

Guidance for One Health field epidemiology mentorship

A supplemental manual to the *Competencies
for One Health field epidemiology (COHFE) framework*



Food and Agriculture
Organization of the
United Nations



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Organization



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Guidance for One Health field epidemiology mentorship: a supplemental manual to the *Competencies for One Health field epidemiology (COHFE) framework*

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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, Almuhairei 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>

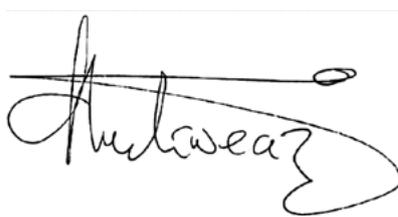
The *COHFE framework* is accompanied by four supplemental manuals:

- *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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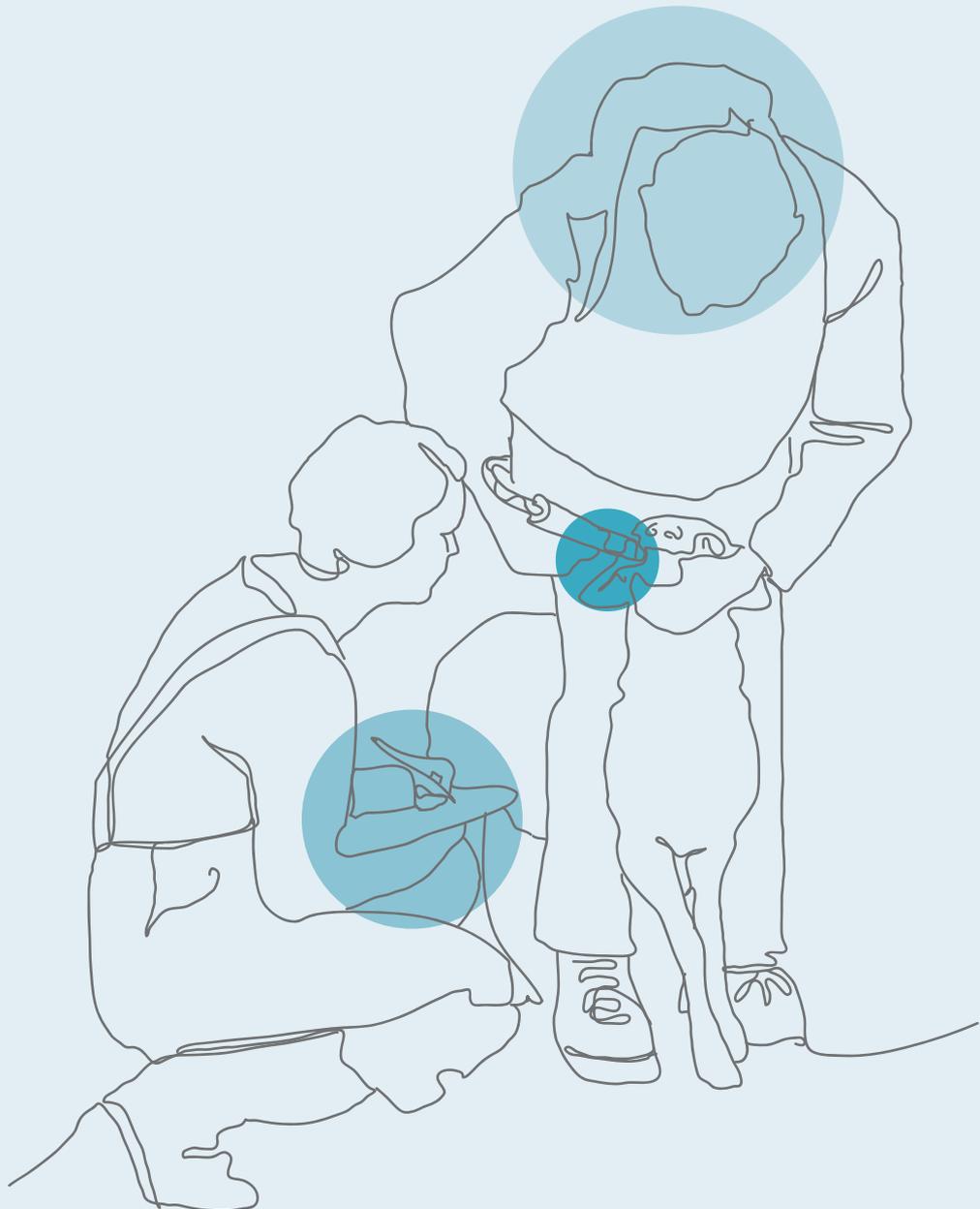
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Acronyms

CDC	Centers for Disease Control and Prevention
COHFE	Competencies for One Health field epidemiology
COVID	Coronavirus disease
EMPHNET	Eastern Mediterranean Public Health Network
FAO	Food and Agriculture Organization of the United Nations
FELTP	Field Epidemiology and Laboratory Training Programs
FETP	Field Epidemiology Training Program
FETPV	Field Epidemiology Training Programmes for Veterinarians
SOPs	Standard operating procedures
TAG	Technical Advisory Group
TEPHINET	Training Programmes in Epidemiology and Public Health Interventions Network
WHO	World Health Organization
WOAH	World Organisation for Animal Health

Introduction

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1.1 Background

Field Epidemiology Training Programs (FETPs) are applied epidemiology programmes aiming to train the public health workforce to prevent, detect and contain infectious disease outbreaks and manage disease surveillance systems (1, 2). Modelled after the Epidemic Intelligence Service of the US Centers for Disease Control and Prevention (CDC), FETPs have expanded globally and now train public health workers from more than 160 countries (3). FETPs are in-service training programmes in which the trainees continue to provide public health services while receiving training. Following the learning-by-doing approach (4, 5), FETPs require that 75% of the training time be spent in field placements under the guidance of a mentor (6). Field epidemiologists are in high demand globally as one epidemiologist is recommended per 200,000 people to support a strong health system (7), but few countries have achieved this benchmark. FETP graduates contribute significantly to this global need (8-11), and have played a crucial role in investigating and controlling the COVID-19 pandemic in several countries (12-14).

Modelled on the pattern of FETPs, Field Epidemiology Training Programs for Veterinarians (FETPVs) have been established in several countries with the support of the Food and Agriculture Organization of the United Nations (FAO). In 2018, FAO reviewed the existing programmes, developed guidelines for FETPVs and identified core competencies required for field veterinary epidemiologists (15, 16). Based on the gaps identified in the FAO Review, the Asia Pacific Consortium of Veterinary Epidemiology (APCOVE; <https://www.apcove.com.au/>) developed training resources for intermediate FETPV programmes and trained FETPV facilitators and mentors to strengthen field epidemiology capacity in the Asia Pacific (17). Since 2018, FAO has also been implementing the In-Service Applied Veterinary Epidemiology Training (ISAVET) programme in Africa to develop the capacity of the frontline animal health workforce (18). Besides standalone veterinary programmes, several other FETPs have special streams for training field veterinary epidemiologists along with public health epidemiologists (19-21). Similarly, Field Epidemiology and Laboratory Training Programs (FELTP), with or without veterinary programmes, have also been established to train the workforce in epidemiology and laboratory skills. Regardless of their names, most

field epidemiology training programmes follow the FETP model and develop applied capacity in outbreak investigation and surveillance under the guidance of mentors.

Both FETPs and FETPVs are competency-based training programmes that aim to build the capacity of the human and animal health workforce by combining classroom activities with on-the-job mentored field activities. In the field, trainees conduct field investigations, manage and analyse surveillance data, and conduct epidemiological studies under the guidance of experienced mentors (22-25). They may also be required to write protocols, prepare investigation reports, make presentations, and draft manuscripts to communicate their findings to a diverse audience (11, 23, 26). This blend of classroom and field activities ensures that the concepts learnt in the classroom are applied directly in the field. In addition, it enables the development of higher-order skills and competencies essential for undertaking the complex and challenging responsibilities of investigating health events, evaluating surveillance systems and analysing surveillance data. Having a skilled mentor to support learning is critical to their success.

The expansion of FETPs and FETPVs around the globe has also posed several challenges. For example, there is an over-reliance on soft international funding without sustainable funding sources and limited in-country institutionalisation of FETPs and FETPVs in many countries. In addition, the core competencies and curricula need to catch up to tackle emerging challenges. A meeting held in 2018 at the Rockefeller Foundation Bellagio Center to address these challenges created the *Global Field Epidemiology Roadmap*, outlining the following long-term vision of the global FETP initiative: “Every country in the world has the applied epidemiology capacities needed to protect and promote the health of its own population and to collaborate with others to promote global health.” (27). The Bellagio meeting coined the phrase “the FETP Enterprise” to represent numerous global partners, agencies, and stakeholders engaged in developing applied epidemiology capacity (28). Later, a Strategic Leadership Group, co-chaired by the US CDC and the World Health Organization (WHO), was formed to provide strategic leadership to the FETP enterprise to guide the development, implementation, and evaluation of FETPs across the globe (29). The roadmap’s recommendations include the “development of a cadre of specially-trained FETP

fellows and alumni” and “continue, strengthen, and expand efforts to assure and improve the quality of FETPs” – both requiring availability and quality of mentors to support field epidemiology trainees.

The rapid emergence of infectious diseases, of which over 60% are of animal origin (30), has posed new challenges for field epidemiology training. Most of these diseases, including COVID-19, emerge at the human-animal-wildlife interface. However, there is a limited capacity among FETP and FETPV trainees to work at this interface and tackle the emerging challenges of climate change, ecosystem degradation, and wildlife health associated with the emergence of infectious diseases (31). FAO is currently developing the Field Training Program for Wildlife, Ecology, Biodiversity and Environment (FTP-WEBE) that will be interoperable with existing public health and animal health programmes and will contribute to strengthening the capacity to work at the human-animal-wildlife interface. In addition, the Tripartite (FAO, WHO and World Organisation of Animal Health, WOA) has jointly developed the Tripartite Zoonoses Guide to support countries in taking a multisectoral, One Health approach to address zoonotic diseases. In 2022, the One Health High-Level Expert Panel introduced a definition for 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” (32). However, further efforts are required to develop a workforce of field epidemiologists that can work across multiple sectors and train mentors to support this effort.

To train field epidemiologists to use a One Health approach, FAO, WHO, and WOA developed the *Competencies for One Health field epidemiology (COHFE) framework*, consisting of 14 domains, to define the knowledge, skills, and competencies required at the frontline, intermediate and advanced training levels. These knowledge, skills and competencies are further classified into core and optional competencies

for One Health and include optional sector-specific knowledge, skills and competencies for human, animal, and environmental health. This framework will enable countries and regions to develop and strengthen field epidemiology training programmes that train candidates to work across multiple sectors for early detection and rapid response to mitigate disease threats. It fills a significant gap in developing a One Health workforce to investigate health threats involving human, animal and environmental sectors or to manage multidisciplinary teams collecting, collating and analysing surveillance information from various sectors. It would also be crucial to build the skills of facilitators and mentors to enable them to employ this framework in training field epidemiologists.

