionary to explain coding, types of variables (S) 3. Use electronic tools for data collection (S)	= Frontline	= Intermediate + 1. Describe the data standards life cycle (process by which standards are created, implemented, and updated) (K) 2. Apply governance policies and guidelines needed to support data collection, (e.g., data exchange, data protection standards and policies) (S) 3. Assess adherence to existing policies for data sharing and data exchange (C) 4. Describe ethical considerations related to data protection, data ownership and data storage (S)
Human			
Animal			
Environment			

Subdomain 9.3
Data analysis

	Frontline	Intermediate	Advanced
One Health (Core)	1. Apply basic principles of data consistency and data cleaning (S) 2. Calculate rates to quantify incidence, prevalence, attack rates, mortality rates, etc. (S) 3. Describe the epidemiological principles of unit (person/animal), place and time (K) 4. Create simple tables, graphs, and maps from surveillance and epidemiologic data (S) 5. Calculate summary statistics including measures of central tendency and dispersion (mean and standard deviation, median and mode), and percentiles and quartiles (S) 6. Use software to manage and summarize data[5] (S)	= Frontline + 1. Develop regular data quality reports/feedback to frontline level (C) 2. Implement a data analysis plan (S) 3. Stratify data and assess for effect measure modification and confounding, controlling for confounding as needed (C) 4. Use statistical tests (parametric and non-parametric) for analysis of epidemiological data (C)	= Intermediate + 1. Use geographic information systems to display geographic distribution of cases and produce maps (C) 2. Conduct a comprehensive evaluation of surveillance systems focusing on data quality attributes, overseeing all administrative levels and interaction patterns, and proposing improvement steps based on needs and gaps analysis (C)
One Health (Optional)		1. Calculate standard errors and confidence intervals (S)	= Intermediate + 1. Calculate a regression coefficient and perform regression modeling (C) 2. Perform multivariate analysis of data from surveillance and epidemiological studies (C) 3. Perform a time series analysis of surveillance data (C)
Human			
Animal	1. Conduct basic value chain mapping (C)		
Environment			

5 The software is the choice of the training programme as multiple software are available either free or paid

Subdomain 9.4
Data interpretation and presentation

	Frontline	Intermediate	Advanced
One Health (Core)	1. Present data in basic tables, graphs, and maps (S) 2. Develop simple routine reports (C) 3. Interpret descriptive data (e.g., surveillance data) (C)	= Frontline + 1. Describe bias, its effects, and ways to minimize bias (K) 2. Develop regular reports/feedback to frontline level (C) 3. Use modern methods of data visualization to display statistical results (C) 4. Interpret data analysis results like measures of association, measures of impact, statistical test results and confidence intervals (C)	= Intermediate + 1. Interpret results from regression, multivariable, and time-series analyses (C) 2. Interpret findings from surveillance, laboratory and epidemiological studies for decision-makers and the public (C)
One Health (Optional)			1. Develop a data visualization plan, including use of infographics if appropriate (C)
Human			
Animal			
Environment			

Subdomain 9.5
Digital tools

	Frontline	Intermediate	Advanced
One Health (Core)	1. Use available software and digital tools for data collection and reporting whenever possible (S) 2. Use word processing, spread sheets, and presentation software[6] (S)	= Frontline + 1. Advocate for and support the implementation and training of digital tools and software (C)	= Intermediate + 1. Oversee the different digital tools for surveillance and selection process based on needs assessment (C)
One Health (Optional)		1. Assess challenges and needs for electronic data collection tools (C)	= Intermediate + 1. Describe internationally agreed standards for disease coding and data exchange (e.g., International Classification of Diseases-11, Health Level Seven (K) 2. Describe digital surveillance tools integration with health information systems (K) 3. Evaluate the selection of digital tools suitable for the national surveillance system (C) 4. Develop a plan for implementing selected digital tool(s) (C) 5. Incorporate relevant digital surveillance data for analysis and situation reporting (C)
Human			
Animal			
Environment			

6 Free or paid software (e.g., Microsoft Word, Excel and PowerPoint)

Domain 10
Ecosystem health

Introduction

Ecosystem health is an integral part of the One Health approach that has been developing rapidly along with the growing awareness of the impact that anthropogenic drivers have on global environmental change, ecosystem integrity and ecosystem function. Epidemiologists at all levels need to be aware of the impact that these drivers have on human, animal and ecosystem health and disease emergence. Barriers to understanding and management of environmentally driven disease events include the lack of awareness by other sectors and gaps in collaboration, communication and data sharing among human, animal and ecosystem health experts at all levels of governance. Field epidemiologists should have an interoperable set of competencies including a good understanding of the links among sectors and disciplines. The overall aim is to protect the environment and prevent the emergence and spillover of disease pathogens across the human-animal-environment interface by understanding the overall ecosystem's health.

At the frontline level, field epidemiologists have basic knowledge on the importance of biodiversity and ecosystem functions. They provide a description of local ecosystem services and describe the local agencies that oversee plant, animal, and ecosystem health, including those that manage natural resources, monitor air, soil, and water quality. Frontline level epidemiologists are aware of local environmental health threats and their mandate to detect and respond across sectors. They are aware of the impacts of local environmental degradation and the need to collaborate with all environmental stakeholders to monitor and predict threats to ecosystem health that have the potential to drive disease emergence in humans and in animals.

At the intermediate level, field epidemiologists have a more developed understanding of the drivers of biodiversity loss and environmental degradation. They have open and collaborative relationships with the agencies that manage plant, animal, and ecosystem health at the regional level and awareness of the policies and regulations that are in effect. They recognize the role of the environment on disease emergence and transmission, and food security.

At the advanced level, field epidemiologists are familiar with biodiversity indices and the international regulations and policies, including those related to endangered species protections, wildlife trade, and the environment. They regularly collaborate and exchange data with agencies that manage plant, animal and ecosystem health and promote data sharing and compatibility. While global climate modelling is beyond the scope of a field epidemiology training programme, graduates are familiar with and able to interpret existing models. They assess how environmental degradation impacts the social and environmental determinants of health for human and animal populations and individuals. Finally, they make recommendations on preventive and responsive policies and regulations that mitigate the risk of disease emergence and support overall sustainability of ecosystems and local societies.

Many of the knowledge, skills and competencies that make up this domain were written based on a curriculum framework from the Field Training Programme for Wildlife, Ecosystems, Biodiversity, and the Environment,[7] a training programme targeting environment sector professionals from natural resources management, forestry and wildlife ecology.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
7. Preparedness and response;
9. Data management, biostatistics, and informatics; and
11. Leadership and management.

Subdomains

1. Biodiversity and ecosystems
2. Plant, animal and ecosystem health
3. Air, water and soil quality
4. Impacts of environmental degradation on health
5. Anthropogenic, environmental and socioeconomic drivers of emerging health threats

7 FAO. 2021. Summary Report: Field Training Programme for Wildlife, Ecosystems, Biodiversity, and the Environment (FTP-WEBE) Curriculum Framework Under a One Health Approach; Edited by David Castellan and Scott Newman, FAO Regional Office for Asia and the Pacific (Bangkok, Thailand), FAO Regional Office for Africa (Accra, Ghana) and the FAO Investment Centre (Rome, Italy)

Subdomain 10.1
Biodiversity and ecosystems

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the importance of biodiversity and healthy ecosystems (K) 2. Identify local ecosystems and describe their interactions (S)	= Frontline + 1. Explain how biodiversity and healthy ecosystems promote health across the environment-human-animal interface (S)	= Intermediate + 1. Identify drivers of temporal and spatial distribution of populations and how this leads to changes in biodiversity at the community and ecosystem level (i.e., changes in biodiversity in time and space) (C) 2. Explain interactions among proximate and ultimate causes of biodiversity loss, such as land cover change, poverty, landscape fragmentation, climate change and others that are impacting biodiversity at local and regional scales (S) 3. Advocate and raise awareness about positive health impacts of ecosystem based approaches (C)
One Health (Optional)	1. Explain the role of biodiversity in sustaining economically and culturally important resources such as clean air, fresh water, pollination, soil fertility, pest and disease control, and wildlife recreation opportunities using local case studies (S) 2. Describe the two main types of ecosystem services: provisioning and regulating (K) 3. Define and explain the relationship between biodiversity, ecological function and ecosystem services to community members (S) 4. Explain how diversity is a key pillar of pest and disease resistance, in natural and managed ecosystems using local examples (S) 5. Describe risks that may threaten ecosystem sustainability and describe how they impact biodiversity, e.g. understand the impact of invasive alien species to ecosystem health and epidemiology (S) 6. Identify, measure and assess indicators of ecosystem function (early warning signals intelligence) (C) 7. Explain structural and functional complexity of ecological systems and their relationship with zoonoses (S)	= Frontline + 1. Differentiate examples of biodiversity at multiple levels: genes, populations, species, ecological communities, landscapes, ecosystems (K) 2. Explain the major drivers of species extinction and biodiversity loss (S) 3. Explain how biodiversity is linked to ecosystem functions (K) 4. Identify links within ecosystems that can indicate a cause of threat or the diagnosis of a health risk (K) 5. Identify and collaborate with local institutions and experts that possess knowledge of natural history and biodiversity in the country and region (S) 6. List and explain drivers of diversification (S) 7. Explain the importance of microbial and invertebrate diversity (K) 8. Develop conceptual map of ecosystem services in community context (workshop or focus group format), focusing on those that contribute to individual or population health of animals, human and the environment (C) 9. Design a map of connections between agricultural diversity, food systems and human health (S) 10. Describe and apply best management practices for natural ecosystems and biodiversity that benefit domestic animal health (S)	= Intermediate + 1. Describe general levels of structural and functional biodiversity (K) 2. Describe the causes and consequences of changes in biodiversity at relevant temporal and spatial scales (S) 3. Explain the importance of ecosystem functions and ecosystem services to society including families, communities and governments (C) 4. Identify unsustainable practices and policies leading to loss of biodiversity at multiple scales and levels (S) 5. Design a systems based diagram showing the connections between deforestation, ecosystems degradation or loss of access to natural resources and the wider felt impacts (S) 6. Collaborate effectively with other professions and sectors to align with intergovernmental agreements related to biodiversity and ecosystem management (C) 7. Utilize community-based participatory methods to identify and engage local and indigenous knowledge for integrative management of biodiversity and ecosystem structure and functions related to One Health (C)

Subdomain 10.1 (cont.)
Biodiversity and ecosystems

	Frontline	Intermediate	Advanced
One Health (Optional)		11. Describe the impact of local food production systems on the health of the ecosystem and propose sustainable practices to mitigate such impact (C) 12. Describe how to collect and analyse data related to biodiversity loss and ecosystem degradation (K)	8. Consider international regulations and policies related to endangered species protection when implementing activities to tackle health threats in an ecosystem (S) 9. Describe biodiversity indices, both structural and functional, and how they are measured (K) 10. Describe the relationship between microbial diversity and health (S) 11. Describe agroecological approaches to sustain biodiversity and ecosystem health (K)
Human			
Animal			
Environment	1. List value, benefits and services of wildlife in the local jurisdiction, including provisioning and regulating functions (K)	1. Develop a map showing the relationship among: loss of biodiversity, decline of ecosystem functions and services, and resilience (S) 2. Provide examples of provisioning services (i.e., food, fiber and biofuel) in local jurisdictions and how these can reduce wildlife composition and functioning (K) 3. Assess the impact of provisioning services on regulating services in a jurisdiction (C) 4. Provide examples of regulating services (e.g., infection dampening, evolutionary pressure towards low pathogenicity in complex, high diversity systems) (K)	1. Apply systems thinking to characterize and manage adverse changes to biodiversity and ecosystems (C) 2. Apply knowledge regarding the geographic distribution of populations of species and communities to identify spatial and temporal patterns of biodiversity within and across landscapes (C) 3. Apply methodological approaches to the measurement of ecological communities and interactions within them within the local context (C) 4. Define and assess biotic integrity (C) 5. Valuate ecosystem services in relation to human and animal health and economics (C) 6. Explain why genetic diversity is important, the basics of conservation genetics and how genetic diversity is measured (K)

