SYSTEMS THINKING APPROACH TO SOLVING ONE HEALTH PROBLEMS

Student Guide
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This module is one of 16 One Health Training Modules developed by the One Health Central and Eastern Africa network (OHCEA), a network of 8 countries, 21 institutions of Public Health and Veterinary Medicine in Africa: Kenya, Uganda, Tanzania, Rwanda, Ethiopia, Democratic Republic of Congo, Cameroon and Senegal. The OHCEA network’s vision is to be a global leader in One Health, promoting sustainable health for prosperous communities, productive animals and balanced ecosystems. OHCEA seeks to build capacity and expand the human resource base needed to prevent, detect and respond to potential pandemic disease outbreaks, and increase integration of animal, wildlife and human disease surveillance and outbreak response systems. The overall goal of this collaboration is to enhance One Health policy formation and implementation, in order to contribute to improved capacity of public health in the region. OHCEA is identifying opportunities for faculty and student development as well as in service public health workforce that meet the network’s goals of strengthening One Health capacity in OHCEA countries. The modules were developed based on One Health Core Competencies that were identified by OHCEA as key elements in building a skilled one Health workforce. This network is supported by two United States University partners: Tufts University and the University of Minnesota through the USAID funded One Health Workforce project.

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Overview of the Systems Thinking Module:

In the 21st century, we find ourselves facing a myriad of complex health challenges that require multi-lateral and multi-disciplinary approaches to solve. Disease outbreaks across borders like Ebola, West Nile Virus TB and the like call for stakeholders all over the world to not only work together but do it in a manner that addresses other concomitant issues surrounding the outbreaks. This is the One Health guiding principle.

“One Health” is an important global activity based on the concept that human, animal and environmental/ecosystem health are interdependent, and professionals working in these areas best serve the population by collaborating to better understand all the factors involved in disease transmission, ecosystem health, the emergence of novel pathogens and emerging zoonotic agents, as well as environmental contaminants and toxins that are capable of causing substantial morbidity and mortality, and impacting on socioeconomic growth, including in less developed countries. The solution to One Health problems thus requires a Systems Thinking approach.

Systems thinking is the use of various techniques to study systems of many kinds. It is the process of understanding how those things which may be regarded as systems influence one another within a complete entity or larger system. In nature, systems thinking examples would be ecosystems in which various elements such as air, water, movement, plants and animals work together to survive or perish. In organizations, systems consist of people, structures and processes that work together to make an organization healthy or unhealthy. In public health and epidemiology, systems thinking approach would involve surveillance and response systems to anticipate and manage an outbreak like Ebola. Such a comprehensive system would ensure that ‘hot spots’ of Ebola are identified early so that local and national healthcare systems, are quickly mobilized and policymakers appropriately informed to take relevant action to prevent the spread of disease. This approach would help the health policymakers build programs and policies that are aware of and prepared for unintended consequences.

Systems thinking differs fundamentally from traditional analytical or statistical methods which focuses on separating the individual components of what is being studied or analyzed whereas systems thinking in contrast, focuses on how the ‘thing’ being studied interacts with other components and constituents of the system. Systems thinking therefore looks at an expanded view that considers larger and larger numbers of interacting issues within the system being studied. This is very important in generating relevant information especially when the issue being analyzed is dynamic or complex with feedbacks from both internal and external sources.

Systems thinking is the relevant One Health approach to problem solving as it will help the learners develop capacity to think in a broader system of interaction in solving infectious disease issues, increase exposure to and improve cross-sectoral and inter-professional collaboration on key disease surveillance and disease outbreaks and provide practical strategies useful for field investigations of disease outbreaks. This module provides students with the skills necessary to take a Systems thinking approach to emerging pandemic diseases. Knowing that men and women have different roles and perspectives that may impact differently in interventions of emerging pandemic diseases and their outcomes, this module will integrate gender perspectives and issues at all levels of systems thinking strategies and processes that will not only add value to the planned outcomes but also promote gender equality and equity.
Target Audience

- The module can be used by undergraduate and post-graduate learners, middle cadre trainees and in-service personnel from multiple disciplines and sectors (Private, NGOS, and Civil Society), as well as policy makers. This module can also be adopted for continuous professional development by health professional organizations such as medical, veterinary, pharmaceutical, nursing, public health, environmentalists and technologist’s professionals.