Mentors play an essential role in the training of field epidemiologists (33). Since field epidemiology programmes focus heavily on the learning-by-doing approach, mentors form the backbone of these programmes (34). They oversee their mentees’ progress and support them in conducting field projects and preparing outputs essential to complete the programme requirements (34). They ensure that their mentees achieve the skills and core competencies to work to prevent, detect and contain infectious disease threats and protect animal and human health. They also provide career advice, act as professional role models, and arrange networking opportunities for their mentees. Mentors also help navigate the political climate to gain opportunities for mentees: a mentor’s willingness and ability to advocate and involve a mentee in outbreak investigation or other work can be critical for the experience of the mentee. As mentors are field epidemiologists and have extensive practical experience, they can also provide their mentees with advice to deal with unexpected issues arising in the field and insider information about the country’s animal, human and environmental health systems. Consequently, mentors make a crucial contribution to the success of FETPs and FETPVs, and, more broadly, to strengthen the epidemiology capacity of the One Health workforce.

Given that mentoring is so critical for the success of FETPs and FETPVs, it could be anticipated that the skills and competencies required to be a successful mentor for field epidemiology training are well known. Unfortunately, this is not the case (33). While a body of literature exists on mentoring competencies required for other health disciplines, empirical evidence of the competencies for field epidemiology mentors is very

limited (33). Most currently available guidelines focus primarily on procedural issues (34) rather than skills and competencies, with the exception of one recently developed manual (35). Furthermore, mentorship guidance is required to complement the *COHFE framework* so that mentors are equipped to train field epidemiologists in using the One Health approach.

Therefore, mentorship guidance was developed for Field Epidemiology Training Programs for public or animal health using a One Health approach. This guidance aims to provide evidence-based recommendations on establishing or expanding existing mentorship programmes for field epidemiologists. This guidance has the following objectives:

1. Describe the mentorship process in field epidemiology training programmes.
2. Define the roles and responsibilities of mentors in field epidemiology training.
3. Identify core competencies required for mentors for field epidemiology training programmes.
4. Propose a training programme for field epidemiology mentors.
5. Propose a framework for the evaluation of mentors to improve the mentorship programme.

It is anticipated that this guidance will increase the availability of mentors for improving the training of field epidemiologists and the effectiveness of One Health systems. The impact of good mentorship can reach far beyond the trainee, as it can strengthen institutions, develop local capacity and health systems (36), and ultimately improve the prevention, early detection and effective containment of disease threats and global health security.

1.2 How the guidance was developed

A core technical team from FAO, WHO and WOAHP conducted a systematic literature search to identify publications related to field epidemiology mentorship and One Health mentorship. Supplementary articles were identified through cross-referencing from the selected articles. In addition, grey literature was included in the review, including documents

identified through the internet search, mentorship guides and presentations from five field epidemiology training programs provided by Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET), Manual for the European Centre for Disease Prevention and Control Fellowship Programme, FETP Development Handbook, FETP-Frontline Planning Guide, and FETP Mentor Handbook.

Competencies identified from the literature were selected and shortlisted, adapted for field epidemiology mentors and subsequently classified into four distinct domains. A new mentor evaluation tool was developed based on the review of existing evaluation tools by including additional question items to ensure that all the subdomains of the competencies were evaluated.

A Technical Advisory Group (TAG), consisting of One Health and field epidemiology experts from several countries, reviewed the competencies and the evaluation tool (Annex 2). The TAG was introduced to the mentorship competencies in an introductory virtual meeting and was requested to subsequently review the document and provide feedback by completing an online survey designed using Microsoft Forms. A working group of the TAG met virtually to discuss the guidance. A copy of the survey was also circulated internally in FAO, WHO, and WOAHP to receive input. Meeting notes, survey responses and other feedback were reviewed to update the competency and the evaluation framework.

1.3 Scope of work

This document was developed to assist field epidemiology training programmes in establishing mentorship programmes using a One Health approach. It describes core competencies for mentors that programmes can use in selecting and training field epidemiology mentors. The manual provides examples of existing mentor training programmes and provides guidance for training and evaluating mentors. In addition, the document describes mentor roles and responsibilities, benefits of mentoring for mentees, mentors and organizations, outlines the qualities of a good mentor, explores approaches to strengthen One Health mentoring in field epidemiology training programmes, and assesses the benefits and limitations of virtual mentoring.

While this document outlines the responsibilities of mentors participating in field epidemiology training programmes, it does not provide prescriptive guidance about the procedural or logistic aspects of conducting these activities. Instead, it focuses on the essential qualities and competencies required for effective mentorship and mentor training.

1.4 How to use this document

This document is intended for use by staff responsible for field epidemiology training programmes.

These programmes are encouraged to leverage the information provided regarding mentor qualities and core competencies described in the document to enhance mentor selection and training. Moreover, the guidance about the structure of a mentor training programme can help establish or strengthen training programmes, while the mentor evaluation tool aims to support the evaluation of mentors in field epidemiology training programmes. Additionally, the discussion on the benefits and limitations of virtual mentoring can assist programmes in delivering flexible mentoring programmes. The approaches described in the document for strengthening One Health mentoring should be used to foster collaboration between mentee and mentor across multiple sectors. Although the document primarily focuses on mentoring in One Health field epidemiology training programmes, other field epidemiology training programmes can equally benefit from the manual.

The *COHFE framework* and *Guidance for One Health field epidemiology mentorship* are accompanied by three additional supplemental manuals:

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

1.5 Definitions

The following definitions were specifically developed for use in the *Competencies for One Health field epidemiology (COHFE) framework* and supplemental

guidance manuals. The terms may be used differently in other contexts or publications. Additional terms are defined in the One Health glossary in Annex 1 of the *COHFE framework*.

Domain: A broad topic or subject area from the *Competencies for One Health field epidemiology (COHFE) framework* that is divided into subdomains

Subdomain: In the *COHFE framework*, a narrower topic or subject area than a domain. Subdomains consist of knowledge, skills, and competencies.

Knowledge: 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: Ability to apply knowledge and 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: 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 the use of 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, or competency that a country programme can choose to include in their programmes based on a country needs assessment but which is not considered a required core competency for One Health field epidemiologists

Training levels

Frontline³: 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 month 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.

Additional definitions

Mentor: An experienced epidemiologist who provides technical, supportive guidance to training programme participants, particularly on their field or practice activities.

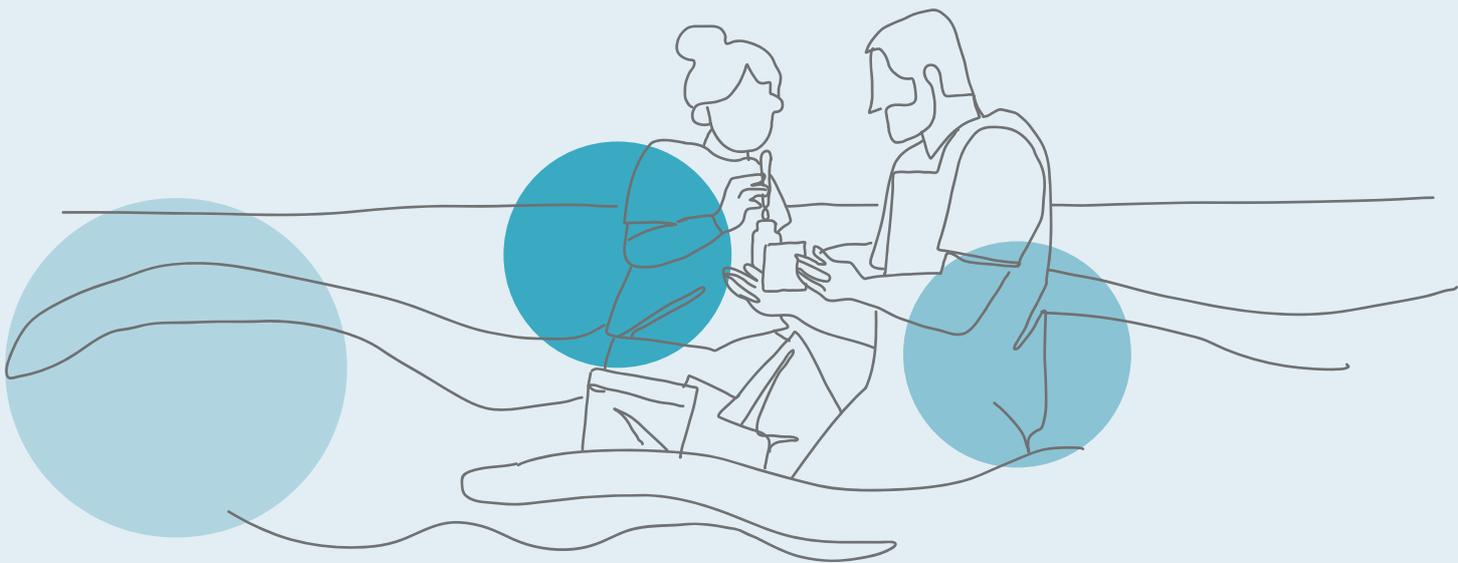
Instructor: an individual responsible for teaching training programme participants, typically in a didactic or classroom setting. They may also guide participants during case studies and simulation exercises.

Supervisor: An institutional mentor; an individual who is familiar with the curriculum, programme objectives and structure and ensures the training participant can complete the programme requirements operationally and logistically; supervisors may also serve as technical mentors for field and practice activities.

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.

2. Mentorship programme

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2.1 What is a mentor?

Mentors are “professionally experienced and respected peers, prepared to set aside their agenda and offer time and attention to the development of their mentee” (37). In the context of FETPs, “a mentor is an experienced epidemiologist who provides technical, supportive guidance to FETP participants, particularly on their field activities” (38). Mentors may also participate in classroom workshops, but this is primarily the role of instructors (also called trainers or facilitators).

Mentors could be full-time training programme employees, sometimes called field coordinators, or work in public health/animal health/environmental ministries, universities or partner agencies and agree to volunteer part-time (38). Some training programmes distinguish between institutional mentors and technical or academic mentors. The institutional mentors (also called supervisors) are familiar with the curriculum, programme objectives and structure, and they ensure the trainee can complete the requirements for graduation, support the trainee to complete the required field studies operationally and logistically within the scope of ministry resources and assess the field performance aspects of training, including developing a work plan, budget, etc. Supervisors may also serve as technical mentors for field and practice activities

FETP-Intermediate and FETP-Advanced trainees and graduates may serve as mentors for FETP-Frontline trainees. The US CDC encourages programmes to assign each participant a primary and secondary mentor to ensure they receive support even when the primary mentor is unavailable (38). Peer to peer mentoring, where FETP candidates support each other, is also valuable in developing a community of field epidemiologists.

2.2 Mentor to mentee ratio

The US CDC recommends that the ratio of trainees to mentors should not exceed five to one (38). This guideline is generally followed. For example, the Namibian FELTP programme reported that their ratio is one mentor to three mentees in the advanced programme and one mentor to five or six mentees in the frontline programme (22). Analysis of data from a 2021 TEPHINET membership survey of 35 programmes

indicated that the ratio ranged between 1:2 and 1:33 across various levels of programmes. Programmes reported having nine mentors for 30 frontline trainees (1:3.33), seven mentors for 15 intermediate trainees (1:2.14) and ten mentors for 20 advanced trainees (1:2). This survey had a fair representation of programme types, as it included 27 typical FETP programme representatives, 6 FELTP programme representatives, 1 FETPV programme representative and 1 representative from a programme involving both laboratory and veterinary participants. Of the 35 programmes, 28 were national and 7 were regional or multi-national. It is recommended that field epidemiology programmes following the One Health approach should aim to achieve a mentor to mentee ratio of about 1:3.