Domains

D1

D2

D3

D4

D5

D6

D7

D8

D9

D10

D11

D12

D13

D14

Subdomain 10.2
Plant, animal and ecosystem health

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the concept of ecosystem services (K) 2. Explain the roles and responsibilities of agencies that manage plant, animal and ecosystem health (K)	= Frontline + 1. Contribute to the integration of plant, animal and ecosystem health data with other ongoing surveillance strategies in humans and animals (S)	= Intermediate + 1. Exchange and analyse data across the public health, animal health and environment health sectors (C)
One Health (Optional)	1. Describe different wildlife populations within a jurisdiction, including those with significant human and livestock interaction or under human care, including farmed wildlife (K) 2. Describe and apply the principles of species conservation during the practice of field epidemiology (S)	= Frontline + 1. Support the review of disease case data in people, livestock, and wildlife to identify trends (presence or absence or prevalence) (C)	= Intermediate + 1. Describe and evaluate the cultural, social and economic context of wildlife and ecosystem services (C) 2. Communicate value of wildlife and ecosystem services to stakeholders (S) 3. Explain the purpose and characteristics of wildlife and ecosystem health assessment (S) 4. Perform wildlife and ecosystem health assessments (S) 5. Integrate wildlife and ecosystem health data with other data streams (C) 6. Communicate wildlife and ecosystem health risks to diverse audiences using various formats (S)
Human			
Animal			
Environment	1. Describe wildlife trade management and sustainable use principles (K) 2. Characterize, identify, assess and prioritize underlying factors that give rise to human-livestock-wildlife interactions, including the risks of conflict, and devise appropriate intervention strategies (C) 3. Define and develop solutions for human-livestock-wildlife conflicts through participatory approaches and local community involvement (C) 4. Facilitate community-level discussions among stakeholders regarding human-livestock-wildlife interactions (S) 5. Follow existing biosafety/security measures concerning handling of wildlife and suggest and implement measures for improvement (C)	1. Apply knowledge of case studies, best practices, and toolkits on human-livestock-wildlife interactions and conflict (S) 2. Characterize how threats to wildlife species may hamper ecosystem services and benefits (K) 3. Develop methods and data sources that signal and forecast wildlife and ecosystem health threats (C) 4. Implement environmental and social impact assessments (C) 5. Explain and apply epidemiological and health promotion principles for wildlife and ecosystem health programmes, to prevent zoonoses and pathogen spillover (S) 6. Use participatory approaches with local communities to manage human-livestock-wildlife conflicts (C)	1. Conduct a systematic approach to wildlife health surveillance (S) 2. Identify, assess, and report on wildlife disease and ecosystem health risks (C) 3. Forecast wildlife and ecosystem health threats (C) 4. Conduct wildlife and ecosystem health investigations (C) 5. Develop wildlife disease management and response plans (C) 6. Apply and adapt the Addis Ababa Principles to frame decision-making on sustainable use of wildlife (C) 7. Describe CITES regulations governing international trade of wildlife and other wildlife use principles from other fora and intergovernmental frameworks, e.g., IUCN, UNEP, etc. (K) 8. Apply policy and regulatory instruments to differentiate between legal and illegal wildlife harvest and trade (S)

Subdomain 10.2 (cont.)
Plant, animal and ecosystem health

	Frontline	Intermediate	Advanced
Environment			9. Interpret biological characteristics and wildlife population data, together with other contextual factors, to calculate sustainability thresholds for harvest and trade, and ensure sustainable and healthy wildlife populations (C) 10. Apply and adapt identification tools for wildlife species, parts and products in trade and understand application of forensic techniques in this context (C) 11. Apply and adapt good practice standards that minimize health risks in wildlife trade value chains, covering both wild and captive production systems in a jurisdiction (C) 12. Identify impediments and the resources necessary (financial, knowledge, sociological, etc.) to generate feasible solutions to human-livestock-wildlife conflict (e.g., market compensation for lost crops, personnel for education campaigns) (C) 13. Use appropriate methods to estimate population size, abundance and demography of wildlife and population trends (S) 14. Utilize maps, geospatial layers and online tools to estimate land cover or habitat change in the local area (S) 15. Use appropriate methods to assess and manage habitat quality and suitability to sustain healthy ecosystems and wildlife populations (C) 16. Provide examples of wildlife population and habitat management techniques that have been effective in a jurisdiction (S) 17. Apply wildlife population and habitat management techniques (S) 18. Communicate the value of sustainable use, regulated and safe wildlife trade and sustainable wildlife management (C) 19. Facilitate local community capacity building and empower communities to manage the health of the local ecosystems and wildlife populations (S)

Subdomain 10.3
Air, water and soil quality

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the health impacts of local environmental contaminants on human, animal and ecosystem health (K) 2. List the agencies involved in monitoring air, water and soil quality (K)	= Frontline + 1. Propose mitigation measures to address the impacts of contaminants in the air, soil and water on human, animal and ecosystem health (C)	= Intermediate + 1. Evaluate how data related to key environmental indicators and health are comparable and compatible (C) 2. Evaluate potential integrated environmental and health data collection schemes for compliance with existing standards (C)
One Health (Optional)	1. Describe air, water and soil cycles and mechanisms for accumulation of contaminants (K) 2. Describe standards and policies related to maximum contaminant levels (K) 3. Describe health impacts of local air, soil and water contaminants in humans and animals (K) 4. Describe the major drivers of environmental contamination (agricultural, manufacturing, etc.) (K) 5. Correlate environmental risk indicators with health indicators (human and animal) (S) 6. Describe factors that influence whether pathogens survive in certain conditions (K)	= Frontline + 1. Develop open and collaborative relationships with the agencies involved in monitoring air, water and soil quality (C) 2. Describe policies and regulations related to natural resource management, land use and pollution (K)	= Intermediate + 1. Describe how air, water and soil quality data can be used as an early warning system for environment-related health events and which signals to monitor (C) 2. Contribute to the development of data sharing agreements and early warning systems amongst agencies involved in One Health (C) 3. Collaborate with agencies involved in collecting and monitoring data on air, water and land resources and environmental pollutants (C)
Human			
Animal			
Environment			

Subdomain 10.4
Impacts of environmental degradation on health

	Frontline	Intermediate	Advanced
One Health (Core)	1. Illustrate the impact of environmental degradation on local ecosystem health (S) 2. Contribute data to environmental impact assessments (S)	= Frontline + 1. Describe how local weather extremes and natural disasters impact human, animal and ecosystem health (K) 1. Assess the impact of environmental degradation on human, animal and ecosystem health by participating in an environmental impact assessment (C)	= Intermediate + 1. Discuss the impact of global climate change on health and the emergence of novel diseases (S) 2. Assess the national or subnational impacts of climate change on health by contributing to vulnerability and adaptation assessments (C)
One Health (Optional)	1. Implement practices that reduce or mitigate the environmental impact of provided human or animal health services (C) 2. Explain the interrelationship between climate change and the frequency and severity of storms, floods, fires and drought (S) 3. Describe the basic concepts of global warming and greenhouse gases (K) 4. Describe how climate change impacts disease transmission and species migration (S) 5. Describe the carbon cycle (K)	= Frontline + 1. Describe local climate conditions and recognize extremes in variability and how they can impact local ecosystems (S) 2. Describe models of global environmental change (K) 3. Describe the major drivers of global warming and explain its impact on food security and changes in livelihoods (S)	= Intermediate + 1. Apply systems thinking to relate how climate and weather variables interact with health to result in disease emergence (C) 2. Describe the concept and practice of Planetary Health (K) 3. Explain models of global environmental change (S) 4. Describe the primary and secondary health impacts of climate change (S) 5. Assess how climate change impacts the social and environmental determinants of health (C) 6. Provide sustainable policy recommendations to promote ecosystem health (C)
Human			
Animal			1. Discuss the impact of climate change on animal productivity and health and links to food security (K)
Environment			

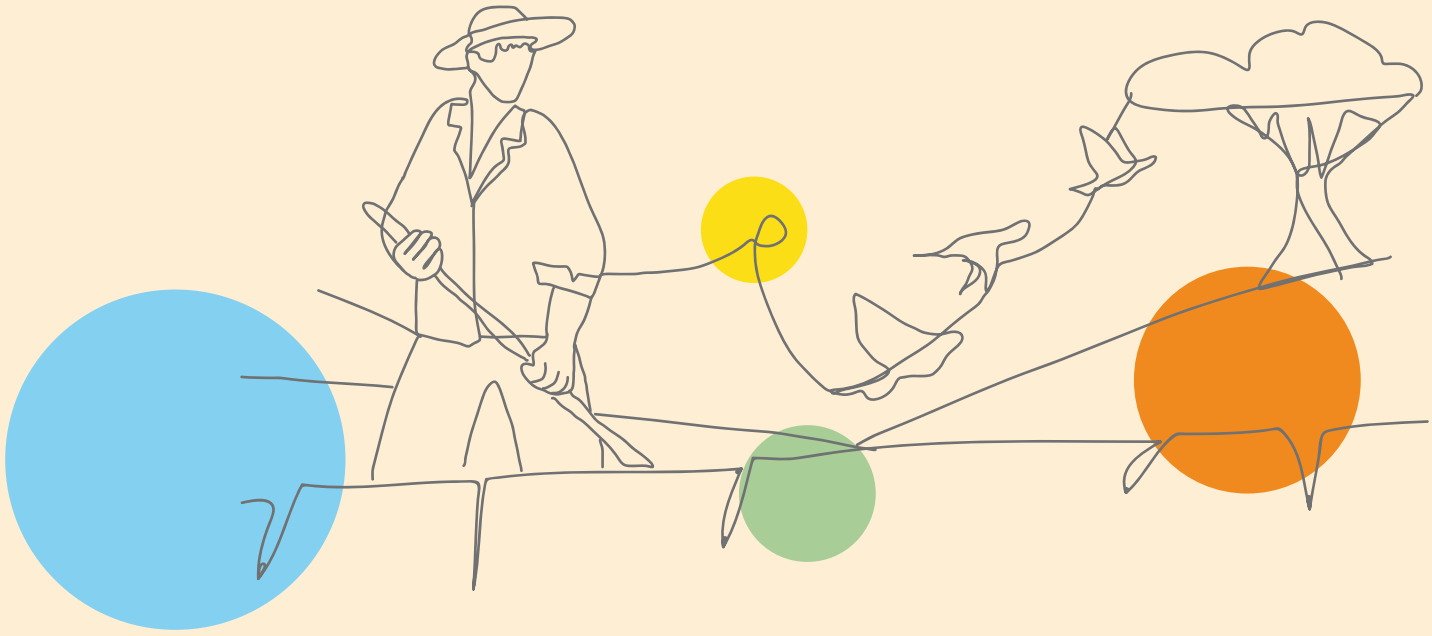
Subdomain 10.5
Anthropogenic, environmental and socioeconomic drivers of emerging health threats

	Frontline	Intermediate	Advanced
One Health (Core)	1. Discuss local examples illustrating the concept of human-environment interface and interactions (S) 2. Describe how habitat incursion, deforestation and changes in land use and land cover impact disease emergence and ecosystem health (S) 3. Describe how local legal and illegal trade in wildlife impact health and facilitate transmission of disease (S)	= Frontline + 1. Describe how travel and transportation increase the risk for disease emergence and transmission (K) 2. List and describe zoonoses with environmental components, including vector-borne disease (K)	= Intermediate + 1. List and describe the anthropogenically induced environmental and socioeconomic drivers that impact health of the system (K) 2. Identify and prioritize health determinants using appropriate tools (S) 3. Conduct a SWOT analysis, identifying strengths, weaknesses, gaps and needs in ability, to assess and manage health threats in the context of a location (C) 4. Identify underlying determinants of health (the range of individual, social, economic and environmental factors that influence health status), and understand interactions among them (C)
One Health (Optional)	1. Identify and assess the environmental and socioeconomic drivers of disease and their signals within the local context (S) 2. Describe how human activities drive environmental change leading to the emergence of disease (S) 3. Describe the role of wildlife trade and wet markets in disease transmission and emergence (S) 4. Describe and monitor the impact of local food production systems on the health of the ecosystem (C) 5. Explain reasons for the emergence or re-emergence of some diseases in response to environmental change (S)	= Frontline + 1. Define the political, historical and technical meanings of the term Anthropocene (K) 2. Describe how increased human demand for resources, including animal protein, is driving disease emergence (K) 3. Describe anthropogenic drivers of endemic and noncommunicable diseases (K) 4. Describe how travel and transportation increase the risk for disease emergence and transmission (K) 5. Analyse and graphically display contribution of drivers to health threats (C) 6. Describe approaches for and benefits of agroecological farming or production (K)	= Intermediate + 1. Gather data to define baseline metrics on disease drivers (climate and land use change, etc.) (S) 2. Define wildlife and ecosystem health determinants and disease drivers, and their interrelationships (S) 3. Synthesize existing local knowledge or scientific literature to assess health determinants and threats operating in a system (C) 4. Understand and apply frameworks for ranking health determinants based on whether they present an immediate, short term or long term threat to human, wildlife and ecosystem health (S) 5. Conduct root cause analysis of disease drivers and health threats in a jurisdiction (C) 6. Relate socioeconomic and environmental determinants of health and local knowledge to devise appropriate intervention strategies (C) 7. Describe the role of the environment on AMR and the impact of AMR on biodiversity and ecosystem health (S)

Subdomain 10.5 (cont.)
Anthropogenic, environmental and socioeconomic drivers of emerging health threats

	Frontline	Intermediate	Advanced
Human			
Animal			
Environment			1. Identify and apply appropriate methods to measure health of, stress on or disturbance to wildlife populations or ecosystems (S) 2. Define the spatial, temporal and demographic characteristics of health threats to wildlife (S) 3. Identify trends in disease drivers for all diseases with a wildlife nexus (C) 4. Develop nature based solutions (C)

Section II
Functional domains



Domain 11
Leadership and management

Introduction

Individuals with leadership and management capabilities help organizations meet their goals and inspire team members to perform to their greatest potential. Field epidemiologists at all levels require basic leadership and management skills in order to effectively perform their work functions. This domain describes competencies needed to support One Health policies and their implementation, organizational and project management, finance and budgeting and security in the field.