Systems Thinking Training Goals

The module is designed to provide participant with capability to:

1. Demonstrate system thinking approaches in mapping one health issues and provide practical strategies useful for field investigations of disease outbreaks, and create solutions.

2. Demonstrate the gender dynamics on system thinking towards One Health interventions in emerging pandemic, prevention, disease control, surveillance and response.

Learning Objectives

At the end of the training the learner should be able to:

- Describe core concepts of systems thinking (ST) theories, definitions and characteristics and their application in One Health interventions.
- Apply Systems Thinking skills and tools in mapping One Health problems and create solutions to problems with practical strategies useful for field investigations.
- Use One Health systems thinking skills to improve inter-professional, inter-discipline and cross-sectoral collaboration on key disease surveillance and outbreaks.
- Apply Systems Thinking skills to improve multi-sectoral cooperation among national, regional and international government health officials along with multilateral health agencies in One Health interventions.
- Demonstrate knowledge of gender and gender dynamics by systematically applying gender sensitive skills to One Health interventions in emerging pandemic, prevention, disease control, surveillance and response.

Programme/Agenda

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<td>application in One Health interventions.</td>
<td>Create solutions to problems with practical</td>
<td>and cross-sectoral collaboration on key disease</td>
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<td>strategies useful for field investigations.</td>
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## Module Overview

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<td>01 Comprehend the core concepts of systems thinking theories, definitions</td>
<td>1. Learn about One health and Systems thinking?</td>
<td>* Brainstorming using sticky notes to define Systems Thinking terminologies</td>
<td>Flipchart or whiteboard and markers, Sticky notes, Computer, LCD projector, screen/blank wall, Module PowerPoint</td>
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<td>and characteristics and their application in One Health intervention</td>
<td>2. Give terms and definitions in System Thinking</td>
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<td>3. Discuss the systems theory and systems characteristics</td>
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<td>* Paper reviews in groups</td>
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<td>4. Distinguish systems thinking from other forms considered traditional analytical</td>
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<td>thinking forms of thinking</td>
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<td>02 Apply ST skills and tools in mapping</td>
<td>1. Develop a concept map based on</td>
<td>* Documentary/video clip to show</td>
<td>Flipchart or whiteboard</td>
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<td>03 Exposure to One Health systems thinking skills to improve inter-professional, inter-discipline and cross sectoral collaboration on key disease surveillance and outbreaks.</td>
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<td>One Health problems and create solutions to problems with practical strategies useful for field investigations.</td>
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<td>1. Map the integration points where individual systems elements (social networks, organizations, government sectors and communities) interact in a One Health challenge.</td>
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<td>2. Utilize systems thinking approach in the One Health scenario that would improve intervention and/or surveillance.</td>
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<td>3. Integrate information and actions across disciplines and sectors using systems thinking tools to strengthen health systems.</td>
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<td>4. Use concepts from ‘wicked’ problem theory to better understand how to formulate and</td>
<td>different mapping systems</td>
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<td>2. Understand interactions and feedbacks among the components of the map.</td>
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<td>Group activity and discussion on mapping different disease outbreak scenarios.</td>
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<td>Brainstorming and Group activity to identify a OH scenario and identify multi-discipline and multi-sectoral players' involvement.</td>
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| 04 | Have knowledge of gender and gender dynamics by systematically applying gender sensitive skills to One Health interventions in emerging pandemic, prevention, disease control, surveillance and response. | 1. Identify basic gender principles, concepts and dynamics  
2. Identify and analyze gender roles through Systems Thinking.  
3. Apply gender sensitive approaches in OH interventions based on systems thinking | Animation to identify gender awareness among learners.  
Group discussions to identify gender roles in disease outbreak problem scenarios  
Map out gender roles in a OH systems thinking intervention | Flipchart or whiteboard and markers  
Computer, LCD projector, screen/blank wall  
Module PowerPoint  
Internet access  
Video clip | 60 |
**Detailed Facilitator Notes**