2.3 Mentor roles and responsibilities

Mentorship is critical to the success of a field epidemiology training programme. For effective training, mentors should understand the training programme requirements, as one of their key roles is to help trainees meet those requirements (33). The FETP Development Handbook outlines that the roles of a mentor are to monitor and evaluate trainee activities, help trainees develop project ideas, troubleshoot barriers to completion of projects, and implement or help facilitate the implementation of recommendations (34). They also arrange access to data and resources to ensure achievement of core competencies (33). In addition, mentors support mentees in designing their studies, conducting analyses, and providing feedback on their reports and manuscripts. However, the role of the mentor is to facilitate the learning of their mentees rather than teach didactically (33). The FETP Mentor Handbook (39) lists mentor responsibilities for each task (see Table 1 below).

Besides helping candidates meet the technical programme requirements, a good mentor also ensures the development of trainees as leaders and communicators and provides them with opportunities to grow and network (33). In addition, mentors can enhance knowledge about professionalism, ethics, and values (40). There is an increasing expectation of a holistic mentorship role in supporting mentees (33). Holistic mentorship gives equal weight to all three components of mentoring – continuing education, personal support and professional development (37). It strives to develop capabilities in mentees to face challenges in both work

and life and provides overall support and enrichment to the trainee experience in addition to providing technical support (33). The activities considered most important for adequate supervision by mentees involve an interpersonal connection between the mentor and the mentee (33). A survey identified that the mentor's role is to create an enabling and supportive environment, instilling confidence and self-belief and reminding the mentees to take care of themselves (36). Although studied in a different context, these roles are equally valid for field epidemiology mentors. Mentors are also expected to encourage positive behaviours and provide emotional support and encouragement (40, 41). According to Garmel (41), the mentor's responsibilities include encouraging mentees to reach their potential, supporting their identity development, encouraging personal and professional development, informing them of new opportunities, protecting them from potential threats and serving as their champion or advocate.

2.4 Benefits to mentors and organizations

Although the primary benefit of mentorship is to mentees, mentors also benefit by engaging with mentees. By supporting mentees in conducting a field project, mentors are challenged through developing a study design and solving a complex real-life problem, as there is something new in all projects. As a result of the experience, they develop new skills and abilities (42) and benefit from professional and intellectual stimulation (40).

Mentors also have an opportunity to work with junior epidemiologists, help them to develop a robust professional identity, and motivate and empower them (37), resulting in positive long-term relationships with mentees (41). It enhances self-esteem, makes professional life interesting, increases motivation and passion for the profession (43) and gives them a sense of purpose (40). Mentorship can also help in the career advancement of mentors, though this can also be a challenge, as it may impact the retention of graduates in technical roles before promotion to administrative levels.

Mentorship also benefits institutions and organizations, as they gain from increased productivity, motivation, and leadership skills. Mentorship programmes increase organizational loyalty and reduce staff turnover (43). Therefore, institutions and organizations should recognize

the contributions made by mentors in mentorship programmes and encourage and reward good mentors (41). Additionally, they should allow mentors to contribute time for mentoring and include mentoring as one of the criteria for promotion.

While it is important to consider the benefits of mentoring, it must be noted that a failed mentorship programme due to poor mentor training can have detrimental effects ranging from loss of confidence, dropping out or changing professions, potentially resulting in loss of talented human resources (42). Therefore, efforts should be made to ensure a valuable mentoring experience.

2.5 Qualities of a mentor

Technical skills

Mentors in field epidemiology programmes need technical competencies in epidemiology, including outbreak investigation, diagnostic tests, designing and conducting epidemiological surveys and studies, data management, data analysis, evaluating surveillance systems and risk assessment. In addition, the mentor should understand how to communicate scientific results at conferences, in journals and to the public. As listed in Table 1, they must have skills in preparing an abstract, a manuscript, a PowerPoint presentation, a poster, and an oral presentation. They should also understand the One Health concept and its application. Moreover, mentors must be adept at preparing various reports such as a data quality audit report, surveillance summary report, surveillance system evaluation report, case investigation report, problem analysis report, and outbreak investigation report. They should also be able to design a study (including those investigating knowledge, attitudes and practice) and guide mentees in developing the epidemiological work plan combining several skills. Finally, to successfully mentor FETP trainees, mentors should also have a sound understanding of programme requirements (33) because if the mentor is highly skilled in epidemiology but does not understand the programme requirements, they may be unable to support mentees to fulfil all requirements.

Table 1
Mentor responsibilities for field epidemiology training programme activities, as adapted from the FETP Mentor Handbook (39).

Activity	Programme Level	Mentor responsibilities
Surveillance		
Data quality audit	Frontline	<ul style="list-style-type: none"> Ensures that trainees choose appropriate topics. Works with trainees to customise the standard data quality audit worksheet. Supports trainees by accompanying them on their first site visit, introducing the programme to the field project and senior staff, and assisting trainees with using the data quality audit worksheet correctly. Conducts an after-action review of the first site visit and advises on improvements for subsequent visits. Provides technical assistance throughout the audit and assists trainees with analysis of key findings using the Strengths, Weaknesses, Opportunities, and Threats (SWOT) tool. Evaluates the data quality audit using the evaluation criteria. Discusses developmental feedback with trainees.
Surveillance data analysis	Frontline, Intermediate, and Advanced	<ul style="list-style-type: none"> Works with trainees to define objectives for surveillance data analysis. Discusses approaches for analysis of data. Supports trainees in using a statistical program for data analysis. Ensures that trainees interpret the results correctly. Guides trainees in presenting the results in tables and figures. Evaluates surveillance analysis using the evaluation criteria and provides feedback.
Surveillance summary report	Frontline, Intermediate, and Advanced	<ul style="list-style-type: none"> Meets with trainees to discuss surveillance systems to be described. Reviews drafts of summary surveillance reports. Arranges time for trainees to present findings to those responsible for maintaining the systems. Ensures that officials responsible for the surveillance systems receive copies of reports. Evaluates surveillance summary reports based on the evaluation criteria. Discusses developmental feedback with trainees.
Problem analysis report	Frontline	<ul style="list-style-type: none"> Helps trainee select quality problems from data quality audit reports. Ensures trainees understand both the problem analysis worksheet and the process to complete it. Ensures trainees communicate findings to appropriate stakeholders. Evaluates problem analysis reports based on the evaluation criteria. Discusses developmental feedback with trainees.
Surveillance system evaluation	Intermediate, and Advanced	<ul style="list-style-type: none"> Meets with trainees to discuss surveillance systems to be described. Reviews drafts reports. Ensures that officials responsible for surveillance systems receive copies of reports. Arranges time for trainees to present findings to those responsible for maintaining surveillance systems. Evaluates surveillance systems evaluation reports based on the evaluation criteria. Discusses developmental feedback with trainees.

Activity	Programme Level	Mentor responsibilities
Outbreak investigation		
Outbreak investigation design/ implementation	Frontline, Intermediate, and Advanced	<ul style="list-style-type: none"> Helps trainees design and conduct a multisectoral outbreak investigation. Meets with trainees to review objectives and strategies for field investigations. Reviews the draft plan for outbreak investigation. Arranges logistics and resources for outbreak investigation. Agrees on how often and when to communicate while trainees are in the field. Maintains communication while trainees are in the field. Ensures the collection of appropriate data and samples. Supports trainees with analysing and interpreting outbreak data to identify demographic, spatial and temporal patterns. Meets with trainees to review accomplishments and plan the next steps. Evaluates outbreak investigations based on the evaluation criteria. Discusses developmental feedback with trainees.
Outbreak investigation report	Frontline, Intermediate, and Advanced	<ul style="list-style-type: none"> Meets with trainees to identify the key information to include in the report. Reviews the outbreak investigation results and helps trainees in finalizing the conclusions and recommendations. Reviews outbreak investigation report drafts and provides constructive feedback. Evaluates report based on the evaluation criteria. Discusses developmental feedback with trainees.
Epidemiologic Study		
Scientific protocol	Intermediate, and Advanced	<ul style="list-style-type: none"> Meets with trainees to discuss topics and types of analytic studies. Meets with trainees to review proposals and analytical plans and provide feedback. Evaluates proposals based on the evaluation criteria. Discusses developmental feedback with trainees.
Epidemiologic investigation	Intermediate, and Advanced	<ul style="list-style-type: none"> Meets with trainees to prepare plans for conducting epidemiological investigations. Supports trainees in submitting ethics applications if required. Helps trainees make logistic arrangements for conducting epidemiological studies. Arranges resources for conducting epidemiological investigations. Guides trainees in managing and analysing data collected. Supports trainees in reporting the results. Evaluates epidemiologic investigation based on the evaluation criteria.
Communication		
Data visualization	Frontline, Intermediate, and Advanced	<ul style="list-style-type: none"> Meets with trainees to review various approaches for visualizing data and helps them in selecting the most suitable approach. Supports trainees in using a computer program for visualizing data. Guides trainees in interpreting data visualization. Evaluates data visualization based on the evaluation criteria.

Activity	Programme Level	Mentor responsibilities
Scientific presentation	Frontline, Intermediate, and Advanced	<ul style="list-style-type: none"> • Meets with trainees to discuss appropriate topics for their presentations. • Provides guidance and reviews drafts as trainees prepare their presentations. • Arranges for practice sessions for oral presentations. • Evaluates presentations based on the evaluation criteria. • Discusses developmental feedback with trainees.
Abstract	Intermediate, and Advanced	<ul style="list-style-type: none"> • Evaluates abstracts based on the evaluation criteria. • Discusses developmental feedback with trainees. • Helps trainees submit abstracts to scientific conferences.
Bulletin article	Intermediate, and Advanced	<ul style="list-style-type: none"> • Meets with trainees to discuss appropriate topics for bulletin articles. • Reviews articles and provides feedback on scientific content, effective writing, and policy implications. • Evaluates articles based on the evaluation criteria. • Discusses developmental feedback with trainees.
Peer-reviewed manuscript	Advanced	<ul style="list-style-type: none"> • Meets with trainees to discuss appropriate topics for manuscripts. • Reviews manuscripts and provides feedback on scientific content, effective writing, and policy implications. • Evaluates manuscripts based on the evaluation criteria. • Discusses developmental feedback with trainees.
Lay audience communication	Advanced	<ul style="list-style-type: none"> • Meets with trainees to define the objective and purpose of communication. • Work with the trainee to identify key messages for communication. • Reviews communication drafts prepared by trainees and provides feedback. • Evaluates communication material based on the evaluation criteria. • Discusses developmental feedback with trainees.
Other		
Programme evaluation	Advanced	<ul style="list-style-type: none"> • Meets with trainees to discuss programmes being evaluated. • Reviews the drafts of reports. • Ensures that officials responsible for programmes receive copies of reports. • Arranges time for trainees to present findings to those directing and operating programmes. • Evaluates programme evaluation reports based on the evaluation criteria. • Discusses developmental feedback with trainees.