At the frontline level, field epidemiologists demonstrate an ability to work across sectors and advocate for One Health policies at the local level, demonstrate professionalism, fulfill project requirements and ensure personal security when conducting field work.

At the intermediate level, field epidemiologists contribute to the development of One Health policies, serve in a leadership role within an organization at the regional level, and ensure the security of the fieldwork team. They participate in the design and implementation of One Health projects including the formulation, management and advocacy for financing and budgets.

At the advanced level, field epidemiologists advocate for One Health policies at the national and international levels, manage cross disciplinary teams, lead the design, implementation and management of One Health projects, including financing, and mitigate security risks.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
3. Field investigations;
4. Disease management;
7. Preparedness and response;
8. Epidemiological studies;
10. Ecosystem health;
12. Communication and community engagement;
13. Training; and
14. Ethics.

Subdomains

1. Leadership and One Health
2. Policy development and implementation
3. Organizational management
4. Project management
5. Finance and budgeting
6. Security in the field

Subdomain 11.1
Leadership and One Health

	Frontline	Intermediate	Advanced
One Health (Core)	1. Apply ethical principles and professional code of conduct (C) 2. Develop and maintain interprofessional, multidisciplinary and multisectoral collaboration and communication (C)	= Frontline + 1. Perform stakeholder mapping (C) 2. Develop community-based approaches for field investigation and health interventions to ensure community engagement (C)	= Intermediate + 1. Regularly communicate ideas and expectations with team members (C) 2. Adapt leadership style according to the context, recognizing when different approaches are most effective (C)
One Health (Optional)	1. Communicate a common understanding of the One Health concept (C) 2. Use listening skills to understand different perspectives and priorities (C) 3. Use communication skills to clearly and regularly express thoughts and ideas (C) 4. Collaborate and work within and across networks (C) 5. Act responsibly in contexts of volatility, uncertainty, complexity and ambiguity (S) 6. Practice flexibility and openness to different ideas and approaches (C) 7. Describe the importance of engaging with formal and informal community leaders (K) 8. Define strategies for community engagement and motivation (K) 9. Practice self-awareness, self-regulation, and prioritize group success (C)	= Frontline + 1. Make decisions in consultation with experts across disciplines (C) 2. Manage a multidisciplinary team in contexts of volatility, uncertainty, complexity and ambiguity (C) 3. Make and justify decisions in the context of conflicting priorities (C)	= Intermediate + 1. Model the use of communication skills to express thoughts and ideas across sectors (C) 2. Develop and implement strategies to encourage innovative solutions (C)
Human			
Animal			
Environment			

Subdomain 11.2
Policy development and implementation

	Frontline	Intermediate	Advanced
One Health (Core)	1. Implement One Health policies at the local level (S)	= Frontline + 1. Propose, support and implement One Health policies at the local and regional levels (C)	= Intermediate + 1. Facilitate the development and implementation of One Health policies at the local, regional, national and global levels (C) 2. Produce policy briefs based on current One Health research along with action plans for implementation (C)
One Health (Optional)	1. Apply the principles of good leadership in policy development and implementation (S) 2. Implement, monitor and test new methodologies and work practices (C) 3. Collaborate with stakeholders keeping in mind their powers or interests (C) 4. Work within the existing governance structure (S) 5. Communicate and notify higher levels on the needs, gaps and opportunities for improvements in field implementation (C)	= Frontline + 1. Articulate the policy cycle and how to engage stakeholders in intersectional collaborations for effective policy making (C) 2. Develop, support and implement emergency response policies to respond to unexpected events (i.e., natural disasters, disease outbreaks, conflict, etc.) (C) 3. Make recommendations from studies, surveys and field investigations to inform policy making (C) 4. Assess regional community leader engagement and awareness of One Health policies (C)	= Intermediate + 1. Advocate for policy making in relation to One Health, taking into account political and multiagency interests (C) 2. Demonstrate proficiency with the policy cycle to secure political commitment, trust building and community participation (C) 3. Monitor and assess the success of implemented strategies by utilizing the methods of development, planning, implementation and evaluation for One Health policies, strategies, programmes and institutions (C) 4. Design One Health strategies to facilitate synergies across sectors and promote multidisciplinary collaboration (C) 5. Apply the principles of implementation science and science diplomacy (C)
Human			
Animal			= Intermediate + 1. Ensure One Health approaches are included in veterinary service policies (C)
Environment			= Intermediate + 1. Maintain a list of government and nongovernment stakeholders, at the local, regional, and national levels, related to environmental health, conservation and biodiversity (S)

Subdomain 11.3
Organizational management

	Frontline	Intermediate	Advanced
One Health (Core)		1. Document roles and responsibilities of team members to ensure accountability (S) 2. Establish effective teamwork and collaboration across disciplines (S)	= Intermediate + 1. Manage a cross disciplinary team (C) 2. Utilize collaborative methods and negotiation and conflict management skills across sectors and disciplines to facilitate cooperation and achieve One Health goals (C) 3. Develop a shared mission, set of core values, and vision to achieve One Health goals to design actions for implementation (C)
One Health (Optional)	1. Provide and support an environment of trust and learning within an organization and across networks (C) 2. Describe the formal and informal organizational structures of the local community and identify local facilitators (C)	= Frontline + 1. Articulate a shared mission, set of core values and vision of the organization to achieve One Health goals (C) 2. Delegate responsibilities and tasks based on skills and expertise of team members (C) 3. Motivate, mentor and mobilize a network of team members (C) 4. Describe published quality management guidelines (e.g., International Organization for Standardization 9001:2015 Quality Management Systems) (K) 5. Describe and apply aspirational ethics and ethical codes of conducts (C)	= Intermediate + 1. Manage in accordance with published quality management guidelines. (e.g., International Organization for Standardization 9001:2015 Quality Management Systems) (C) 2. Promote multidisciplinary policies by identifying misalignments between organizational structures or visions and the structure of external policy and implementation characteristics (C)
Human			
Animal			
Environment			

Subdomain 11.4
Project management

	Frontline	Intermediate	Advanced
One Health (Core)	1. Fulfill project requirements according to operational plan (S)	= Frontline + 1. Establish clear and objective project goals and outcomes with input from a multidisciplinary team (C) 2. Create an implementation timeline (S)	= Intermediate + 1. Incorporate One Health principles in all aspects of planning (C) 2. Plan project activities based on outputs and budget (C) 3. Manage risks by identifying, analyzing and responding to risks that arise over the life cycle of project (C) 4. Establish a monitoring and evaluation plan to critically evaluate project outputs at all stages of implementation using appropriate and validated indicators (C)
One Health (Optional)	1. Describe the principles of project management and monitoring (K) 2. Describe and manage formal and informal organizational structures (C)	= Frontline + 1. Create a formal project management structure (S) 2. Document progress and produce project reports for upper management and donors (C) 3. Adapt project management process and tools to the mission of the organization (S)	= Intermediate + 1. Conduct a risk assessment during the project planning period (C)
Human			
Animal			
Environment			

Subdomain 11.5
Finance and budgeting

	Frontline	Intermediate	Advanced
One Health (Core)		1. Formulate and implement budget plans for programmes and projects (S)	= Intermediate + 1. Advocate for national financing for One Health planning and projects both within and across sectors (C) 2. Check and validate the financial sustainability of proposals (C)
One Health (Optional)	1. Explain how cross-sectoral collaboration allows for shared use of limited resources to improve health outcomes (K) 2. Project and recommend changes to activities within a budget and financial plan (S) 3. Describe how financing for One Health activities is shared across sectors but allocated in individual sector budgets (K) 4. Advocate for local government budgetary support for One Health planning and activities (S) 5. Engage local support through securing funding or involving stakeholders (NGOs, private sector, etc.) in specific actions (C) 6. Participate in strategic planning and the development of budgets for One Health projects (C) 7. Perform basic accounting and follow financial management principles (S)	= Frontline + 1. Seek additional resources and prepare funding proposals (C) 2. Describe donor reporting requirements (K) 3. Describe the fundamentals of a cost-effectiveness evaluation (K)	= Intermediate + 1. Advocate for international funding for One Health planning and projects, especially in developing and poor countries (C) 2. Produce donor reports (S)
Human			
Animal			1. Analyse and recommend resource allocation within veterinary services dedicated to One Health field activities (C)
Environment			

Subdomain 11.6
Security in the field

	Frontline	Intermediate	Advanced
One Health (Core)	1. Identify personal security risks and practice security awareness (S) 2. Prepare risk mitigation action plans prior to engaging in fieldwork (S) 3. Practice situational awareness to keep yourself and your colleagues safe (C)	= Frontline + 1. Ensure team members are practice security awareness and take precautionary measures (C)	= Intermediate
One Health (Optional)	1. Effectively engage with security organizations (C) 2. Apply practical techniques to manage risks and deal with difficult circumstances including conflicts (C) 3. React appropriately in the event of actual danger, threat or injury (C) 4. Explain personal psychological reactions to security incidents and know where to obtain help (C) 5. Explain the cultural characteristics of the local population, particularly offensive language and unacceptable practices (S) 6. Demonstrate awareness of mental health and wellbeing in the working environment (S)	= Frontline + 1. Develop and implement security policies and procedures based on organizational requirements (C) 2. Train professionals, paraprofessionals and multidisciplinary teams to apply security guidelines properly (C) 3. Support good mental health and wellbeing in the working environment (C)	= Intermediate + 1. Analyse the security risk implications associated with conducting field work (C) 2. Implement risk mitigation strategies and controls (C) 3. Create an environment that promotes good mental health, wellness and security of the group (C)
Human			
Animal			1. Ensure that veterinary services have internal policies for occupational diseases and security incidents (C)
Environment	1. Identify seasonal climate patterns, and areas vulnerable to flood, drought and extreme events (S)	= Frontline	= Intermediate

Domain 12
Communication and community engagement

Introduction

Communication includes the competencies necessary for conducting exchange of information at the local, regional and national level. Field epidemiologists should have effective oral and written communication between various audiences. They should also be well versed in risk communication strategies related to human, animal and ecosystem health. For field epidemiologists, there are differences in routine communication of field findings compared to emergency communication during outbreaks or pandemics. This distinction for routine communication applies to frontline One Health field epidemiologists compared to emergency communication activities which are handled at the intermediate and advanced levels.

At the frontline level, field epidemiologists demonstrate basic skills in preparing oral presentations and written communication and understand the needs of the audience.

At the intermediate level, field epidemiologists define communication needs for different target audiences and manage messaging related to risk communication.

At the advanced level, field epidemiologists use advanced communication methods for working with individual and stakeholder audiences.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
3. Field investigations;
4. Disease management;
7. Preparedness and response;
8. Epidemiologic studies;
10. Ecosystem health;
11. Leadership and management; and
13. Training.