**Registration**
- Sign the OHCEA attendance register

**Welcome** (Facilitator welcoming remarks and introductions.

Participant introductions:
- In pairs, share your:
  - Name
  - Where you are from
  - Type of work and position
  - The latest research you have been engaged in
- Prepare 1-minute introduction of your partner to the class
- Go around the room and have each pair present their partner to the class.

**Expectations**
There are two flipcharts in the front of the room: one titled “Expectations” and the other “Concerns.”

- Take two different colored Post Its® notes
- Write down your expectations for the short course on one of the Post Its® notes (specify color) and your concerns about the course on the second the Post Its® notes (specify color)
- Place your expectation Post Its® notes on a flipchart titled “Expectations” and your concerns Post Its® notes on another flipchart titled “Concerns”
- Organize the Post Its per common themes
- Review the agenda for the week and the goals of the short course

**Goals of the Short-Course**

- Comprehend the core concepts of system and systems thinking
- Can apply systems thinking skills in mapping One Health problems and provide practical strategies useful for field investigations of disease outbreaks, and create solutions to one health problems.
- Have increased exposure to One Health systems thinking skills to improve cross-sectoral, inter-professional and inter-discipline collaboration on key disease surveillance and disease outbreaks.
- Have Systems Thinking skills for improved cooperation among national, regional and international government health officials along with multilateral health agencies in One Health interventions.
- Have knowledge of gender and gender dynamics by systematically applying gender sensitive skills to One Health interventions in emerging pandemic, prevention, disease control, surveillance and responses
This course is sponsored by OHCEA.

- OHCEA is the One Health Central and Eastern Africa network comprised of 24 academic institutions from eight African countries consisting of Schools of Public Health and Veterinary schools with two US partners. The US partners are: Tufts University and the University of Minnesota. This project is funded through the USAID- Emerging Pandemics Threat 2 grant.

- OHCEA’s vision is to be a global leader in One Health promoting sustainable health for prosperous communities, productive animals and balanced ecosystems. OHCEA seeks to expand the human resource base needed to detect and respond to potential pandemic disease outbreaks.

Pre-Test (15 minutes)
Complete pre-test. A pre-test is used to gauge how much you will have learned over the week; a post-test will be administered at the end of the course. The two tests will be compared. There is no grade associated with the pre-test.

Break

Please read the following articles prior to coming to the training.

The application of systems thinking in Health: why use Systems thinking? By David H. Peters
Health Research Policy and Systems 2014,12:51
http://www.health-policy-systems.com/content/12/1/5

One Health: Interdependence of people, other species and the planet by Meredith A. Barret and Steven A. Osofsky
https://rmportal.net/groups/one-health-students-online-platform/one-health-interdependence-of-people-other-species-and-the-planet/view

Session 1:
The core concepts of systems thinking (ST) theories, definitions and characteristics and their application in One Health interventions

This opening session provides an overview of the systems thinking module and provide terms and definitions that are meant to equip the student with basic knowledge on systems thinking, concepts, theory and characteristics. Systems Thinking is relevant to One Health approach in problem solving as it will help the learners develop capacity to think in a broader system of interaction in solving infectious disease issues.
Learning Objective:
Participants will be able to identify:
- Define the core concepts of One Health, system and systems thinking
- Discuss the systems theory and systems characteristics
- Distinguish systems thinking from traditional analytical forms of thinking
- Describe the elements of complex problems through systems thinking
- Evaluate the advantages of a systems thinking approach in health systems
- Apply systems thinking skills in mapping One Health problems and provide practical strategies useful for field investigations of disease outbreaks, and create solutions to one health problems.