Personal attributes

Besides the technical skills in epidemiology, personal attributes are required to be good mentors. In a study conducted in the Asia Pacific region with field epidemiology mentees, interpersonal abilities were among the most critical qualities identified for adequate supervision (33). Even if mentors have good technical skills, they only become good mentors if they are inclined to take on the volunteer role, find time for mentoring and are dedicated to supporting their mentees.

Personal attributes such as enthusiasm, compassion and selflessness were considered critical for mentoring excellence in a study based on a review of nomination letters for a prestigious lifetime achievement award in the mentorship (44). Similar qualities of good mentors reported in other studies include empathy, compassion, respect, integrity, and establishing a trusting relationship (36, 45-47). In addition, good mentors should have generosity, interest in helping, research experience, a well-established network (48) and be dependable and knowledgeable (49). Leadership and role modelling were also identified as fundamental characteristics of good mentors (36). On the other hand, potential barriers to the success of a mentorship programme investigated in a different context were micro insults or micro aggressions, which would also apply to field epidemiology programmes (50).

Availability is considered a fundamental quality of good mentors. Making firm time commitments, with regular, frequent, and high quality meetings, was a feature of award-winning mentors (44). Garmel (41) described mentoring for medical students and noted that a mentor should be available and approachable. Similarly, a survey conducted in the Asia Pacific with field epidemiology mentees also indicated that availability is a highly desired trait, as good mentors are expected to be readily available and approachable, making plenty of time available for mentees (33). Arrazola, Polster, Etkind, Moran and Vogt (51) reached the same conclusion for mentoring an intensive training course for applied epidemiologists. On the other hand, a general lack of time or time management strategies to balance mentoring with other pursuits was considered a potential barrier to effective mentoring (50).

It is worth mentioning that many FETP mentors volunteer time to provide mentoring in addition to their regular job responsibilities. This can reduce their

availability and ability to engage effectively with their mentees, which can have an undesirable effect on candidate progress. Therefore, organizations should reduce mentor workloads so that they can contribute time for mentoring candidates. Further, mentorship is especially effective when the mentor and mentees are working on the same or related projects, which can help the mentor fulfil their own job responsibilities.

Soft skills

Providing constructive feedback is a crucial feature of good mentors. Garmel (41) considers that good mentors provide honest feedback in a constructive and caring manner and receive feedback from the mentee without threat. To provide constructive feedback, mentors should be exceptional communicators (52). Active listening is crucial for mentors to understand what the mentee means and to understand and interpret body language and implicit messages, so listening well and demonstrating patience are core qualities of good mentors (40, 41). On the contrary, a lack of comfort with difficult conversations, a lack of training on how to provide feedback and a lack of timely feedback are considered barriers to effective mentoring (33, 50). The challenges of effective feedback include different expectations between mentors and mentees (33).

Mentors should also be able to adapt to meet mentee's educational needs, as they have different backgrounds (40). Mentors should be skilful at identifying their strengths and weaknesses and their learning style and use this understanding to guide them in the right direction. "Being able to adapt supervisory style according to trainees' needs and contextual demands" was identified as the critical ability of a good mentor in a survey of FETP trainees (33). This characteristic is also crucial for providing effective feedback.

Mentors in field epidemiology training programmes that follow the One Health approach need some additional skills and attributes to support mentees from multiple sectors to work across the human-animal-environmental interface. In such programmes, it is essential for mentees to conduct field assignments or projects involving other sectors, e.g., for candidates from the public health sector to conduct investigations in animal and ecosystem health and vice versa. Although it is challenging for mentees to learn the context and the methods used in other sectors, it develops their skills in working across multiple

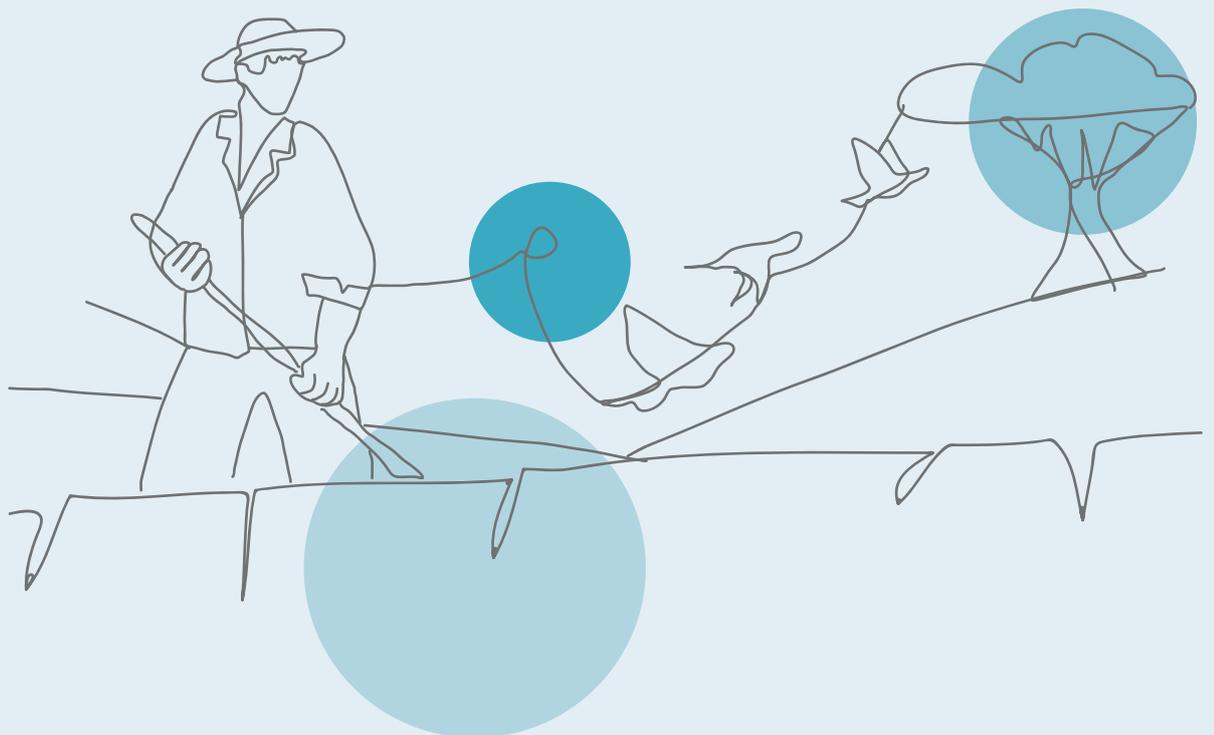
2. Mentorship programme

sectors training, which will be critical for future epidemiologists (53). Similarly, mentoring candidates from different sectors is challenging, as mentors may need help understanding those sectors and contexts.

Therefore, mentors and mentees in such training programmes should attend introductory courses on One Health principles and practices.

3. Mentoring in programmes following the One Health approach programme

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3.1 Approaches to strengthen One Health mentoring

As some usual administrative structures support working in isolation, proactive measures may be required to break the siloes and encourage collaboration and networking among trainees across disciplines. Some examples and ideas to improve partnerships and multidisciplinary activities among mentees are presented below.

One Health mentorship teams

Mentorship teams in field epidemiology training programmes following the One Health approach should be cross-sectoral, multisectoral and multidisciplinary. It is recommended to establish mentorship teams with one Primary Mentor and two Ancillary or Secondary mentors. The Primary Mentor should be from the major discipline of the candidate (e.g., public health), and the Ancillary Mentors should be from two other sectors (e.g., animal and ecosystem health). The Primary Mentor should have the main responsibility for mentorship, but regular input should be sought from the remaining two mentors. Joint mentorship meetings should be organized at least monthly to encourage the candidate to consider issues related to other sectors and help develop their One Health competencies.

Joint simulation exercises

Involving mentees in joint simulation exercises for investigating outbreaks in which different sectors share responsibilities helps develop One Health competencies and improves their capabilities to work in a multidisciplinary environment. For example, Alexander and colleagues (54) piloted a multidisciplinary disaster exercise to train emergency medicine residents in disaster planning. The residents reported high satisfaction and learning collaboration with other community services. Although it may be difficult to organize such exercises specifically for trainees, programmes should try to engage in simulation exercises already planned by countries.

Multisectoral stakeholder consultation meetings

Stakeholder engagement meetings with community representatives from human, animal and environmental health provide a great experience for trainees to network and learn about One Health priorities. It is also important for the mentors to be aware of the pressing issues from the community perspective.

Multisectoral workshops or seminars

Multidisciplinary workshops or brainstorming sessions, e.g., for designing project proposals, encourage mentees to think outside the box and consider issues related to their problem in another sector or discipline. It also introduces ideas for tools and methods used in other sectors that are relevant and applicable to their work. For example, multidisciplinary, cross-cultural workshops organized in Indonesia strengthened research capacity among early career researchers by developing partnerships and initiating new collaborations and networks (55). In Thailand, similar scientific writing workshops, directly related to FETP outputs, are organized.

Joint mentoring sessions

Joint sessions at which mentees present their project proposals to receive feedback can be conducted, inviting professionals from animal health, public health and environmental health sectors. These sessions can complement standard structured learning. This approach has been found to be useful in the research environment for fostering interdisciplinary connections and enhancing participants' ability to conduct interdisciplinary research (56).