Subdomains

1. Oral communication to technical and nontechnical audiences
2. Written communication to technical and nontechnical audiences
3. Risk communication
4. Communication for events

Subdomain 12.1
Oral communication to technical and nontechnical audiences

	Frontline	Intermediate	Advanced
One Health (Core)	1. Explain the goal of a communication initiative to the intended target audience (K) 2. Communicate clearly, calmly and respectfully (C) 3. Understand the importance of team communications and practice active listening (C) 4. Prepare a presentation for oral communication, using the appropriate support and technological tools and adapting the language to the target audience and context (C)	= Frontline + 1. Define the communication needs of different target audiences and contexts (C) 2. Describe the goal of a communication initiative to the intended target (C) 3. Deliver a presentation for oral communication, using the appropriate support and technological tools and adapting the language to the target audience and context (C)	= Intermediate + 1. Define and anticipate the communication needs of different target audiences and contexts (C) 2. Apply advanced communication methods appropriate to the different target audiences and contexts (C) 3. Enable team communications and support active listening practices (C)
One Health (Optional)	1. Apply the main rules for public speaking (e.g., style, posture, verbal, paraverbal, and nonverbal language, eye contact, dressing code, etc.) and emotional control (C) 2. Take account of audience feedback, responding in a timely manner (C) 3. Acknowledge differences among the target audiences (C) 4. Recognize gender issues relevant for communication in different settings (K)	= Frontline + 1. Provide feedback to the audience, facilitate dialogue and manage conflicts during oral presentations (C) 2. Manage differences to ensure respectful exchanges among the audience (C) 3. Practice active listening in team communications (C) 4. Consider gender issues in different communication settings (K)	= Intermediate + 1. Define and explain the goal of a communication initiative to the intended target, engaging the beneficiaries in active response (C) 2. Prepare a comprehensive presentation for oral communication, using the most appropriate supports and technological tools, adapting the language to the target audience and context (C) 3. Review and provide indications for oral presentations (C) 4. Demonstrate public speaking rules (e.g., style, posture, verbal, paraverbal, and nonverbal language, eye contact, dressing code, etc.) confidently in different contexts, use active listening and control emotions (C) 5. Facilitate consensus through dialogue and respectful acknowledgement of differences among the audience (C) 6. Ensure that gender issues are addressed in communication settings (C)
Human	1. Use the basic participatory epidemiology communication methods in public health (C)	= Frontline + 1. Adopt participatory epidemiology communication methods in public health (C)	= Intermediate + 1. Enable adoption of participatory epidemiology communication methods in public health (C)
Animal	1. Use the basic participatory epidemiology communication methods in animal health (C)	= Frontline + 1. Adopt participatory epidemiology communication methods in animal health (C)	= Intermediate + 1. Enable adoption of participatory epidemiology communication methods in animal health (C)
Environment			

Subdomain 12.2
Written communication to technical and nontechnical audiences

	Frontline	Intermediate	Advanced
One Health (Core)		1. Define key messages for an effective written communication (C)	= Intermediate + 1. Write key messages and assess their effectiveness in relation to the communication goal (C)
One Health (Optional)	1. Identify key messages for an effective written communication (C) 2. Draft key messages providing a basic logical structure, adapting the language, format and style to the target audience and context (C) 3. Contribute to preparation of written documents for different target audiences (e.g., press releases, briefing notes; concept notes, fact sheets, etc.) (C)	= Frontline + 1. Write key messages providing a logical structure and adapting the language, format and style to the target audience and context (C) 2. Write documents for different target audiences (e.g., press releases; briefing notes; concept notes; fact sheets; etc.) (C) 3. Co-author a paper for publication in a peer-reviewed scientific journal, according to journal's guidelines (C)	= Intermediate + 1. Assess key messages for logical structure and adaptation to the language, format and style of the target audience and context and disseminate for publication (C) 2. Lead on writing a scientific paper intended for publication in a peer-reviewed scientific journal (C) 3. Peer-review a scientific paper intended for publication in a peer-reviewed scientific journal (C)
Human			
Animal			
Environment			

Subdomain 12.3
Risk communication

	Frontline	Intermediate	Advanced
One Health (Core)	1. Describe the role of risk communication in the risk analysis process (K)	= Frontline	= Intermediate + 1. Use the most appropriate methods and tools to build trustful relationships with stakeholders, acknowledge uncertainty and care to address risk perception and protect beneficiaries from fake news (C)
One Health (Optional)		= Frontline + 1. Define expected and desired changes in the target population's behaviors, (i.e., the objectives of a risk communication campaign) (C) 2. Distinguish the most appropriate methods and tools to build trustful relationships with stakeholders, acknowledge uncertainty and care to address risk perception (C)	= Intermediate + 1. Work with partners and stakeholders to manage risk communication in times of peace and during emergency situations (C) 2. Evaluate needs and expectations of the target audiences and stakeholders on risk communication (C) 3. Engage stakeholders to achieve the desired changes following risk communication (C) 4. Work confidently with media, including social media, to establish a positive relationship for risk communication (C) 5. Develop criteria to assess communication bias (C)
Human			
Animal			
Environment			

Subdomain 12.4
Communication for events

	Frontline	Intermediate	Advanced
One Health (Core)		1. Organize events for technical and nontechnical audiences (C)	= Intermediate + 1. Promote and participate in the communication process to organize events for technical and nontechnical audiences (C) 2. Participate in defining an event agenda, identifying target audiences, goals, contents, speakers and considering organizational aspects (C) 3. Lead the event assessment analysis, including review of lessons learned (C)
One Health (Optional)	1. Apply the components of effective communication to organize events for technical and nontechnical audiences (S) 2. Contribute to design an event agenda, identifying target audiences, goals, contents, speakers and considering organizational aspects (C) 3. Support the event organization team by providing technical contributions, disseminating information through different media and serving as a contact point for participants (C)	= Frontline + 1. Participate in defining an event agenda, identifying target audiences, goals, contents, speakers and considering organizational aspects (C) 2. Participate in the event assessment analysis (C)	= Intermediate
Human			
Animal			
Environment			

Domain 13
Training

Introduction

Training is a fundamental component of the capacity building process that occurs in both formal and informal settings. Field epidemiologists are called to interact and manage teams at various levels, and knowledge and competency transfer has to be considered as a core responsibility to facilitate the organizational human resources growth and improvement.

This domain defines the competences that field epidemiologists should demonstrate to manage individual and group learning processes, design, deliver and evaluate learning needs' assessment studies, and develop and evaluate residential, virtual or blended training programmes. Competencies are also described for delivering user driven training initiatives, applying residential and blended learning methods for both classroom and virtual training and mentor based training at three levels: trainee, trainer and mentor. One subdomain describes the necessary competencies to develop accurate, relevant and engaging contents for eLearning, while one is dedicated to continuous quality improvement and risk management principles in the training context.

At the frontline level, field epidemiologists demonstrate engagement and support in learning processes and dynamics, understanding of learning needs' assessments, participation in training delivery and eLearning development and capacity to apply quality standards and risk management measures.

At the intermediate level, field epidemiologists facilitate learning processes to develop safe learning environments, develop and use learning needs' assessments, design, develop, carry out and assess training programmes, design and develop educational contents for eLearning and adopt quality standards and risk management measures.

At the advanced level, field epidemiologists lead learning processes to enable safe learning environments, lead learning needs' assessments, training design, delivery and assessment, support research and innovation in the field, provide scientific coordination to eLearning initiatives, and promote and transfer competencies on quality standards and risk management.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
4. Disease management;
5. Laboratory capacity;
6. Infection prevention and control, biosafety and biosecurity;
7. Preparedness and response;
8. Epidemiological studies;
10. Ecosystem Health,
11. Leadership and management;
12. Communication and community engagement; and
14. Ethics.

Subdomains

1. Learning processes
2. Learning needs assessment, training programme design, development and assessment
3. Training delivery
4. eLearning
5. Quality and risk management in training

Subdomain 13.1
Learning processes

	Frontline	Intermediate	Advanced
One Health (Core)			1. Describe, implement and lead individual and group interactive learning processes to develop a safe learning environment that meets learning needs of beneficiaries (C)
One Health (Optional)	1. Engage in individual and group learning processes, ensuring interactive approaches (C) 2. Contribute to facilitate a safe learning environment that meets learning needs of beneficiaries (C) 3. Contribute to support learners in achieving their learning outcomes (S) 4. Engage in One Health learner communities (C) 5. Describe multidisciplinary and multisectoral group dynamics (K) 6. Describe the different learning styles (K)	= Frontline + 1. Implement individual and group interactive learning processes to develop a safe learning environment that meets learning needs of beneficiaries (C) 2. Apply adult learning principles (S) 3. Support learners in achieving their learning outcomes (C) 4. Describe and facilitate multidisciplinary and multisectoral group dynamics, managing emotions and conflicts (C) 5. Create One Health learner communities and motivate participation (C) 6. Understand the different learning styles and adopt the main training methodologies to facilitate learning (S) 7. Describe age specific learning patterns and adapt learning contents to them (S)	= Intermediate + 1. Apply adult learning principles (C) 2. Support and inspire learners in achieving their learning outcomes (C) 3. Create One Health learner communities, motivate participation, and establish cascade processes (C) 4. Evaluate the different learning styles to adopt the most appropriate training methodologies to facilitate learning (C) 5. Customize learning pathways for the different learners (C) 6. Design and deliver age appropriate learning content on One Health issues (C)
Human			
Animal			
Environment			

Subdomain 13.2
Learning needs assessment, training programme design, development and assessment

	Frontline	Intermediate	Advanced
One Health (Core)	1. Participate in the learning evaluation process (S)	= Frontline	= Intermediate + 1. Lead development of learning needs assessment studies and the design, development and assessment of training plans and programmes, including training of trainers, assuring the necessary resources (C)
One Health (Optional)	1. Contribute to the assessment of learning needs (S) 2. Describe a learning needs' assessment report and identify relevant information to design training programmes (S) 3. Interpret training programmes and contribute to their development (C) 4. Understand the basic methodologies to strengthen and assess learning progress (S) 5. Identify learning resources to be included in training programmes (C)	= Frontline + 1. Design learning needs assessment studies, develop and assess training plans and programmes, including training for trainers (C) 2. Identify the most advanced methodologies to strengthen and assess learning progress (C) 3. Develop basic and advanced residential, virtual and blended training programmes (i.e., learning outcomes, learning methodologies, technical contents, choice of facilitators, delivery, duration of training, ratio of theory to applied training, and training modalities, etc.) (C) 4. Design and apply an evaluation process coherent with the expected learning outcomes and an impact assessment (C) 5. Liaise with a network of subject matter and pedagogical experts and institutions to provide adequate resources for the training programmes to be implemented (C) 6. Utilize virtual learning solutions and tools to produce eLearning modules and liaise with technical providers to choose appropriate options (C)	= Intermediate + 1. Lead and develop basic and advanced residential, virtual and blended training programmes (learning outcomes, learning methodologies, technical contents, choice of facilitators, delivery, duration of training, ratio of theory to applied training, and training modalities, etc.) (C) 2. Lead, design, and apply an evaluation process coherent with the expected learning outcomes and an impact assessment (C) 3. Lead and liaise with a network of subject matter and pedagogical experts and institutions to provide adequate resources for the training programmes to be implemented (C) 4. Facilitate the appropriate use of virtual learning solutions and tools to develop eLearning modules (C)
Human		1. Identify sources of educational material and refer potential trainees to appropriate learning opportunities (C)	= Intermediate
Animal			
Environment			

Subdomain 13.3
Training delivery

	Frontline	Intermediate	Advanced
One Health (Core)			
One Health (Optional)	1. Identify and use the basic training methodologies for virtual, residential and blended training to carry out specific training activities (S) 2. Use the basic methodologies to strengthen and analyse 3. learning progress (C) 4. Tutor residential or virtual class activities and conduct evaluations (C) 5. Facilitate on the job individual training, providing the necessary guidance to the trainee and monitoring the ongoing improvements through appropriate tools (C) 6. Implement joint field training initiatives, including: surveillance, outbreak investigation, field research, etc. (C) 7. Transfer basic knowledge, skills and abilities through on the job mentorship, using both didactic and hands on approaches (C)	= Frontline + 1. Use a wide variety of training methodologies, for virtual, residential, and blended training and programmes, to manage and assess them appropriately (C) 2. Apply the most advanced methodologies to strengthen and assess learning progress (C) 3. Innovate in the use of learning methodologies, exploiting management and technological resources (C) 4. Act as hands on tutor and mentor for individuals and groups (C) 5. Strengthen joint field training initiatives, including surveillance, outbreak investigation and field research (C) 6. Design tools for and facilitate hands on individual training and monitor the ongoing improvements (C)	= Intermediate + 1. Use a wide variety of training methodologies for virtual, residential, and blended training programmes and adopt the most advanced methodologies to strengthen and assess learning progress, to lead and assess such programmes appropriately (C) 2. Support research and innovation in the use of learning methodologies, exploiting management and technological resources and assuring availability of necessary financial resources (C) 3. Link ad hoc field in outbreaks with existing initiatives for community engagement (C) 4. Supervise tool design and facilitation of hands-on individual training (C) 5. Enhance use of training of trainers programmes (C)
Human			
Animal			
Environment			