Discovery Activity; What is One Health?

Watch the following videos:

One Health: from concept to Action by CDC
https://www.youtube.com/watch?v=TG0pduAYESA

One Health: from Idea to action:
https://www.youtube.com/watch?v=gJ9ybOumITg&t=4s

Discuss the two videos

Take 5-7 minutes to think about and legibly write down on separate post it notes the answers to the following questions:
- Define what One Health approach means
- Identify two examples of One Health in practice
- Identify two to three advantages to multiple disciplines working together to promote one health

Display these post-it notes on the wall in three separate sections. Then in a plenary review the following
- What are the common things identified?
- What are the differences?
- Is there anything that surprised anyone?

Come up with a group description of what One Health is

There are many similar definitions of One Health by health organizations, but for the course we will adopt the American Veterinary Medical Association (AVMA) definition of One Health (www.avma.org)

AVMA: One Health is defined as the integrative (collaborative) effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals, and the environment. Together, the three make up the One Health triad, and the health of each is inextricably connected to the others in the triad.
**Presentation: Overview of One Health Concepts**

This presentation introduces One Health, the interdependence between humans, animals and the environment and why disciplines need to work together and One Health Core competencies. It also answers the questions: why one health and why now?

**Discovery Activity: What is Systems thinking?**

To understand and appreciate the relationship within systems, it is important to adopt systems thinking to tackle complex health problems and risk factors. Systems thinking has huge and untapped potential first in deciphering the complexity of a public health issue and then in applying this understanding to design and evaluate interventions that improve health across all areas. Systems thinking can provide a way forward for operating more successfully and effectively in complex real-world settings.

Divide into two groups. Each group will receive one of the following scenarios

**Scenario 1:**

“The severe drought affecting Kenya, which has driven up the cost of food and fueled inflation, has become a key issue on the election campaign trail. Food security has deteriorated since the end of 2016 and conditions remain dire in half of the country’s 47 counties. The situation has been exacerbated by the impact of climate change, and it is anticipated that some regions could reach emergency levels of need by September. The consequences of this drought could stretch across many sectors including agriculture, education, livestock, and even cause political instability”

**Scenario 2:**

“In January 2010, a catastrophic 7.0M earthquake struck Haiti with an epicenter near the town of Léogâne, killing anywhere from 100,000 to 316,000 people and displacing an estimated three million inhabitants. Ten months later, what would become the world’s worst cholera epidemic in modern times, killing at least 10,000 people to date and sickening an estimated 800,000 more, broke out in the rural Center Department of Haiti, about 65 miles north of the nation’s capital, Port-au-Prince. By the first ten weeks of the outbreak, cholera had spread throughout Haiti. In an update, the New York Times reported that the UN’s “auditors found that poor sanitation practices remained unaddressed not only in its Haitian mission but also in at least six others in Africa and the Middle East.” Despite the horrific and shameful lessons learned in Haiti, UN peacekeepers throughout the world are still lax in their adherence to established protocols for wastewater, sewage, and hazardous waste disposal.

Discuss the following questions:
In each scenario, can the you identify at least 5 consequences of the problem?
Can they also identify 5 different stakeholders in the problem?
Can they discuss the different sectors/disciplines/departments that should be engaged in analyzing the problem and developing solutions?
Discuss different ways to solve the crisis

Present your findings in a plenary. Use this to generate a discussion. These two problems cannot be approached unilaterally. They need a Systems Thinking approach to identify the multifaceted problems and to generate solutions. The solutions will require input from different building blocks including government sectors, communities, financial resources, information, service delivery sector. All these sectors need to coordinate and collaborate effectively to get a satisfactory solution.

Systems are rarely simple and when you begin to learn about a system, its complexity may be a bit overwhelming. A systems thinking approach allows us to begin to understand the complexity and use it to find answers that matter.