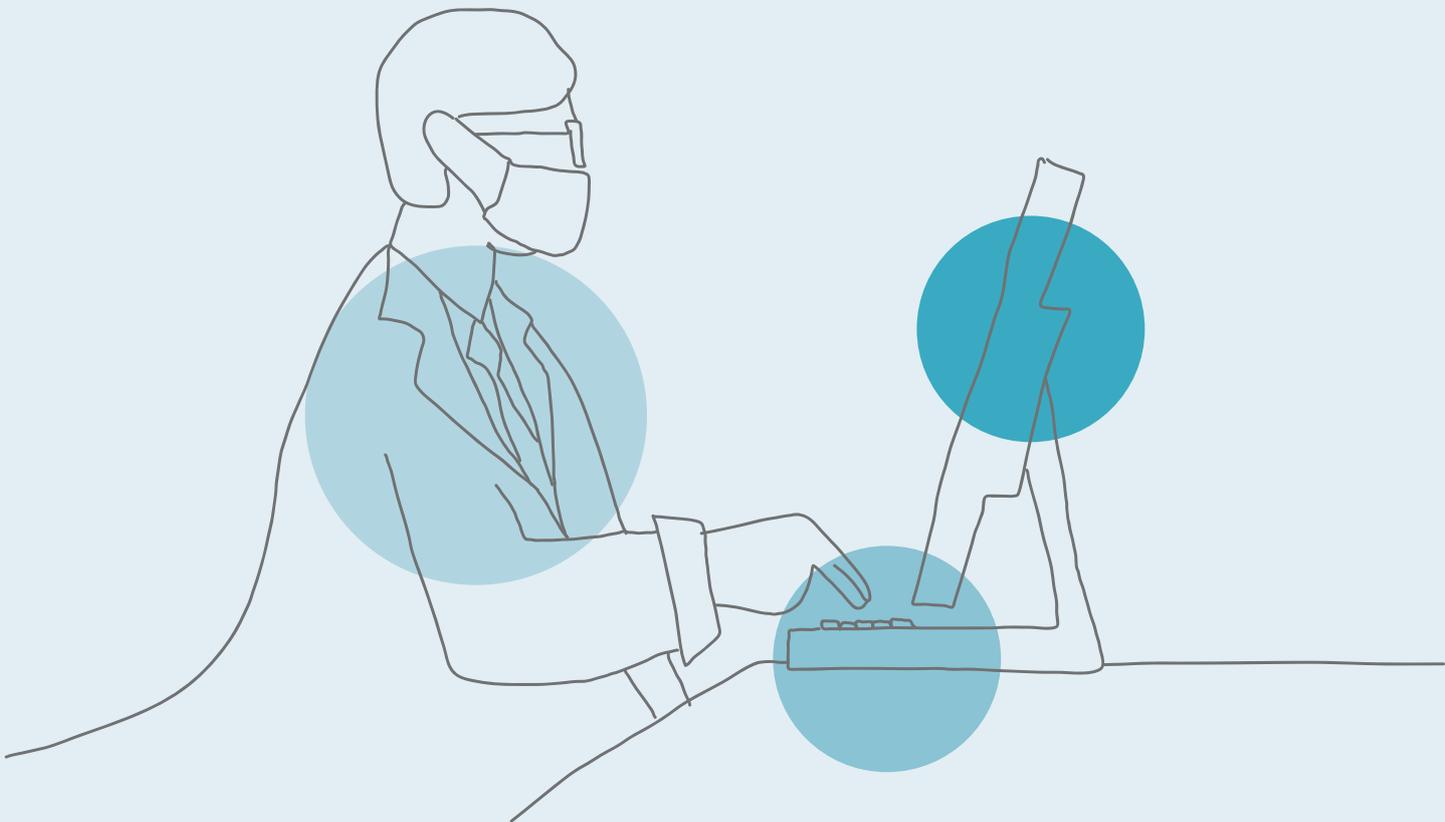
3.2 One Health proficiency levels

Although there is little literature on One Health mentorship, Gebbie and colleagues (57) have defined competencies required for interdisciplinary research, some of which apply to One Health mentoring. They identified that communication and collaboration are essential for interdisciplinary research and suggested that an interdisciplinary scholar should be able to use theories and methods of various disciplines in developing integrated theoretical and research frameworks, communicate and collaborate regularly with scholars from multiple disciplines and participate in training exercises with scholars from other disciplines. Adapting this framework, we defined three hierarchical proficiency levels for One Health mentees. Mentors should encourage their mentees to move up from the beginner to the expert level over time, but the experience of working at any of these levels will be beneficial.

- 1. Beginner:** Mentors should encourage their mentees to broaden their understanding of other sectors by being curious about topical issues involving other sectors and gaining an appreciation of diseases that impact multiple sectors. To achieve this, they could ask them to attend presentations, seminars and conferences involving other sectors and present their work to other sectors.
- 2. Proficient:** Mentors should arrange opportunities for mentees to collaborate with professionals from other sectors, participate in joint classroom and field exercises, conduct joint field investigations and simulation exercises, and prepare joint investigation reports. These activities will give them better insights into the work of other sectors and improve their understanding of the methods and tools used in different sectors.
- 3. Expert:** Mentees should be encouraged to innovatively incorporate methods and approaches used in other sectors in their investigations and integrate concepts and techniques from multiple sectors. At the expert level, a mentee's understanding of different sectors should be very high, with blurred boundaries between sectors.

4. Virtual mentoring

4.1	Benefits of virtual mentoring	20
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4.3	Recommendations for establishing a virtual mentoring programme	21



The inability to meet face-to-face during the COVID-19 pandemic increased the need to provide virtual mentoring via video conferencing, emails, online chats and other digital tools. Although e-mentoring or virtual mentoring was certainly in use earlier, it became the only approach for many mentors and mentees during the pandemic. Mentors continue to use this approach after the pandemic subsided, as it provides some benefits over the traditional approach. However, it cannot be used to impart all skills and competencies and limits opportunities for trainees to develop relationships and networking. Although in-person mentoring should remain the main approach for field epidemiology mentoring, this section discusses the benefits and limitations of virtual mentoring and provides some recommendations for programmes to include virtual mentoring as a component.

4.1 Benefits of virtual mentoring

Several studies have reported virtual mentoring to be beneficial for mentees in various health disciplines (58) and found no significant difference between tele-mentored and non-tele-mentored procedures (59), although the use of smartphones for e-mentoring was not preferred (60). Studies have reported professional development and increased mentee knowledge, skills, level of confidence and expanded networks after a mentorship programme (61, 62). Mentors also reported a gain in confidence in their practice and their ability to mentor (63). Some key benefits of virtual mentoring are:

Flexibility: Virtual mentoring provides flexibility or logistical ease (64) as mentors and mentees do not have to be at the same location; thus, a mentor can provide support even when travelling for work purposes. For example, about one-third of the e-mentored midwives in New Zealand identified geographical isolation as a barrier to being a mentor and being mentored (65), suggesting that e-mentoring can remove the location barrier and allow mentees to choose suitable mentors.

Mentoring within the One Health approach: Two approaches for One Health mentoring discussed above, i.e., organizing joint mentoring sessions and establishing One Health mentorship teams, can be better implemented via virtual mentoring, as it would be challenging to bring mentors and mentees together from different sectors. This could enable the provision of cross-sectoral advice to mentees, which would

strengthen their ability to work with professionals from other sectors and implement the One Health approach for solving real-life problems.

Capacity development: Many resource-limited countries do not have enough professionals to qualify as mentors for field epidemiology training programmes, particularly in the early years of establishing such programmes. This either puts pressure on fewer individuals to support a greater number of mentees than they realistically can, thus reducing the quality of mentoring, or limits the number of candidates who can be enrolled in a training programme. This bottleneck can be resolved through virtual mentoring by engaging mentors from different districts, provinces or other countries. Similar approaches have been tried in other health disciplines (66). FAO's *Epidemiology Mapping Tool and Training Needs Assessment Tool* can be used to evaluate the current capacity and to adapt the training approach to meet the country's needs.

4.2 Limitations of virtual mentoring

Relationships and network building: As observed during the COVID-19 pandemic, virtual meetings work well for completing activities and tasks but pose challenges for developing and maintaining relationships and networks (64). This may negatively affect the quality of communication between the mentor and the mentee, thus impacting the overall mentorship experience of the mentee. Additionally, it may impact the development of valuable networks between trainees. The effect of these limitations can be diminished by interspersing virtual meetings with occasional face-to-face social activities where feasible.

Applied field competencies: Virtual mentoring works well to impart skills such as designing epidemiological studies, managing and analysing surveillance data, and preparing a report or a presentation. However, it is usually not ideal for providing hands-on field epidemiology skills, e.g., in using personal protective equipment, collecting and submitting samples, interviewing farmers, making a clinical diagnosis, or investigating an outbreak. It is preferable for a mentor to accompany a mentee to the field to demonstrate these approaches. Although e-mentoring has been implemented in other health disciplines that similarly require hands-on training, like surgery (67), radiology (60) and occupational therapy (62), it would be useful

for training programmes and accreditation bodies to identify competencies that can be delivered via virtual mentoring and use additional technologies for mentoring.

Technological bottlenecks: In many countries, the lack of reliable internet connection or significant cost of data significantly impedes virtual learning or mentoring. With these constraints, it can be very difficult for mentors to follow up with mentees on their projects, and virtual mentoring may not be successful.

4.3 Recommendations for establishing a virtual mentoring programme

Although face-to-face mentoring remains the default approach for most field epidemiology training programmes, virtual mentoring could also support candidates in geographically isolated locations, strengthening mentoring involving multiple disciplines or capacity development in resource-limited countries. It can be used alone or along with face-to-face mentoring to provide more flexibility and improve communication between mentors and mentees, but programmes must identify skills and competencies that could be imparted via virtual mentoring before including a virtual mentoring component in their programmes. Here are some recommendations for establishing a virtual mentoring programme:

- Field epidemiology training programmes must identify activities that can be conducted via virtual mentoring and those that are better conducted via face-to-face mentoring.
- Preferably, start the mentoring process in person (68) to enable the mentor-mentee pairs to develop relationships before transitioning fully into an e-mentoring mode.
- Train mentors in using e-mentoring (66). Just as e-learning is not the same as face-to-face learning, and special training is required to develop the skills, mentors should be trained for successful e-mentoring.

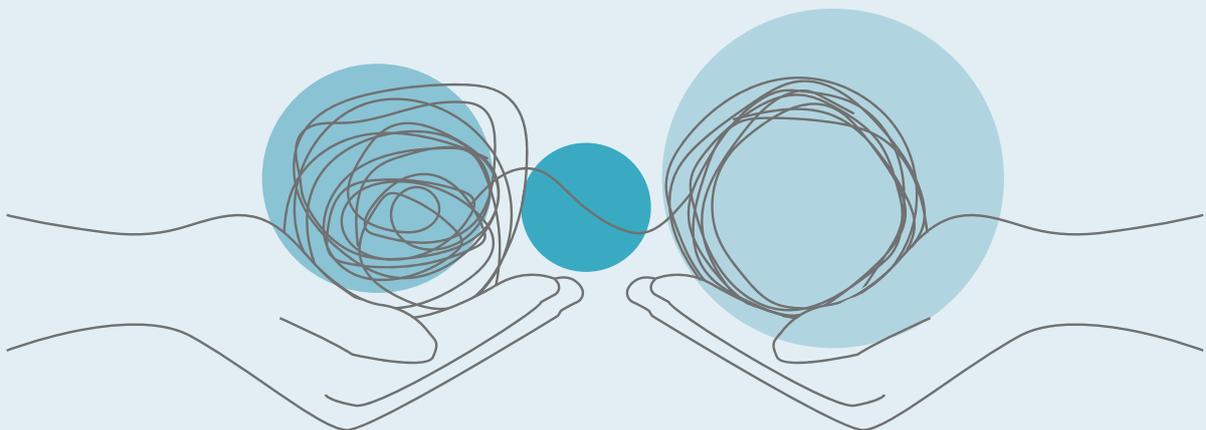
- Organize an orientation session for mentees (66) to sensitize them about special issues and requirements of e-mentoring and the tools used for virtual mentoring (e.g., Zoom, MS Teams, Padlet).
- Mentors and mentees should discuss expectations and identify the best communication method.
- Mentors and mentees should look for opportunities to meet in person (e.g., at conferences), even if the mentoring is done completely online.
- Consider mutual interests, experiences and expectations in pairing mentor and mentee (69).
- Ensure open and clear communication. This is important for any mentoring, but it is critical for e-mentoring.
- The host organization should oversee the e-mentoring programme through regular evaluation (70).

Virtual mentoring is undoubtedly more challenging than traditional face-to-face mentoring. Both the mentor and the mentee must dedicate time and resources to make it successful. Mentors shifting from the traditional to the virtual mentoring approach could “reassess, realign, and reimagine” their mentoring relationship to enhance its effectiveness (71). Programmes aiming to develop e-mentoring training for mentors could refer to the core competencies for e-mentoring for medical educators (72).

In general, field epidemiology training programmes using the One Health approach should continue to use the in-person mentoring approach to ensure development of peer-to-peer networks, trainee confidence and interpersonal skills. Virtual mentoring may be introduced, if indicated, for some competencies and skills after considering the above recommendations.