Subdomain 13.4
eLearning

	Frontline	Intermediate	Advanced
One Health (Core)			
One Health (Optional)	1. Participate as subject matter expert in development and delivery of eLearning modules and courses (S) 2. Identify the main resources to be included in development of eLearning modules (S)	= Frontline + 1. Develop eLearning modules, combining educational content and methodological expertise (C) 2. Assess and incorporate the most appropriate resources to develop contents for eLearning (C)	= Intermediate + 1. Guide development of eLearning modules in the role of scientific coordinator leading the team of subject matter experts in collaboration with the methodological coordinator (C) 2. Plan for necessary maintenance, anticipated updates and associated budgeting for eLearning modules (C)
Human			
Animal			
Environment			

Subdomain 13.5
Quality and risk management in training

	Frontline	Intermediate	Advanced
One Health (Core)			
One Health (Optional)	1. Identify processes that rely on an effective management of training actions (K) 2. Recognize the risks arising from undesired events and implement the defined appropriate mitigation measures (S) 3. Describe customer orientation concepts and contribute to address customer satisfaction (S) 4. Apply continuous quality improvement principles for trainees, training of trainers and trainer of mentors including orientation workshops for trainers and mentors to maintain minimum quality standards (C) 5. Include qualitative and quantitative evaluation of training curricula, training methods, training logistics, trainee outputs and outcomes including measuring short, medium and long term impacts (C)	= Frontline + 1. Define and map the processes that rely on effective and efficient management of training actions (S) 2. Identify the risks arising from undesired events, design and put in place the appropriate mitigation measures (C) 3. Define specificities of the customer orientation approach as applied to training (C) 4. Design and apply customer satisfaction measures (C)	= Intermediate + 1. Lead the definition and mapping of the processes that rely on effective and efficient management of training actions (C) 2. Validate, monitor and control the application of the measures to identify the risks arising from undesired events, design and put in place the appropriate mitigation measures (C) 3. Implement target audience feedback measures (C) 4. Promote a quality approach to the management of training. (e.g., International Organization for Standardization 9001:2015 norms; Analyse, Design, Develop, Implement, Evaluate cycle, etc.) (C) 5. Transfer competences on quality and risk management in training (C) 6. Assure the necessary resources for quality and risk management (S)
Human			
Animal			
Environment			

Domain 14
Ethics

Introduction

Professional ethics are based on human moral, cultural and religious values which guide human behaviour governance systems. The field epidemiologist is responsible for maintaining professional ethical standards and norms in order to engender societal trust. This trust is prerequisite to enable field epidemiologists to perform their field duties and protect communities and populations. Ethics applies to the manner in which field activities, including investigation and surveillance, research, data management and reporting are conducted. In addition, ethical codes of practice include gender and discrimination issues.

Sector specific differences exist at all three levels, specifically related to use of human subjects, animal welfare and ethical field challenges including potential conflicts of interest. One Welfare includes the interconnections between social, human and animal welfare and the integrity of the environment. This includes environmental ethics related to environmental stewardship, biodiversity, air, water, and soil resources sustainability and pollution prevention. At all levels, the ethical code of practice includes gender and discrimination issues.

At the frontline and intermediate level, field epidemiologists avoid conflicts of interest and apply ethical principles and practices daily to gain and maintain public trust, in the performance of duties including investigation and surveillance, research, data management and reporting.

At the advanced level, field epidemiologists lead and support the resolution of ethical conflicts and apply ethical principles and practices daily to gain and maintain public trust, in the performance of duties including investigation and surveillance, research, data management and reporting. The advanced level will collaborate in situations dealing with conflict resolution at the local and national levels.

Cross-references

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
4. Disease management;
5. Laboratory capacity;
6. Infection prevention and control, biosafety and biosecurity;
7. Preparedness and response;
8. Epidemiologic studies;
9. Data management, biostatistics, and informatics;
10. Ecosystem health;
11. Leadership and management;
12: Communication and community engagement; and
13. Training.

Subdomains

1. Ethics and its role related to health
2. Ethical issues related to field epidemiology
3. Moral challenges related to ethical decision-making
4. Legal and regulatory ethical frameworks
5. The five step process for ethical decision-making

Subdomain 14.1
Ethics and its role related to health

	Frontline	Intermediate	Advanced
One Health (Core)	1. Apply principles of professional ethics (C) 2. Define professional ethics and the legal frameworks related to humans, animals and the environment (S) 3. Define ethics in relation to human, animal and environmental health management, welfare and biosafety and biosecurity procedures (S) 4. Define ethics in relation to teaching, mentoring and research including confidentiality, data integrity and protection, data and information sharing and conflicts of interest (C)	= Frontline	= Intermediate
One Health (Optional)	1. Define the four principles of biomedical ethics: beneficence, non-maleficence, autonomy and justice (C)	= Frontline	= Intermediate
Human	1. Identify ethical concepts related to an individual's physical, emotional and mental integrity (C)	= Frontline	= Intermediate
Animal	1. Apply basic WOAH guidelines governing animal welfare (C)	= Frontline + 1. List the components of "Practical" Ethic for Animals[8] (K)	= Intermediate
Environment	1. Explain basic principles of environmental justice and the local historical context and policies that have led to current environmental justice disparities (S) 2. Describe environmental ethics relevant to environmental stewardship, biodiversity, air, water and soil resources sustainability and pollution prevention (K) 3. Describe sociocultural and economic considerations in payment for ecosystem services (S)	= Frontline + 1. Apply basic principles of environmental justice and the local historical context and policies that have led to current environmental justice disparities (S) 2. Explain environmental ethics to promote environmental stewardship, biodiversity, air, water and soil resources sustainability and pollution prevention (S) 3. Explain sociocultural and economic considerations in payment for ecosystem services (C)	= Intermediate + 1. Develop and lead training on basic principles of environmental justice and the local historical context and policies that have led to current environmental justice disparities (C) 2. Develop and lead training on environmental ethics to promote environmental stewardship, biodiversity, air, water and soil resources sustainability and pollution prevention (C) 3. Develop and lead training on sociocultural and economic considerations in payment for ecosystem services (C)

8 Fraser, D. (2012). A 'practical' ethic for animals. Journal of agricultural and environmental ethics, 25(5), 721-746.

Subdomain 14.2
Ethical issues related to field epidemiology

	Frontline	Intermediate	Advanced
One Health (Core)			
One Health (Optional)	1. Describe the scope of ethics related to: • Care • Safety • Informed consent • Duty to care (compensation) (C) 2. Describe the importance of ethics in teaching, research and the performance of field duties (C) 3. Describe ethical issues arising from community and population, consultation, interviews and focus groups; gender and cultural context of field epidemiology projects (C) 4. Describe the ethical and health impacts of transhumance on human, animal and environmental health (C)	= Frontline + 1. Describe the concept of One Welfare including interconnections between social, human and animal welfare and the integrity of the environment (C) 2. Explain the role of human mental health in animal welfare (C) 3. Explain the link between behavioural rehabilitation of animals and people (C) 4. Explain the need for coordinated action between animal welfare and conservation of nature (C)	= Intermediate + 1. Develop and lead training on the concept of One Welfare including interconnections among social, human and animal welfare and the integrity of the environment (C) 2. Utilize ethical guidelines and legal policies to propose strategies and responses for emergency clinical crisis in any sector (C)
Human			1. Appraise risks and benefits of including a placebo arm in clinical field studies (e.g., during an outbreak) (C) 2. Explain so-called therapeutic misconception and how it could affect duties of health care workers in emergencies (K)
Animal	1. Apply animal welfare guidelines when dealing with the following issues: • Animal transportation • Animal rescue • Animal husbandry and production • Animal handling methods • Humane depopulation • Animal cruelty and neglect • Animal hoarding • Natural and anthropogenic disaster relief • Veterinary care (S)	= Frontline	= Intermediate
Environment	1. Describe ethical concerns related to: • Introduction to invasive species • Pollution • Climate change • Damage to biodiversity and ecosystem health of flora and fauna • Human-wildlife conflict • Land use (C)	= Frontline	= Intermediate

Subdomain 14.3
Moral challenges related to ethical decision-making

	Frontline	Intermediate	Advanced
One Health (Core)	1. List the stakeholders involved in making ethical decisions: • Patients (human and animals) • Clients (human) • Civil society (S) 2. Describe conflict resolution methods at the community level (S)	= Frontline + 1. Perform ethical decision-making (C)	= Intermediate + 1. Collaborate in conflict resolution at the national and community levels (C)
One Health (Optional)	1. Explain the moral challenges stakeholders face related to: • Moral distress • Divided loyalties • Conflict of interest (C) 2. Apply ethically relevant criteria for triage, resource allocation and standard of care in emergency response (C)	= Frontline + 1. Monitor ethically relevant criteria for triage, resource allocation and standard of care in emergency response (C)	= Intermediate + 1. Develop ethically relevant criteria for triage, resource allocation and standard of care in emergency response (C) 2. Advise on conflicts between individual rights and decision-making versus community and population health protection (C)
Human			1. Evaluate ethical issues when defining priorities within a limited budget situation (C)
Animal	1. Explain the challenges and decisions public and private veterinarians face in balancing: • Human health • Animal health • Animal welfare • Farmer livelihoods • Food security • Economic development • Wildlife-livestock conflicts • Disease spillover (C)	= Frontline	= Intermediate
Environment	1. Explain the challenges and decisions public and private environment professionals face in balancing: • Human-wildlife conflict • Wildlife-livestock conflict • Disease spillover • Land use • Community development • Conflicts between agroecosystems and natural biodiversity and ecosystems (C)	= Frontline	= Intermediate

Subdomain 14.4
Legal and regulatory ethical frameworks

	Frontline	Intermediate	Advanced
One Health (Core)	1. Adhere to prevailing ethics by-laws, standards and best practices (C) 2. Report ethics incidents up the chain of command (C) 3. Adhere to by-laws and regulations governing professional behavior (C)	= Frontline + 1. Advocate for ethical policy making by describing ethical and moral provisions in guidelines, legal and regulatory frameworks (C)	= Intermediate
One Health (Optional)	1. Apply enforcement action when appropriate (C)	= Frontline	= Intermediate
Human	1. Adhere to ethical considerations and legal standards related to reporting and sharing of data and research studies involving human subjects (C) 2. Adhere to data protection requirements related to collection of personal information in surveillance and during outbreak investigation (C) 3. Describe and apply concepts related to informed consent (C)	= Frontline + 1. Apply anonymization and pseudonymization (C) 2. Define, identify and manage conflicts of interest (C) 3. Evaluate online survey services relative to data security, handling and storage (C)	= Intermediate
Animal	1. Describe WOAH Animal Welfare Guiding Principles (S) 2. Describe the implementation of good animal welfare practices (C)	= Frontline	= Intermediate
Environment	1. Describe the principles of Green Circular Bioeconomy (S) 2. List international legal frameworks to protect natural resources (UN Convention on Biological Diversity, CITES, etc.) (K) 3. List the WHO 10 Chemicals of Concern and their current thresholds of exposure risk (K)	= Frontline	= Intermediate

Subdomain 14.5
The five step process for ethical decision-making

	Frontline	Intermediate	Advanced
One Health (Core)	1. Explain the five step process for ethical decision-making: • Assess the situation • Assess your values and potential conflicts • List options and the pros and cons of each • Assess options in relation to autonomy (respect) and justice (fairness) • Review options and select one (C)	= Frontline	= Intermediate
One Health (Optional)			
Human			
Animal			
Environment			