**Using concept maps to distill the problem further**

Concept mapping is a technique used to show the relationship of concepts/ideas/facts. The visual representation, usually a web connecting nodes, illustrates participants understanding of the information being considered from the problem to the solution. Learners create their own understanding through interactions with the things/content/experiences that are part of the problem.

Create a concept map of the problem/Scenario above and the various consequences by:

- Starting with the “core” of the problem, as a node, typically in the center of a page.
- Extend lines outward from the center-node to the next levels/elements/components of the topic, to create relationship with and among sub-nodes.
• Expand the map/integrate and inter-relate all relevant elements of the topic.

Keep drawing as far out as possible to see the levels to which the problems extent. Next to each problem, they should begin to identify resources, stakeholders and solutions. Display the concept maps on the wall and do a walk through. To debrief this section, discuss how they were able to think through the different levels of the problem.

Based on these exercises,

- In a plenary discussion come up with groups description of what **Systems Thinking** is.
- Define what Systems Thinking approach means as opposed to Traditional Analytical Thinking.

**Power point presentation on One Health systems thinking**

After the Introductory presentation, write on one post it note, 2 examples of what you would consider One Health complex problems and on another post two ways they would use a systems thinking approach to find solutions to the problem. Put these on the wall and do a quick discussion Why did you specifically chose those issues and why did you chose the solution?

**Watch the following two videos**

Video clip1: Systems thinking: a cautionary tale -cats in Borneo

https://www.youtube.com/watch?v=17BP9n6g1F0

After watching this video:
Take 10 min minutes to think about and write on separate post it notes the answers to the following questions from lessons learned in the video clip.

- What started the problem?
- Explain the ripple effect of spraying the mosquitoes with DDT?
- What is the importance of considering the whole?

**Video clip 2 - Systems thinking, Australian Research Institute for Environment and Sustainability- You Tube**

Take 10 min minutes to think about and legibly write down on separate post it notes the answers to the following questions from lessons learned in the video clip.

- List as many elements as possible that form and sustain a stable environment.
- Describe the interconnectivity between the elements of the environment.
- What practices have contributed to making the environment unstable.
- What do you understand by the phrase ‘unsustainable use of resources’
- Can the actions of one sector fix the environment?

Notes
Session 2:
Apply ST skills and tools in mapping One Health problems and create solutions to problems with practical strategies useful for field investigations.

In this session, participants will be exposed to a deeper understanding of systems thinking as the art of making reliable inferences about system behavior by developing a deeper understanding of underlying structures. If you understand the component elements of a system and how they are connected with each other, then you can predict the way the system might behave in a given situation. Participants will interrogate through discussions; what system thinking is all about.

Learning objectives:
• Identify the building blocks of a One Health system essential elements of a OH challenge/problem and map its components.
• Identify the skills of a Systems thinker
• Using One Health Problem Based Learning cases begin to critically think through a complex One Health problem and to develop solutions.

Systems thinking views problems as part of a wider dynamic system. It involves much more than a reaction to present outcomes or events. It demands a deeper understanding of the linkages, relationships, interactions and behaviors among the elements that characterize the whole system.

Building blocks of a One Health system:

The first step is to analyze the building blocks of a system. The image below shows the building blocks of a standard human health system.
Since we are dealing with One Health systems, draw what you would consider building blocks for a One Health system. Consider the human animal and environmental interactions, the drivers of disease emergence, and the different player and stakeholders that should be a part of it.

Discuss the different elements of this image including the inner circle, the middle circle and the outer circle as well as the different drivers and influences of One Health.

**Skills of system thinking:**

Given the complex relationships and dynamic characteristics of a One Health system, applying conventional approaches commonly used to identify problems, create solutions and implement interventions will not take us far enough. We need a radical shift in the Intervention design and need to use some creative and critical thinking skills.