5. Core competencies for mentors

Domain 1: Professional expertise	24
Domain 2: Planning and communication	26
Domain 3: Professional development	27
Domain 4: Professional Integrity	28



Competency is the proven ability to apply knowledge, skills, personal, social and methodological abilities (attitudes/behaviours) in work or study situations and professional and personal development regarding responsibility and autonomy. A core competency is the minimum required level of competency expected to be achieved by the participants in training programmes. Except for the recently published manual listing skills for successful mentoring (35), we are unaware of any work done to identify core competencies for field epidemiology mentors, although scholars in other health disciplines have defined competencies for mentors.

Mentor and trainer competencies are crucial for the successful training of field epidemiologists. A recent TEPHINET survey asked FETP alumni to rank ten learning needs. Trainer/mentor capabilities were rated highest by the respondents: “Those responsible for teaching/developing learners need the right competencies, skills, and relevant tools to create effective training materials, deliver impactful training, and support learner development and confidence to succeed.” This suggests that respondents considered mentor and trainer competencies crucial for successfully training field epidemiologists. Improving mentor capability through standardised training and education is critical to establishing and maintaining a successful mentorship programme (49).

Although the technical competencies for field epidemiology mentors differ from those required for mentors in other disciplines, several functional competencies are expected to be similar. The following competencies were identified through a review of available literature. *Lengerich, Siedlecki* (43) proposed competencies for chronic disease epidemiologists involved in a mentorship programme, including planning, analysis, communication, basic public health, informatics and computer knowledge, and cultural diversity. *Hamer, Hansoti* (36) delineated nine core global health research mentoring competencies: maintaining effective communication, aligning expectations with reasonable goals and objectives, assessing and providing skills and knowledge for success, addressing diversity, fostering independence, promoting professional development, promoting professional integrity and ethical conduct, overcoming resource limitations, and fostering institutional change. *Abedin, Biskup, Silet, Garbutt, Kroenke, Feldman et al.* (73) derived 19 competencies for mentors of junior clinical and

translational science investigators, divided into six thematic areas: communication and managing the relationship, psychosocial support, career and professional development, professional enculturation and scientific integrity, research development, and clinical and translational investigator development. *Fleming, House, Hanson, Yu, Garbutt, McGee et al.* (74) determined the psychometric properties of a mentor skills inventory with 26 items. Their analyses were valuable in determining competencies for FETP mentors and identifying items for mentor evaluation.

A draft list of competencies was prepared based on the literature review. The list was discussed by the core technical team from FAO, WHO and WOAHA and reviewed by the TAG. The final core competencies for mentors were grouped into four domains:

1. professional expertise
2. planning and communication
3. professional development
4. professional integrity.

Domain 1: Professional expertise

Professional expertise in field epidemiology is essential for mentors to effectively train mentees in conducting outbreak investigation, surveillance, epidemiological studies, data management, data analysis, biosafety and biosecurity. Competencies required for conducting epidemiological studies are grouped with those required for conducting field/outbreak investigation in the subdomain Field investigation.

As this is the only domain dealing with technical competencies, it was impossible to make it comprehensive. Please refer to *COHFE framework* for detailed competencies expected from field epidemiologists. Although different technical competencies are required for mentors guiding frontline, intermediate and advanced level candidates, no such distinction is made in the competencies listed in this domain for the sake of brevity. Refer to the competencies as detailed in the *COHFE framework* for different levels, considering that intermediate level graduates can mentor frontline candidates, and advanced level graduates can mentor intermediate trainees.

This domain is less critical for people trained in field epidemiology as they will likely have all these competencies, and many more, but it is particularly

important when engaging experts from other disciplines. They may be enrolled as mentors if they at minimum have the core competencies described in this domain. Programme directors may nominate

mentors with some but not all of the technical competencies described in this domain, but in these cases, additional support from a co-mentor or associate mentor should be sought.

Table 2
Professional expertise domain competencies for One Health field epidemiology mentors.

Subdomain	Competency
1.1 Field investigations	1.1.1 Supports mentees in formulating and refining field investigation questions
	1.1.2 Guides mentees in designing and conducting epidemiological investigations, including surveys, studies, and outbreak investigations
	1.1.3 Trains mentees in writing field investigation reports
	1.1.4 Reviews and evaluates field investigation reports based on the set evaluation criteria
1.2 Surveillance	1.2.1 Guides mentees in evaluating surveillance systems based on best practices and recommends actions for improvements
	1.2.2 Facilitates development of mentee's skills in developing and applying case definitions to identify different types of cases
	1.2.3 Reviews surveillance system evaluation reports and provides feedback
	1.2.4 Assesses surveillance system evaluation reports based on the evaluation criteria
1.3 Data management and analysis	1.3.1 Guides mentees in assessing and improving the quality of data collected during epidemiological investigations
	1.3.2 Supports mentees in developing and implementing analysis plans, conducting analyses and interpreting the results
	1.3.3 Guides mentees to select appropriate statistical methods to analyse surveillance data, draw conclusions and make actionable recommendations
	1.3.4 Reviews analyses and analytical reports and provides feedback for developing data analysis and interpretation skills
	1.3.5 Supports mentees in presenting their results, including preparing abstracts, presentations and journal articles
1.4 Biosafety and biosecurity	1.4.1. Ensures the availability of biosafety and biosecurity equipment and materials for different types of investigations
	1.4.2 Guides mentees in using biosafety standard operating procedures (SOPs) for sample collection, handling, labelling, storage, transportation and waste disposal
	1.4.3. Supports and guides mentees in implementing biosecurity SOPs in the field
	1.4.4 Monitors the application of biosafety and biosecurity SOPs by mentees in the field or laboratory

Domain 2: Planning and communication

Planning and communication are fundamental competencies for a mentor. Although these are not technical competencies, they differentiate a good mentor from a poor mentor. Good mentors set clear expectations, and help mentees develop and monitor project timelines and disseminate their findings.

Empirical research has shown that good mentors make time available for mentees (33, 41, 44, 51), whereas lack of time commitment is a barrier to effective mentoring (50). Mentorship is especially effective when the mentor and mentees are working on the same or related projects, which can help the mentor fulfil their own job responsibilities.

Effective communication and constructive feedback are critical in mentorship. Mentors should actively listen, interpret implicit and explicit messages and provide feedback in a considerate manner (40, 41, 52). Poor quality feedback and not providing feedback in a timely manner are reported barriers to effective mentoring (33, 50).

One Health is included here as a subdomain because the associated competencies relate to cross sectoral communication. In alignment with the three hierarchical levels of One Health mentoring described in section 3.1, the competencies in this subdomain can also be viewed in three levels: beginner (2.6.1–2.6.2), proficient (2.6.3–2.6.4) and expert (2.6.5).

Table 3
Planning and communication domain competencies for One Health field epidemiology mentors.

Subdomain	Competency
2.1 Availability	2.1.1 Develops a mutually agreeable meeting plan and meets with mentees according to the agreed schedule
	2.1.2 Reviews meeting notes and action items at each meeting
2.2 Communication	2.2.1 Maintains effective communication with mentees and pursues strategies to improve communication
	2.2.2 Listens attentively and pays attention during meetings
	2.2.3 Communicates with empathy and compassion
2.3 Planning and goal setting	2.3.1 Helps mentees define realistic goals and objectives
	2.3.2 Sets clear relationship expectations
	2.3.3 Supports mentees in developing realistic timelines
	2.3.4 Monitors timelines to ensure their achievement
2.4 Feedback	2.4.1 Provides constructive feedback for written and oral work
	2.4.2 Reviews submitted work before meetings and provides thoughtful advice for improvement
	2.4.3 Assesses mentees' knowledge, skills and competencies
	2.4.4 Motivates mentees to improve their work
2.5 Project planning and implementation	2.5.1 Provides guidance in preparing project proposals
	2.5.2 Supports mentees in preparing proposals for ethical review
	2.5.3 Arranges resources to conduct projects
	2.5.4 Guides mentees in disseminating the findings of their projects

2.6 One Health	2.6.1	Provides opportunities for mentees to attend seminars and conferences in other sectors
	2.6.2	Establishes and coordinates One Health mentoring team involving professionals from other sectors
	2.6.3	Encourages mentees to present their work at seminars and conferences of other sectors
	2.6.4	Facilitates mentees' collaborations with professionals in other disciplines
	2.6.5	Facilitates joint investigations involving professionals from other sectors
	2.6.6	Encourages mentees to incorporate methods and tools from other sectors in their projects

Domain 3: Professional development

Traditionally, professional development was not considered a core responsibility of a mentor, but it has acquired a key place in the evolving role of the mentor, particularly within the concept of a holistic mentor (33, 37). A holistic mentor is expected to not only train mentees in technical competencies required to perform the job but also to nurture development as leaders in their field. Holistic mentors create an enabling and supportive environment, instill confidence and belief in self, and provide emotional support and encouragement (36, 40, 41). These

attributes can also enable mentees to eventually become mentors themselves.

Good mentors encourage them to reach their potential and act as their champions (41). Some of the competencies included in this domain overlap with those listed elsewhere planning and communication, but the emphasis in this domain is on the development and growth of the mentee. Some of these competencies can be developed through leadership training of mentors. Advanced level graduates could benefit from mentor training prior to being engaged as a mentor for frontline and intermediate level mentees.

Table 4
Professional development domain competencies for One Health field epidemiology mentors.

Subdomain	Competency	
3.1 Fostering independence	3.1.1	Helps mentees establish career goals and motivates them to achieve them
	3.1.2	Guides the development of self-confidence
	3.1.3	Guides the development of professional skills
	3.1.4	Provides guidance in navigating the institutional environment
3.2 Fostering development	3.2.1	Guides the implementation of a career development plan
	3.2.2	Helps mentees to prioritise and manage time
	3.2.3	Helps mentees to develop communication skills
	3.2.4	Supports mentees in developing conflict management skills
	3.2.5	Supports mentees in establishing a work-life balance
3.3 Fostering collaboration	3.3.1	Coordinates or works collaboratively with other mentors
	3.3.2	Identifies critical gaps in the knowledge and skills of the mentoring team and assists with recruiting co-mentors
	3.3.3	Provides networking opportunities to expand mentee's professional network
	3.3.4	Refers mentees to other experts for advice when needed

Domain 4: Professional integrity

This domain is about setting standards of integrity and the professional values expected from a field epidemiologist. Field epidemiologists perform crucial roles in society. Many times, they work in situations where having public trust is paramount for the communication and implementation of their decisions and recommendations. A lack of public trust in field epidemiologists could act as a barrier to the adoption of their advice during outbreaks, which would make it difficult for One Health authorities to establish control.

Therefore, it is essential for field epidemiologists to have the competencies listed in this domain to gain societal trust.