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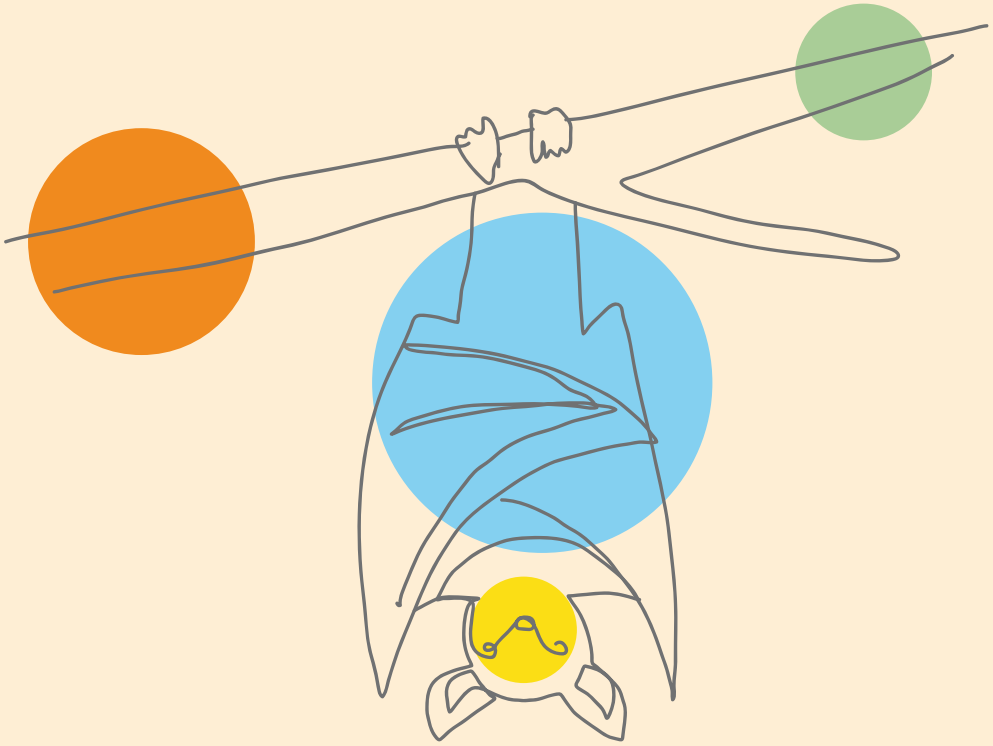

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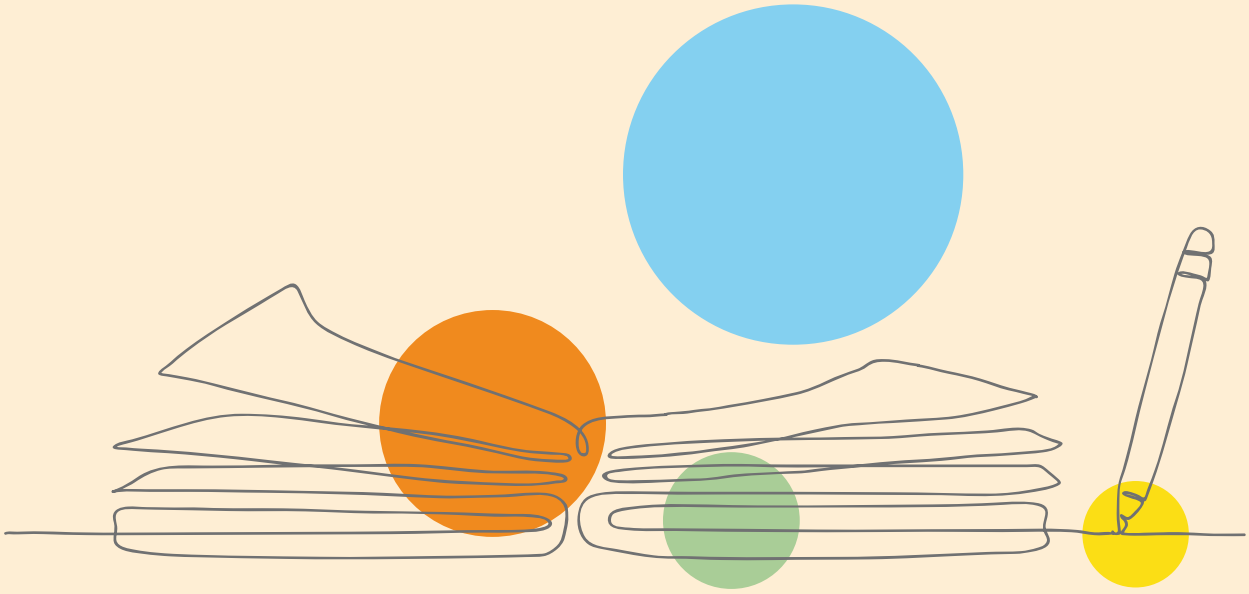
Annexes



Annex 1

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The core technical team from FAO, WHO and WOAH would like to thank the following individuals for contributing their time and expertise for reviewing the *COHFE framework* and the associated guidance documents.

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Annex 2

Competencies template

Domain: *Select one domain from the list of agreed upon domains*

Subdomain: *A topic under the domain (no action verbs)*

	Frontline	Intermediate	Advanced
One Health	Add all items here (Knowledge/ Skill/Competency) with the following rules for each item: 1. Start with an action verb from Bloom's taxonomy 2. Indicate the type (Knowledge/Skill/ Competency) e.g.: perform regular analysis of surveillance data (S)		
Human			
Animal			
Environment			

Annex 3

One Health glossary

Term	Definition
active listening	The practice of engaging closely with what a speaker is saying and indicating understanding, typically by asking relevant questions, using gestures, and summarizing *(1)*
aggregated data	Data that are summarized to express information related to a group of people, animals, plants, or objects classified under the same category (e.g. age, sex, species, substance) for a disease or health-related event
agricultural ecosystem	Artificial ecosystems created in the process of developing land and coastal/aquatic areas for farming, animal husbandry, and fishing *(2)*
agroecological	Pertaining to agroecology, a holistic and integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of sustainable agriculture and food systems. It seeks to optimize the interactions between plants, animals, humans and the environment while also addressing the need for socially equitable food systems within which people can exercise choice over what they eat and how and where it is produced *(3)*
alien species	A species introduced outside its natural past or present distribution; if the species is problematic, it is termed an invasive alien species *(4)*
all-hazards approach	An approach to the management of the entire spectrum of emergency risks and events based on the recognition that there are common elements (and common capacities required) in the management of these risks, including in the responses to virtually all emergencies *(5)*
animal production	The production, rearing or growing of animal products including harvesting, milking and farmed animal production prior to slaughter. It also includes hunting and fishing and the harvesting of wild products *(6)*
anonymization	Anonymization is the process of turning data into a form that does not identify entities or individuals *(7)*
Anthropocene	The most recent period in the earth's history, when human activities have a very important effect on the earth's environment and climate *(8)*
anthropogenic drivers	Human-induced factors that directly or indirectly cause a change (in an ecosystem). The categories of anthropogenic driving forces are demographic, economic, sociopolitical, cultural and religious, scientific and technological *(9)*
anthroponosis (anthroponotic)	An infection or disease that is transmissible from humans to animals under natural conditions *(10)*
antimicrobial resistance (AMR)	Antimicrobial resistance is the ability of microorganisms to persist or grow in the presence of drugs designed to inhibit or kill them. These drugs, called antimicrobials, are used to treat infectious diseases caused by microorganisms such as bacteria, fungi, viruses and protozoan parasites *(11)*

Term	Definition
antimicrobial stewardship	A coherent set of actions which promote the responsible use of antimicrobials. This definition can be applied to actions at the individual level as well as the national and global level, and across human health, animal health and the environment *(12)*
basic priority rating system	A system used to rate health priorities, which incorporates various data sources and can be used to quantify disease problems or risk factors, or both. The health priority might be rated according to size, urgency, severity of the problem, economic loss, impact on others, effectiveness, propriety, economics, acceptability, legality of solutions, and availability of resources, among others *(13)*
bias	Any systematic error in the design, conduct or analysis of a study which results in estimates that depart systematically from the true value *(14)*
biodiversity (biological diversity)	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Article 2 of the Convention on Biodiversity) *(15)*
biodiversity indices (structural and functional)	Structural biodiversity (in terms of numbers, biomass, the composition of species and the population structure of communities) and functional biodiversity (presented as series of interactions between the various trophic levels) *(16)*
biosafety	The maintenance of safe conditions in storing, transport, handling, and disposing of biological substances to prevent inadvertent exposure of personnel *(17)*
biosecurity	The set of measures taken to limit or counter release of biological substances to the community or environment *(17)*
biotic integrity (biological integrity)	The ability to support and maintain a balanced, integrated adaptive assemblage of organisms having species composition, diversity, and functional organization comparable to that of natural habitat of the region *(18,19)*
burden of disease	The burden of a particular disease or condition is estimated by adding together: the number of years of life a person loses as a consequence of dying early because of the disease (Years of Life Lost, YLL) and the number of years of life a person lives with disability caused by the disease (Years of Life lived with Disability, YLD). Recent efforts have also been made to quantify the burden of animal diseases. *(6,20,21)*
carbon cycle	The series of processes by which carbon compounds are interconverted in the environment, involving the incorporation of carbon dioxide into living tissue by photosynthesis and its return to the atmosphere through respiration, the decay of dead organisms, and the burning of fossil fuels *(22)*
case definition	A set of standard criteria for deciding whether an individual unit of has a particular disease or other outcome of interest *(14)*
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	International agreement between governments that aims to ensure international trade in specimens of wild animals and plants does not threaten the survival of the species *(23)*
climate change	A change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods *(24)*

Term	Definition
cold chain	A low temperature-controlled supply chain; an uninterrupted series of refrigerated production, storage and distribution activities, along with associated equipment and logistics, which maintain quality via a desired low-temperature range. It is used to preserve, extend and ensure the shelf life of products, such as fresh agricultural produce, seafood, frozen food, photographic film, chemicals, and pharmaceutical products, particularly vaccines *(25)*
communication	A process by which information is exchanged between individuals through a common system of symbols, signs, or behavior *(26)*
community animal health worker	A worker who provides basic services and gives husbandry advice to livestock keepers. They disseminate information on farming techniques and methods to optimize animal production and play an important role in epidemiological surveillance *(27)*
community health worker	A frontline public health worker who is a trusted member of or has an unusually close understanding of the community served. The trust relationship enables the worker to serve as a link between health and social services and the community to facilitate access to services and improve the quality and cultural competence of service delivery *(28)*
confounding	Confounding occurs when part of an apparent association between an exposure and an outcome is in fact due to a third factor that is associated with the outcome and with the exposure *(14)*
continuous quality improvement	A quality management approach based on the idea that most processes can be improved and made more efficient through incremental regular changes that become a part of an organization's day-to-day activities
disease cluster	Aggregations of a disease in space or time in amounts believed to be greater than could be expected by chance *(6)*
disease intervention model	Can be divided into two broad areas, the preventive and the therapeutic disease intervention models. The preventive disease intervention model includes interventions that prevent disease from occurring and thus reduce the incidence (new cases) of disease. The therapeutic intervention model includes interventions that treat, mitigate, or postpone the effects of disease, once it is under way, and thus reduce the case fatality rate or reduce the disability or morbidity associated with a disease. Some interventions may have both effects *(29)*
doffing	To take off personal protective equipment
donning	To put on personal protective equipment
dummy table	An empty table constructed before data are collected and into which data are entered once they are collected *(30)*
early warning system	Systems which predict or forecast the formation or movement of a potentially disastrous phenomenon which may develop into or cause a disaster, natural or otherwise *(31)*
ecosystem	Mutually interrelated communities of species and abiotic components, existing as a system with specific interactions and exchange of matter, energy, and information *(6)*