**Group Activity:**
List what you would consider at least two skills of systems thinking.
Problem Based Learning (PBL) is a system of inquiry where people are trained to become problem solvers through identifying the problem and analyzing it themselves. It is commonly used by different disciplines and allows for users to review a problem from multiple perspectives.

PBL requires special teaching techniques in which the teacher facilitates learning by supporting, guiding and monitoring the learning process. The goals of PBL are to help the students develop flexible knowledge, effective problem-solving skills, self-directed learning, effective collaboration skills and intrinsic motivation, in addition to domain-specific technical skills and knowledge.

In a PBL model, participants work collaboratively to solve real-world, complex problems. To solve these problems, students create learning plans for how they will acquire the knowledge and skills necessary to develop solutions. In seeking solutions, the students interact with academic and technical experts, as well as a
range of stakeholders including business, government, non-governmental organizations and community-based organizations.

In this session, the participants will be provided with a One Health Problem Based learning case and will use PBL techniques to arrive at a solution.

**presentation on what PBL s and why use PBL?**

Watch the video on what is Problem Based Learning: https://www.youtube.com/watch?v=sNhismExIwU

You will be introduced to the different trigger system used in PBL. Use this to work through the Rift Valley fever case. This case will be completed over a period of three days

Notes
Session 3: Overview: Exposure to One Health systems thinking skills to improve inter-professional, inter-discipline and cross sectoral collaboration on key disease surveillance and outbreaks.

In this session, learners will be exposed to the interrelationships between various disciplines involved in responding to issues that occur at the interface of animal, human and environmental health in any OH approach. In this experiential learning session, participants work together to document interactions between different sectors when solving a One Health issue like an anthrax outbreak. They will be encouraged to create and use system mapping to deepen understanding of One Health problems. They will also be able to use concept mapping to explore a complex issue and experientially learn about systems thinking. As an activity, they will identify a One Health Challenge and map out its components in a Systems Thinking approach using relevant sections of the One Health Systems Mapping and Analysis Resource Toolkit (OH-SMART).

Learning objectives:

- Identify the essential elements of a OH challenge/problem and map its components.
- Map the integration points where individual systems elements (social networks, organizations, governments, communities, ecosystems) interact in a One Health challenge.
- Utilize systems thinking approach in the One Health scenario that would improve intervention.
- Integrate information and actions across disciplines and sectors using systems thinking tools.
- Use concepts from ‘wicked’ problem theory to better understand how to formulate and approach complex One Health challenge.

System Stakeholder networks:

Another vital aspect of system thinking revolves around how systems stakeholder networks are included in the system. Stakeholders are not only at the center of the system as mediators and beneficiaries but are also actors driving the system. This includes their participation as individuals, civil society, organizations, government ministries, stakeholder networks and as key actors influencing the major building blocks as health care workers, managers and policy makers. Different stakeholders may each see the purpose of the system differently. This should be considered a positive because it brings different perspectives

Divide into 2 groups: Read the following case studies
Karatu case study

Karatu district is located in Arusha region, Tanzania and is known by its agricultural activities and people practice irrigated farming. Among the major drawbacks that faces the farmers are pests. As a means to overcome such problems, farmers indiscriminately use pesticides to protect their crops. This practice has been reported to be associated with many problems to the people, domestic and wild animals and the environment at large. Cases of abortions in humans and animals are quite high in the district and are associated with pesticide poisoning. Skin diseases and infertility are also rampant especially to people working in horticultural farms. Incidences of fish and aquatic bird mortalities especially Lesser flamingoes (Phoenicopterus minor) are quite high and all are linked with pesticide poisoning. For example, in 2004, up to 45 000 Lesser flamingoes died at Lake Manyara, which is being fed by rivers draining from the agricultural fields in Karatu district. Studies have shown high levels of pesticide residues in milk, beef and local chicken eggs. A case control study conducted in pregnant women who go to deliver at Mount Meru Hospital in Arusha showed that they had very high levels of pesticide residues in breast milk and abdominal fats. The newly born babies had also high levels of pesticides in mucous and umbilical blood. Studies further showed high levels of pesticides in water collected from Lake Manyara and different rivers around irrigated farms.