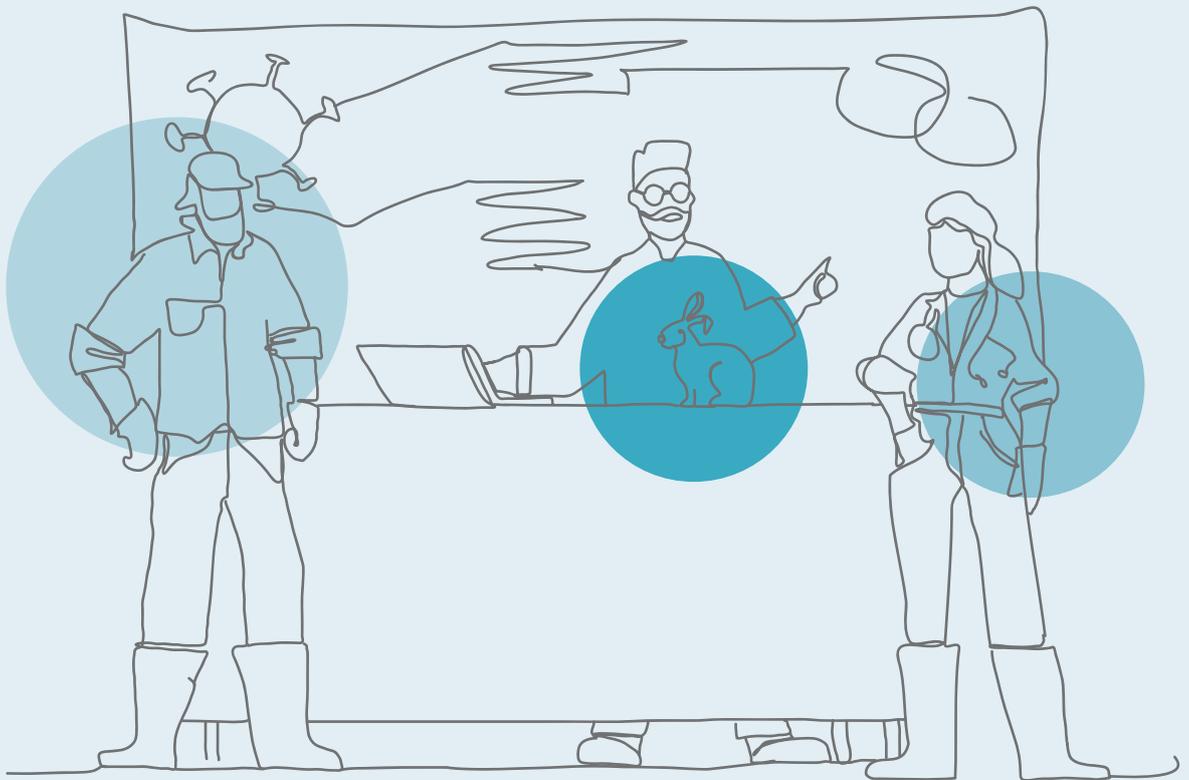
A mentor should act as a role model by acting with honesty and integrity, conducting research conscientiously, and paying due regard to cultural diversity and cross-cultural and cross-gender communication. Inculcating these values in the mentee by demonstrating and practising these behaviours will bolster the ethical standards of the profession.

Table 5
Professional integrity domain competencies for One Health field epidemiology mentors.

Subdomain	Competency
4.1 Professional and ethical integrity	4.1.1 Demonstrates honesty and openness with mentees
	4.1.2 Acknowledges mentee's professional contributions
	4.1.3 Serves as a role model for personal and work behaviours
	4.1.4 Supports the reporting of inappropriate behaviour and harassment
4.2 Animal, human and environmental ethics	4.2.1 Guides responsible conduct of research
	4.2.2 Raises awareness about the importance of ethical guidelines, maintaining confidentiality and institutional rules
4.3 Cultural and gender sensitivity	4.3.1 Demonstrates skill and sensitivity with cross-cultural and cross-gender communication
	4.3.2 Demonstrates willingness for ongoing learning and training in critical diversity
	4.3.3 Embraces diversity by encouraging collaboration with individuals of different races, ethnicities and genders
	4.3.4 Recognizes own biases, whether conscious or unconscious and is willing to work to overcome them

6. Training mentors

6.1	Existing mentor training programmes	30
6.2	Mentor training programme	31
6.3	Mentor evaluation	32



Mentorship training is essential to ensure mentors successfully guide their mentees in field epidemiology training. Mentors are expected to have technical and soft skills to be selected to mentor candidates in field epidemiology training programmes. Nevertheless, they need training on the programme expectations, their responsibilities in guiding trainees in their project and their role in professional development. A training guide or workshop is indispensable, especially for first-time mentors.

Mentor training for One Health and other field epidemiology training programmes can be delivered jointly, as the mentorship competencies are fundamentally similar across programmes, with the exception of some additional competencies for collaboration and coordination necessary for One Health field epidemiology mentors.

6.1 Existing mentor training programmes

TEPHINET has a training module for FETP programme mentorship, which can also be used for FETPV programmes. Several FETP and FETPV programmes have adapted this training module and developed guides to support mentors. They also run workshops and training programmes to upskill their mentors. For example, the Egypt FETP programme organizes a workshop focusing on how to be a good mentor and the characteristics of good and poor mentors. The workshop also includes information about the mentorship process, such as establishing a relationship and setting goals and ground rules. In addition, they provide information about specific mentor responsibilities such as classroom workshops, communication, technical support, professional development, and working with onsite supervisors and FETP leadership. India's Applied Epidemiology Programme organizes a similar workshop but further emphasizes the importance of communication between mentor and mentee and resolving conflicts. They also discuss mentor roles in various technical activities. India's National Institute of Epidemiology has developed a manual for mentors that provides information about the FETP programme and outlines their responsibilities. Similarly, the Tanzania FETP has developed a mentor handbook that discusses the programme design, mentorship basics, mentor responsibilities, and mentorship resources. They also have a mentor-mentee agreement form which outlines commitments and is jointly completed by them. South

African FETP has a similar field supervisor handbook that provides information about their programme objectives and structure, core competencies and learning activities, trainee supervision, field site placements and field supervisor training and responsibilities. FAO's Frontline ISAVET programme has developed a mentor training manual (35) and a 5-day, in-person, highly interactive mentor training course with lessons, exercises, role plays, and group discussions.

The East Mediterranean Public Health Network (EMPHNET) conducts a formal 3-day mentorship training workshop (<https://lms.emphnet.net/mod/page/view.php?id=1208>). The workshop's overall objective is to "build the capacity of the mentors to effectively and efficiently mentor the FETP residents during their fieldwork and support them to design and manage their projects." The specific objectives are to "(a) comprehend the FETP programme structure and design, (b) comprehend the roles and responsibilities of the FETP Mentor, (c) demonstrate the characteristics of an effective mentor, (d) explain the fieldwork assignment and assessment tool and (e) provide constructive feedback on mentee's skills and development needs for the successful completion of the participant's projected in the fieldwork." The topics of the workshop, completed in nine sessions, include: Overview of mentoring, Tips for successful mentoring, Effective feedback, Mentor role and competencies, and Mentor training.

The National Centre for Epidemiology and Population Health at the Australian National University conducted a formal mentor training workshop in Australia in 2019 (75). Like the EMPHNET mentorship training programme, their aim was "to develop and strengthen the knowledge, skills and competence required for confident and effective training and mentoring of field epidemiology trainees." Their objectives were: (1) "To strengthen the knowledge and skills to design, plan, deliver and evaluate training materials and courses for respective field epidemiology training programmes; (2) To initiate opportunities to share best practices, teaching ideas and lessons learned between FETPs; and (3) To build people-to-people partnerships between FETP/ faculty in Australia, Laos PDR, Cambodia, Vietnam, Papua New Guinea, Solomon Islands and the Pacific Island Countries and Territories." Unlike the EMPHNET programme, this workshop had a greater focus on developing teaching skills and networks. However, as in the EMPHNET programme, it focused on characteristics of good and

poor mentors and constructive feedback, suggesting that these are the core topics for a mentorship training programme for FETPs.

Another Australian mentor training workshop, this one for FETPV mentors, was run online over four days in 2022 by APCOVE. The overall goal of this workshop was to “improve mentors’ skills and confidence for guiding candidates and maintaining candidates’ motivation”. The learning outcomes of the workshop were to: “(1) Outline strategies to increase effective mentoring in my practice; (2) Demonstrate skills for giving and receiving constructive feedback; (3) Describe how the experiential learning cycle can improve mentoring, and (4) Write a learning contract to guide a mentoring relationship.” As expected, there is much overlap between this mentor training programme and the two discussed above as well as other FETP mentor training programmes, although this workshop was targeted at mentors for FETPV programmes.

As is evident, various FETP programmes provide resources and training for their mentors. Although their approaches differ, most programmes focus on developing technical and soft skills. Based on the existing mentorship programmes in FETP programmes and considering the core competencies defined above, we have developed a training programme to ensure the development of a holistic mentor. This training programme may be implemented at the country or regional level.

6.2 Mentor training programme

Professional expertise

Mentors selected for FETP programmes should have the technical skills and competencies listed in Domain 1. However, the mentor training for this domain should focus on (a) the expectations, rules and regulations of the programme, (b) the mentor’s responsibilities in supporting their mentees in conducting the field or classroom activities, (c) and their role in guiding their mentees in preparing various reports, evaluating and assessing reports, and providing feedback. These outcomes were shared in the various mentor training workshops, as listed above. For example, the EMPHNET programme objectives were to “comprehend the FETP programme structure and design” and “comprehend the roles and responsibilities of the FETP Mentor”. It should also be an opportunity to identify activities

for which the mentor does not have sufficient skills, so a secondary mentor can be identified to support mentees in those activities.

Planning and communication

Developing a mutually agreed plan for mentorship and setting up ground rules is essential for developing a healthy relationship and setting mutual expectations. The plan can also be a support if disagreements or conflicts arise between mentors and their mentees. The plan should include information about the frequency of meetings and the roles and responsibilities of mentors and mentees. It should set clear relationship expectations aligned with mentorship goals and objectives. It could be based on a plan template used in an existing FETP programme. Mentor training should focus on developing this plan in consultation with the mentee.

Mentor training should also focus on maintaining effective communication with the mentee. Communication is the key factor that differentiates good from poor mentors. Effort should be made to train mentors in active listening, empathy and strategies to improve communication.

Providing good quality constructive feedback is crucial for the success of a mentorship programme and is a component of most FETP mentoring programmes discussed above. Timely and constructive feedback is crucial for a good mentorship experience and the development of trust and transparency in the relationship between mentor and mentee. However, it is a skill that can be learnt, so mentorship training should train mentors to provide constructive feedback.

Continuing professional development

The role of a mentor in the continuing professional development of their mentees is important, but it is not easy to train mentors in this competency. Importantly, mentors should be made aware of the need to support continuing professional development of their mentees, so they can look for opportunities to build their mentee’s professional profiles. Professional development training should focus on developing career and project plans, managing time, developing communication and leadership skills, developing collaborations and networks, and maintaining work-life balance.

Professional and ethical integrity

Mentors are expected to have professional and ethical integrity, but they should also be trained to ensure they also develop this competency in their mentees.

Mentors should be sensitized on the need for ethics approvals for research involving human and animal subjects and the procedures for developing and submitting ethics applications. Mentors should also be trained in cultural diversity to work with mentees from different cultures, ethnicities, or genders.

Recommended contents and structure of the training programme

The following training programme content and structure were developed, based on existing programmes, to enable mentors to achieve the desired competencies. This guidance may be further adapted according to the programme needs. Programmes may develop customized handbooks or guides for their mentors.