Term	Definition
ecosystem function	The capacity of natural processes and components to provide goods and services that satisfy human needs directly or indirectly *(32)*
ecosystem health	The state of an ecosystem in which its dynamic attributes are expressed within the normal ranges of activity relative to its ecological state of development *(33)*
ecosystem integrity	The state of an ecosystem that displays the biodiversity characteristic of the reference, such as species composition and community structure, and is fully capable of sustaining normal ecosystem functioning *(33)*
ecosystem services	Benefits people derive from ecosystems: goods, like food, wood, raw materials, plants, animals, fungi and micro-organisms; or provisioning, from essential regulating services such as pollination of crops, prevention of soil erosion and water purification, and cultural services, like recreation and a sense of place *(34)*
ecosystem-based approach	A strategy for integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way *(35)*
effect modification	Variation in the effect of a defined factor across the levels of another factor; interaction *(14)*
electronic medical records	Systematized collection of patient and population electronically stored health information in digital format *(36)*
environmental stewardship	Responsible use and protection of the natural environment through conservation and sustainable practices to enhance ecosystem resilience and human wellbeing *(37)*
epidemiologic triad	A traditional model of infectious disease causation, consisting of an external agent, a host, and an environment in which host and agent are brought together, causing the disease to occur in the host *(38)*
event-based surveillance	The rapid collection of ad hoc information about acute public health events. Event-based surveillance uses a variety of official and unofficial information sources to detect clusters of cases with similar clinical signs and symptoms that may not match the presentation of readily identifiable diseases. Official sources include national authorities and other agencies, such as the United Nations system. Unofficial sources include media reports, other unofficial public information (e.g. internet sites), and reports from the public *(39)*
field (applied) epidemiology	The application of epidemiological principles and methods in response to urgent health problems. Applied epidemiology includes field epidemiology but also refers to epidemiology conducted in academic and research settings *(40)*
field investigation	an epidemiologic investigation conducted in response to urgent health problems when an on-site investigation is necessary for timely intervention *(41)*
food security	A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Based on the definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization and stability over time *(31)*

Term	Definition
food system	All actors and interactions along the food value chain—from input supply and production of crops, livestock, fish, and other agricultural commodities to transportation, processing, retail, wholesale, and preparation of foods to consumption and disposal. Food systems also include the enabling policy environments and cultural norms around food *(42)*
freedom from disease (pest- or disease-free area)	An area identified by the competent authorities in which a specific pest or disease does not occur. A pest- or disease-free area may surround, be surrounded by, or be adjacent to an area in which the specific pest or disease is known to occur but is subject to control measures such as the establishment of protection, surveillance and buffer zones which confine or eradicate the pest or disease *(43)*
global environmental change	Addresses large-scale chemical, biological, geological, and physical perturbations of the Earth's ocean, land surface, and hydrologic cycle with special attention to time scales of decades to centuries, to human-caused perturbations and their impacts on society *(44)*
global warming	A gradual increase in the overall temperature of the Earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons, and other pollutants *(22)*
greenhouse gas	A gas that contributes to the greenhouse effect by absorbing infrared radiation; carbon dioxide and chlorofluorocarbons are examples *(22)*
group dynamics	The processes involved when people in a group interact with each other *(22)*
hazard	Anything with the potential to cause adverse health effects (e.g. virus, bacteria, chemical, flood, earthquake, snake); a threat *(17)*
humanitarian response	Material or logistical assistance provided for humanitarian purposes, typically in response to humanitarian crises *(45)*
husbandry	Care, cultivation, and breeding of crops and animals; management and conservation of resources *(22)*
field training	A probationary training and evaluation programme that gives trainees first-hand experience in a field of work *(46)*
indicator-based surveillance	The systematic collection, monitoring, analysis, and interpretation of structured data, i.e. indicators, produced by a number of well-identified, predominantly health-based formal sources *(47)*
infection prevention and control (IPC)	A practical, evidence-based approach that prevents patients and health workers from being harmed by avoidable and preventable infections *(48)*
International Health Regulations (IHR)	International legal instrument issued by the World Health Organization, binding since August 2012 on all WHO Member States (194 countries), with the aim to help the international community prevent and respond to acute public health risks that have potential to cross borders and threaten people worldwide *(45)*
Joint External Evaluation (JEE)	A voluntary, collaborative, multisectoral process to assess country capacities to prevent, detect and rapidly respond to public health risks whether occurring naturally or due to deliberate or accidental events. The JEE helps countries identify the most critical gaps within their human and animal health systems in order to prioritize opportunities for enhanced preparedness and response *(49)*

Term	Definition
learning	The complex and long term psychosocial process of individual acquisition or modification of information, knowledge, understanding, attitudes, values, skills, competencies or behaviours through experience or study
learning environment	A learner's immediate physical surroundings, resources available to support the learning process, and the social interaction or type of relationship functioning within this context which influences learning
learning styles	A set of behaviours and attitudes that influence how students learn and interact with teachers and peers; cognitive, affective, and physiological behaviours that indicate how learners perceive, interact with, and respond to the learning environment *(50)*
learning needs	The essential learning tools (literacy, oral expression, numeracy, problem solving) and basic learning content (knowledge, skills, values, attitudes) required by humans to survive, develop their full capacity, live and work in dignity, participate fully in development, improve their quality of life, make informed decisions, and continue learning; the scope of learning needs and how they should be met varies with country context and culture and changes over time *(51)*
learning processes	The process people pass through to acquire new knowledge and skills, which influences attitudes, decisions and actions *(52)*
mass gathering	Event attended by a sufficient number of people or animals to strain the planning and response resources of the host community, state or province, nation, or region where it is held
maximum contaminant level	The highest level of a contaminant that is allowed in drinking water *(53)*
microbial diversity	The range of different kinds of unicellular organisms, bacteria, archaea, protists, and fungi *(54)*
movement restriction	A restriction temporarily placed on traffic into and/or out of areas
multidisciplinary	Combining or involving several disciplines or professional specializations in an approach to a topic or problem *(22)*
multisectoral	Involving participation of more than one sector working together on a joint programme or response to an event. Saying multisectoral does not always mean that the human, animal, and environmental health sectors are engaged as is the case when saying a One Health approach *(17)*
Nagoya Protocol	The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity is an international agreement which aims at sharing the benefits arising from the utilization of genetic resources in a fair and equitable way *(55)*
natural ecosystem	An ecosystem where human impact has been of no greater influence than that of any other native species, and has not affected the ecosystem's structure since the industrial revolution. Human impact excludes changes of global proportions, such as climate change due to global warming *(56)*
natural resources	Materials or substances occurring in nature which can be exploited for economic gain *(22)*

Term	Definition
nature-based solutions	Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits *(57)*
negative predictive value	Probability that an individual found negative to a test is truly free of the disease or outcome of interest for which the test was performed *(58)*
nosocomial infections	Health care associated infection (HCAI), also referred to as nosocomial or hospital infection, is infection occurring in a patient during the process of care in a hospital or other health care facility which was not present or incubating at the time of admission *(6)*
One Health	One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent. The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development. *(59)*
one welfare	The One Welfare concept emphasizes the link between animal welfare, human wellbeing, biodiversity and the environment. It builds upon and complements the development of the One World, One Health concept to fully achieve comprehensive approaches in support of global sustainable development *(60)*
parallel testing	Two or more diagnostic tests are applied to an individual, animal or herd at the same time
paraprofessional	A title given to individuals in various occupational fields, such as education, healthcare, engineering, and law. Historically, paraprofessionals assisted the master professional of their field. In more recent times, paraprofessionals have become a professional in their own right, providing services which meet the needs of a particular recipient or community *(61)*
participatory epidemiology	The use of participatory approaches and methods to improve our understanding of the patterns of diseases in populations *(62)*
participatory methods	Participatory methods include a range of activities with a common thread: enabling ordinary people to play an active and influential part in decisions which affect their lives *(63)*
personal protective equipment	All equipment and clothing designed to provide protection, which is intended to be worn or held by an employee at work and which protects against one or more risks to safety or health. In the context of exposure to pathogens, it includes gloves, eyewear, goggles, faceshield, apron or procedure gown, shoe covers. *(45)*
planetary health	A solutions oriented, transdisciplinary field and social movement focused on analyzing and addressing the impacts of human disruptions to Earth's natural systems on human health and all life on Earth *(64)*
positive predictive value	Probability that an individual found positive to a test is truly affected by the disease or outcome of interest for which the test is performed *(58)*

Term	Definition
primary health care	Health care provided at the first point of contact between a patient (human or animal) and the health care system. Primary health care providers offer preventive care and first-line medical care services. They refer patients, when appropriate, to specialist health care providers.
pseudonymization	A deidentification procedure by which personally identifiable information is replaced by one or more artificial identifiers. Pseudonymized data can be restored to its original state with the addition of information that allows individuals to be reidentified *(65)*
quarantine	Restriction of the activities of well persons or animals who have been exposed to a case of communicable disease during its period of communicability (i.e., contacts) to prevent disease transmission during the incubation period if infection should occur *(66)*
receiver operating curve system	Graphical representation of the curve constituted by points corresponding to the sensitivity and specificity of a test according to a chosen cutoff value *(58)*
risk	The likelihood of the occurrence and the likely magnitude of the consequences of an adverse event during a specified period *(67)*
risk assessment	Risk assessment is defined as the systematic process of gathering, assessing and documenting information to estimate the level of risk and associated uncertainty related to an event or contaminant, during a specified period of time and in a specified location *(17)*
risk communication	The real time exchange of information, advice and opinions among experts, community leaders or officials and the people who are at risk or who have a direct influence on risk mitigation due to their practices or behavior. Risk communication ensures that people and communities are aware of current threats and can be used to promote behaviors to reduce ongoing risks *(17)*
risk management	The identification and implementation of policies and activities to avoid or minimize the likelihood and/or impact of ongoing or potential zoonotic disease events. In practice, risk management typically refers to responding to current disease events (e.g., quarantine, culling, movement control) *(17)*
risk-based surveillance	Use of information about the probability of occurrence and the magnitude of the biological and/or economic consequence of health hazards to plan, design and/or interpret the results obtained from surveillance systems. Risk-based surveillance can include one or several of the following four approaches: risk-based prioritization, risk-based requirement, risk-based sampling, risk-based analysis *(6)*
sampling strategy	Describes how the sample was selected from the population being monitored or surveyed (e.g., objective sampling, selective sampling, suspect sampling, convenient sampling, census) *(68)*
Sanitary and Phytosanitary (SPS) agreement	Agreement on the Application of Sanitary and Phytosanitary Measures: The Agreement on the Application of Sanitary and Phytosanitary Measures sets out the basic rules for food safety and animal and plant health standards. It allows countries to set their own standards. But it also says regulations must be based on science. They should be applied only to the extent necessary to protect human, animal or plant life or health. And they should not arbitrarily or unjustifiably discriminate between countries where identical or similar conditions prevail *(69)*

Term	Definition
sensitivity	Ability of a test to correctly detect individuals with the disease or infection of interest *(58)*
sentinel surveillance	The repeated collection of information from the same prearranged sample of sources to identify changes in the health status of a specified population over time. These sentinels should act as a proxy for the larger population of interest; they may be selected on the basis of risk but can also be selected randomly or on the basis of convenience or compliance. Sentinel surveillance may include the use of animal sentinels to detect circulation of arboviruses and other pathogens of concern *(70)*
serial testing	Running multiple tests on an individual, animal or herd one at a time, instead of concurrently
slaughterhouse	A place where animals are slaughtered for food *(22)*
specificity	Ability of a test to correctly detect individuals free of the disease or infection of interest *(58)*
spillover	An infection that is normally limited to one species or group but sporadic cases in other groups may be seen. For example, spill over infection of bat-rabies can cause sporadic cases in cats and dogs. It is frequently used in food-borne infections also in the sense of spill over (through one or several steps in the food-chain) to humans *(6)*
stakeholders	Denoting a type of organization or system in which all the members or participants are seen as having an interest in its success *(71)*
standard operating procedures (SOP)	A set of step by step instructions compiled by an organization to help workers carry out complex routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations *(6)*
strengths, weaknesses, opportunities and threats (SWOT) analysis	A strategic planning and strategic management technique used to help a person or organization identify strengths, weaknesses, opportunities, and threats related to business competition or project planning; sometimes called situational assessment or situational analysis *(72)*
surveillance	The systematic ongoing collection, collation, and analysis of data for health purposes and the timely dissemination of health information for assessment and response as necessary *(73)*
syndromic surveillance	Surveillance that uses health-related information (clinical signs or other data) that might precede or substitute for formal diagnosis. This information may be used to indicate a sufficient probability of a change in the health of the population to deserve further investigation or to enable a timely assessment of the impact of health threats which may require action. This type of surveillance is not usually focused on a particular hazard so can be used to detect a variety of diseases or pathogens including new (emerging) diseases. Syndromic surveillance has been used for early detection and also for case detection during outbreaks *(70)*