6.3 Mentor evaluation

An educational or training programme is incomplete without evaluation because feedback and evaluation help improve the programme's quality. Mentorship

programmes are no exceptions and benefit immensely from mentee feedback, as it enhances mentor competencies and identifies issues needing to be addressed.

Mentorship evaluation programmes are based on desirable mentor characteristics or competencies. Several evaluation tools have been developed for evaluating mentorship programmes, including in some FETP mentorship programmes. For example, the Egypt FETP programme has a mentor feedback form that enables mentees to evaluate mentors on personal communication (10 items), skill development (4 items), intellectual development (5 items) and personal career development (3 items). Similarly, the Tanzanian FETP programme has an evaluation form to be completed by the mentee containing 12 items. The South African FETP programme has a supervisor evaluation form to be completed by training participants. It is specifically focused on evaluating mentor support for tasks such as field investigation, surveillance system evaluation, and analysis of epidemiological data.

Besides FETP mentor programmes, several tools for mentor evaluation have been developed in other mentorship programmes. For example, Yukawa, Gansky, O'Sullivan, Teherani and Feldman (76) created and provided validity evidence for a Mentor Evaluation Tool to assess the effectiveness of mentoring

Table 6
Recommended training programme for field epidemiology mentors.

Domain	Suggested topics for training	Approx. time
Professional expertise	Expectations, rules and regulations of the programme	½ day
	Supervising field projects and evaluating reports	½ day
Planning and communication	Qualities of a good mentor	½ day
	Developing a mentorship plan	½ day
	Providing constructive feedback	½ day
	One Health and the importance of joint training	½ day
	One Health coordination and collaboration	½ day
Professional development	Developing career and project plans	½ day
	Time and project management	½ day
Professional integrity	Ethics approvals	½ day
	Cultural and gender sensitivity	½ day

Table 7
Mentor evaluation tool for field epidemiology training programmes.

Domain	Mentor evaluation items ¹
Professional expertise	<ol style="list-style-type: none"> 1. My mentor assisted me in the identification of research topics and in preparing project proposals. 2. My mentor guided me in developing and implementing my fieldwork. 3. My mentor helped me develop my capacity in data analysis and interpretation.
Planning and communication	<ol style="list-style-type: none"> 4. I was able to communicate regularly with my mentor. 5. My mentor helped me formulate clear goals. 6. My mentor routinely monitored my progress and reviewed proposed timelines and milestones. 7. My mentor provided constructive feedback on my work such as project report, abstract, manuscript, poster, or oral presentation. 8. My mentor established a mentorship team involving mentors from multiple sectors. 9. My mentor encouraged me to collaborate and participate in activities involving professionals from multiple sectors.
Professional development	<ol style="list-style-type: none"> 10. My mentor assisted me with setting my professional development goals. 11. My mentor helped me become increasingly independent in my work. 12. My mentor took a sincere interest in my career. 13. My mentor provided insights into building a successful career. 14. My mentor facilitated the building of my professional network. 15. My mentor helped me to work effectively with other individuals.
Professional integrity	<ol style="list-style-type: none"> 16. My mentor acknowledged my contributions appropriately. 17. My mentor provided guidance on responsible conduct of research. 18. My mentor demonstrated skill and sensitivity with cross-cultural and cross-gender communication.
Overall	<ol style="list-style-type: none"> 19. Overall, I am satisfied with my mentor. 20. I recommend my mentor for future mentorship activities.

1 Training programmes may adapt this tool to suit their needs and add additional One Health evaluation questions.

in health sciences. They shortlisted 13 items mapped to the five mentoring domains and six competencies.

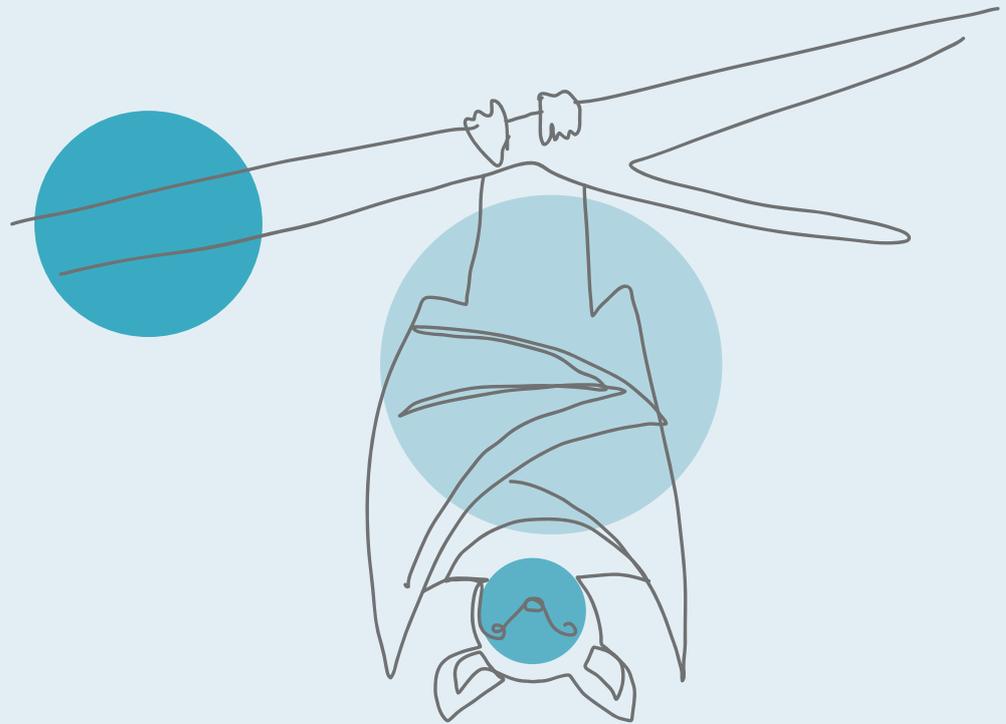
Table A1.1 in Appendix 1 lists and compares mentor evaluation items from two FETP programmes with those developed by Yukawa, Gansky (76), classified according to the competency domains defined above. There are several shared items across all evaluation tools, but some are unique to FETPs or Yukawa, Gansky (76) programmes. In addition, the three evaluation tools covered most of the subdomains of mentor competencies defined above, except the professional integrity domain.

We developed a new mentor evaluation tool based on the review of existing evaluation tools (Table 7). New question items were added to ensure that all subdomains of the competencies identified for mentorship programmes are evaluated. The response

options for these questions should be on a Likert scale, ranging from strongly disagree to strongly agree.

This tool needs to be assessed and validated. Field epidemiology training programmes could expand it to include a list of indicators suiting their needs and adjust the questions to ensure that they measure the indicators. For example, a mentee may have three mentors representing the three sectors, requiring further adaptation to evaluate their combined performance under a One Health approach. It will also be important for the mentee and mentor to evaluate and document the quality of the One Health coordination and collaboration to provide the lessons learned to the programme coordinator.

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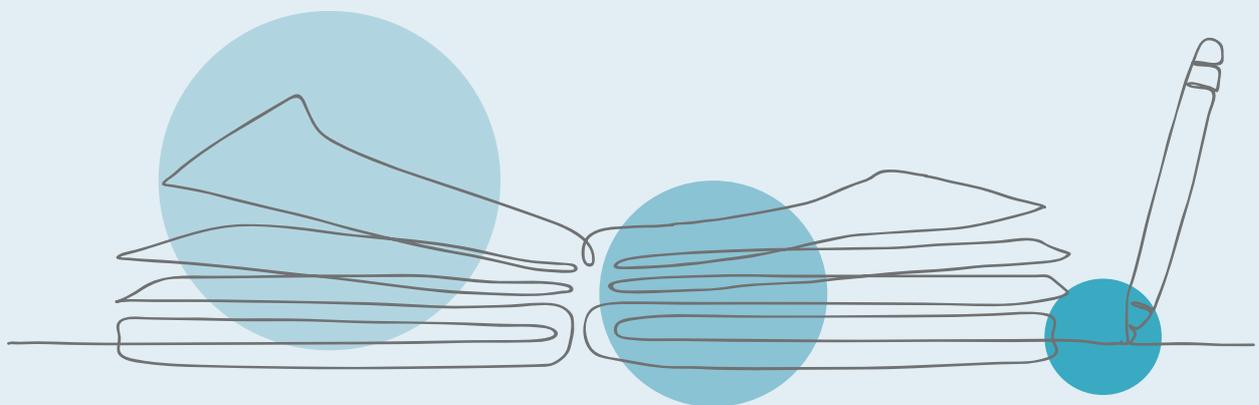
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Annex 1

COHFE framework technical advisory group and reviewers

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Annex 2

Comparison of mentor evaluation tools

Table A1.1

Comparison of mentor evaluation tools from two FETP programs with that from Yukawa et al. (2020)

	Yukawa, Gansky (75)	Tanzania FETP	Egypt FETP
Professional expertise			
1.1 – 1.4	My mentor demonstrates professional expertise.	My mentor guided me in developing and implementing my fieldwork projects.	Assisted in the identification of research topics and advised on methodologies. Helped me develop my capacity for data interpretation. Provided valuable and timely technical assistance.
Planning and communication			
2.1 Availability	My mentor is accessible.	My mentor was accessible and available.	Is appropriately accessible to me.
2.2 Communication	My mentor is an active listener.	I was able to communicate regularly with my mentor.	Listened carefully to my concerns.
2.3 Planning	My mentor helps me to formulate clear goals.		Routinely monitors my progress and reviews proposed timelines and milestones with me.
2.4 Feedback	My mentor provides useful critiques of my work.	My mentor provided constructive feedback and advice.	Provided thoughtful advice and feedback on my research progress and results. Provided guidance in the development and presentation of research projects.
	My mentor motivates me to improve my work.		Helped me to be critical and objective concerning my own results and ideas.
	My mentor provides thoughtful advice on my scholarly work.		Provided constructive feedback on my presentation and writing skills.

	Yukawa, Gansky (75)	Tanzania FETP	Egypt FETP
Professional development			
3.1 Goal setting	My mentor is helpful in providing direction and guidance on professional issues.	My mentor assisted me with my achieving my professional development goals.	Helps me to clarify my responsibilities such as contributing to team effort and responding to criticism.
3.2 Fostering independence	My mentor encourages me to establish an independent career.		Helped me to develop good negotiating skills. Encouraged me to present my work at scientific meetings. Helped me become increasingly independent in conducting my research. Provided me with training in the mentoring skills to mentor others.
3.3 Fostering development	My mentor takes a sincere interest in my career.	My mentor provided insight into the realities of building a successful career. My mentor demonstrated a reasonable interest/concern towards me.	Illustrates good mentoring skills. Illustrates good work habits.
3.4 Fostering collaboration	My mentor facilitates building my professional network.		Illustrates active teamwork and collaboration. Helped me to work effectively with other individuals.
Professional integrity			
4.1 Integrity	My mentor acknowledges my contributions appropriately.		
	My mentor is supportive of work-life balance.		
Overall			
	Overall, I am satisfied with my mentor.	I recommend my mentor for future mentorship activities. Overall, my mentor was an asset and a benefit to me. I anticipate a continued relationship with my mentor.	Serves as role model.

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