Term	Definition
systems thinking	The process of understanding how things interact within a whole to produce its characteristics or properties. It is carried out many different ways using different techniques, yet always focuses on the context and the interrelationships of the parts rather than on them in isolation (as with scientific reductionism). It is concerned more with cyclic behavior, feedback mechanisms, critical thresholds, cross: scale interactions (than linear cause and effect dynamics of mechanistic systems). Systems thinking techniques may be used to study any kind of system, natural, scientific, engineered, human, or conceptual. It is argued as the only way to fully understand how a problem or element occurs or persists (e.g., an emerging pathogen) and to avoid unintended consequences of targeting a single element or variable *(6)*
target audience	A specific group of people identified as the intended recipient of a message *(74)*
Terrestrial Animal Health Code (WOAH)	The aim of WOAH Terrestrial Animal Health Code is to assure the sanitary safety of international trade in terrestrial animals (mammals, birds and bees) and their products. This is achieved through the detailing of health measures to be used by the veterinary authorities of importing and exporting countries to avoid the transfer of agents pathogenic to animals or humans, while avoiding unjustified sanitary barriers *(45)*
therapeutic misconception	A subject's inaccurate information or belief about a treatment, impacting the individual's autonomy and choice to consent to the procedure or participate in a research trial *(75)*
training of trainers	A model that is intended to engage master trainers in coaching new trainers that are less experienced with a particular topic or skill, or with training overall *(76)*
transboundary animal disease	Epidemic diseases which are highly contagious or transmissible and have the potential for very rapid spread, irrespective of national borders, causing serious socioeconomic and public health consequences *(6)*
transhumance	The action or practice of moving livestock from one grazing ground to another in a seasonal cycle *(22)*
universal health coverage (UHC)	Universal health coverage means that all individuals and communities receive the health services they need without suffering financial hardship. It includes the full spectrum of essential, quality health services, from health promotion to prevention, treatment, rehabilitation, and palliative care across the life course *(77)*
vaccine immunology	Vaccine immunology includes the components of the immune system, passive vs. active immunization, the mechanism(s) by which immunizations stimulate(s) immunity, and the types of vaccines available *(78)*
value chain	Value chains are the input, production and marketing chains that supply livestock products to the consumer. The chains are operated by people as an economic activity. Therefore, we can say that: Value chains are groups of people linked by an activity to supply a specific commodity. Value chains describe the processes through which inputs, animals and products pass during the production process *(79)*
vector-borne disease	A vector-borne disease can be defined as a disease transmitted by a living being, usually an arthropod vector, to a vertebrate host *(80)*

Term	Definition
verbal autopsy	Verbal autopsy (VA) is a method of determining individuals' causes of death and cause-specific mortality fractions in populations without a complete vital registration system. Verbal autopsies consist of a trained interviewer using a questionnaire to collect information about the signs, symptoms, and demographic characteristics of a recently deceased person from an individual familiar with the deceased. A standard VA instrument paired with easy-to-implement and effective analytic methods can help bridge significant gaps in information about causes of death, particularly in resource-poor settings *(81)*
verbal, nonverbal, and paraverbal language	Verbal communication refers to our use of words while nonverbal communication refers to communication that occurs through means other than words, such as body language, gestures, and silence. Both verbal and nonverbal communication can be spoken and written *(82)*
wet market	A marketplace selling fresh meat, fish, produce, and other consumption-oriented perishable goods in a non-supermarket setting, as distinguished from "dry markets" that sell durable goods such as fabrics and electronics. These include a wide variety of markets, such as farmers' markets, fish markets, and wildlife markets. Not all wet markets sell live animals, but the term wet market is sometimes used to signify a live animal market in which vendors slaughter animals upon customer purchase *(83)*
wildlife	Animals considered to be wild or feral or otherwise not adapted to domestic situations; may be mammals, birds, fishes, reptiles, amphibians, etc. *(17)*
zoonosis (zoonotic)	An infectious disease that can be spread between animals and humans; can be spread by food, water, fomites, or vectors *(17)*

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Annex 4

Competency prioritization tool

Background

Competencies for One Health field epidemiology (COHFE) framework is the first global initiative to develop field epidemiology competency guidelines under a One Health approach. Fourteen domains have been identified under the guidance, as follows:

Frontline domains	**Technical**	**Domain 1**	Foundational knowledge and skills
		Domain 2	Surveillance systems
		Domain 3	Field investigations
		Domain 4	Disease management
		Domain 5	Laboratory capacity
		Domain 6	Infection prevention and control, biosecurity and biosafety
		Domain 7	Preparedness and response
		Domain 8	Epidemiological studies
		Domain 9	Data management, biostatistics, and informatics
		Domain 10	Ecosystem health
	Functional	**Domain 11**	Leadership and management
		Domain 12	Communication and community engagement
		Domain 13	Training
		Domain 14	Ethics

One Health field epidemiology competencies, knowledge, and skills were defined by a core technical team from FAO, WHO and WOAH and extensively reviewed and edited by a global Technical Advisory Group (TAG). These members provided external validation of the One Health field epidemiology competencies through a series of facilitated virtual meetings.

Goal of the tool

The TAG acknowledge that the framework contains a large number of knowledge, skills and competencies and that countries have limited time and resources to deliver One Health field epidemiology training programmes. Therefore, the TAG conducted an exercise to distinguish between core competencies, which are non-negotiable for curriculum implementation, and optional competencies, which should be included based on a country's needs and training gaps. The tool can be downloaded at https://www.who.int/initiatives/COHFE-framework.

The goal of this Competency Prioritization Tool is to help identify the relative importance of the optional competencies of the One Health field epidemiology curriculum within the context of the country's specific needs and strategic objectives, which may include:

- **Regional context**
  - Geography, climate, and multilateral cooperation/ partnerships

- **Country context:**
  - Human technical and governmental financial resources
  - Current state of field epidemiology capacity
  - Academic resources

- **Enabling institutional factors**
  - Laboratory capacity
  - Field capacity

Development of the tool

This tool allows for a pairwise comparison of each optional competency within each domain to determine the relative importance and ranked order in which optional competencies can be considered for inclusion in the curriculum.

This tool owes much of its design and function to the Competency Prioritization Tool[9] developed by the Public Health Foundation, which utilizes the pairwise comparison methodology to allow organizations to prioritize competencies in the Core Competencies for Public Health Professionals.

After determining whether competencies in the framework should be core or optional, the prioritization tool was developed in spreadsheet format, with optional competencies listed by domain. Core competencies are listed for reference but are not included in the ranking matrix. Descriptions of the optional competencies appear along the Y-axis, and the identification numbers of these same competencies appear along the X-axis. Within the white cells of the lower left portion of the matrix are dropdown menus which allow users of the tool to rank the relative importance of each competency against all other optional competencies. This is done by comparing the competency listed in the first row and column of the matrix where the given cell intersects.

9 Public Health Foundation. Competency Prioritization Tool. Accessed 10/11/2021. http://www.phf.org/resourcestools/Documents/3-Step_Competency_Prioritization_Sequence.pdf

Once all comparisons are made for a given domain, hidden formulas in the matrix sum the scores of all ratings to provide a score and rank for each competency.

Instructions for use of the tool

Steps:

1. For each optional competency, the numbered competencies are listed in column E (along the y-axis), and in row 5 (along the x-axis).
2. To make each pairwise comparison, the expert will assign a rating from the dropdown menu in the white cells in which the competency on the y-axis (in column E) is compared to the competency along the x-axis (in Row 5). The Likert-type scale options are Much more important, More important, Equally important, Less important, and Much less important.
3. Once all comparisons are made, the tool automatically assigns a score and ranking for each competency, which appears in the columns to the right of the matrix.

Example:

In the following example, a pairwise comparison ranking was made for each of the optional competencies in **Domain 2: Surveillance Systems**, **Competency 2.1.1** was rated as *Much more important* to **Competency 2.1.2**. In the next row, **Competency 2.1.3** was rated as *Equally important* to **Competency 2.1.2**, *Much less important* than **Competency 2.1.1**, and so on.

The pairwise ratings were used to calculate a score for each competency, along with a ranking. Therefore, programme planners may choose to include **Competencies 2.1.3** and **2.1.5** (which were rated the highest) and may decide not to include **Competencies 2.4.2** and **2.1.6** (which were rated the lowest).

Note that this tool is meant to assist in decision-making rather than being prescriptive. Cutoffs for inclusion or exclusion of competencies should be made on a case by case basis depending on country needs and priorities.

Frontline Technical Domain 2

Surveillance Systems

Core competencies
Competency
Subdomain 2.1: Characteristics of a functional surveillance system • 2.1.1 Describe the role and objective of surveillance systems in public health, animal health and environmental health
Subdomain 2.2: Detection and reporting of cases, clusters, and health threats • 2.2.1 Identify health threats (signals) from community and media sources • 2.2.2 Apply case definitions for priority diseases • 2.2.3 Differentiate between types of surveillance (e.g., indicator-based, event-based, etc.) and types of surveillance systems (e.g., sentinel, hospital, lab, risk-based, etc.) • 2.2.4 Perform signal detection from both indicator-based surveillance and event-based surveillance • 2.2.5 Verify signals using signal-alert-event logic
Subdomain 2.3: Surveillance data collection, analysis and interpretation • 2.3.1 Notify authorities of priority diseases that exceeds thresholds • 2.3.2 Analyse surveillance data using descriptive epidemiological and simple statistical methods
Subdomain 2.4: Surveillance reporting • 2.4.1 Prepare basic situation reports for potential health threats
Subdomain 2.5: Monitor and assess the quality of surveillance data • 2.5.1 Ensure the timeliness, completeness and quality of reported data
Subdomain 2.6: Surveillance systems design and evaluation • None

Optional competencies: Prioritization Tool

Competency	2.1.1	2.1.2	2.1.3	2.1.4	2.1.5	2.1.6	2.1.7	2.2.1	2.2.2	2.3.1	2.3.2	2.4.1	2.4.2	2.4.3	2.6.1	Score	Rank
2.1.1 Define what a surveillance system is including its structural and functional components and interactions																30,2	11
2.1.2 Describe the One Health aspects of surveillance systems (coordination and integration of surveillance activities between multiple sectors)	More important															39,7	7
2.1.3 Describe types of surveillance (e.g., indicator-based, event-based), and types of surveillance systems (e.g., sentinel hospital, lab, risk-based, etc.)	Equally important	Less important														20,6	15
2.1.4 Describe the characteristics (e.g, comprehensive vs sentinel surveillance, syndromic vs lab confirmed, case-based vs aggregate surveillance)	More important	Much less important	More important													23,3	14
2.1.5 Define attributes (e.g., timeliness, sensitivity) of a functional surveillance system	More important	Equally important	Less important	More important												44,6	3
2.1.6 Describe the roles and responsibilities of a surveillance system	More important	Less important	Much less important	Less important	Equally important											33,1	10
2.1.7 Describe the surveillance cycle, including administration levels and reporting flows	Equally important	More important	Equally important	Much more important	More important	Less important										39,8	5
2.2.1 Follow reporting channels to report cases and signals to appropriate administration levels	Equally important	Less important	Equally important	More important	Less important	Less important	Equally important									25,9	12
2.2.2 Use diverse sources of information for event-based surveillance	Much less important	Much more important	More important	Equally important	More important	More important	Equally important	More important								42,9	4
2.3.1 Describe the principles of data collection for surveillance and apply them in multiple sectors	More important	Equally important	Equally important	More important	Less important	Less important	More important	Equally important	More important							49,4	1
2.3.2 Describe and identify trends, patterns and thresholds of priority diseases	More important	Less important	More important	Equally important	Equally important	More important	Less important	Equally important	More important	Equally important						39,8	5
2.4.1 Produce surveillance summary bulletins and reports	Less important	Equally important	More important	Less important	Equally important	Less important	More important	Much more important	More important	Less important	More important					47,9	2
2.4.2 Report to next administration level	Equally important	Equally important	More important	Much more important	Less important	More important	More important	Less important	Less important	Much less important	Less important	Much less important				38,2	8
2.4.3 Apply recommendations from the feedback of the higher administration levels	Less important	More important	More important	More important	Less important	Equally important	Less important	Less important	More important	Less important	Much less important	Less important	Much less important			23,4	13
2.6.1 Support the design of surveillance systems using knowledge of the local context, key stakeholders, human resource availability and field logistics	Less important	More important	More important	More important	Much less important	Less important	Less important	Less important	Less important	Less important	More important	Much more important	More important	Equally important		37,3	9