Efforts have been done by the government to overcome the problem. The Tanzania Ministry of Agriculture has been conducting seminars, extension work and restricting uses of pesticides including advocating the integrated pest control systems but the problem still exist and is getting worse.

Mining in Lake Tshangalele: Environmental and health impact assessment in the Democratic Republic of Congo
To provide incentives and attract investors to the mining sector a new mining code was enacted in the DRC in July of 2002. The new code attracted several new mining companies generally of smaller size compared to those operating at the time of the reform. For economic reasons, small mining operations tend to operate closer to large populations creating health and environmental problems. To mitigate the environmental impact of extractive industries, the government of DRC has recently enacted an environment framework law. However, this 2011 legislation still needs other implementation measures to guarantee its effectiveness.

The increase in mining operations in Lubumbashi, a city of 1.3 million inhabitants and surrounding areas has led to air and water pollution directly affecting humans, animals and the food chain. The mines are estimated to provide direct employment to between 200,000 and 280,000 permanent full-time miners and are located only 0.1 km from the edge of the city (see Figure). During the peak season, the total number of miners reaches an estimated 400,000 workers. About 74% of miners are diggers while the remaining are sorters and washers.

Miners and their families are exposed to heavy metals through dust inhalation, food and water contamination. In Shinkolobwe and Kolwezi, miners are exposed to radiation of up to 24 mSv/year. Poor sanitary conditions in miners’ camps also favor epidemics. Recent studies have shown a significant risk of heavy metal contamination in humans, goats and fishes. Massive excavations related to copper mining operations affect the ecosystem such that the natural habitat of rodents and other animal carriers of pathogens that may cause known and unknown diseases are invading human habitats creating a serious health risk. In 2011, an outbreak of unknown disease with hemorrhagic fever like symptoms caused several deaths and hospitalizations in Kapolowe health district 114 Km North West of Lubumbashi. However, follow up was not made as there was generally a poor understanding of these exposures and their
specific effects and they did not have adequate capacities to study and mitigate these problems. Evidence suggests fish from Lake Tshanga-Lele located in the same district are heavily contaminated. Fish from this lake constitute a main source of protein for the population of the city of Lubumbashi. Illnesses of unknown origin have also been observed in goats within the same area. These kinds of exposures from mining and activities related to it may be associated with significant disease burden. The World Health Organization (WHO) estimates that environmental risk factors contribute to 24% of the global burden of disease from all causes, and to 23% of deaths, emphasizing that this is likely a conservative estimate because for many diseases, the associations are poorly understood (Prüss-Üstün and Corvalán, 2006).

Stakeholder mapping

You have been provided with a set of sticky notes.
1. On a sticky note, write a name of a stakeholder or player in your case study scenario. One name per note. Write as many stakeholders as you can think of. Identify them by their roles. Consider their gender as well especially at the community level.
2. Line the sticky notes on the plain piece of paper according to whether they are international, national, regional or local.
3. Draw a circle around those stakeholders with lots of power and authority using a red marker.
4. Draw a square around those players with the most interest in the activity or who are impacted the most.
5. Using a red marker, draw arrows that show flow of decision making (power and authority) from one stakeholder to another.
6. Using a green Marker draw arrows that show flow of resources (funding) from one stakeholder to another.
7. Using a blue marker draw arrows that show communication flow from one stakeholder to another. Have the groups discuss the map and the following questions:
   - Who has power and authority?
   - Who do you think should have power and yet does not?
   - Who is being left out of the different arrows and yet considered important and how do you include them?
Can you identify any gender differences in power, communication flow and resource flow?

One Health Systems Mapping

(This tool/activity was adopted from the OH-SMART toolkit developed by the University of Minnesota in collaboration with the United States Department of Agriculture)

Instructions: using the two case studies above. Draw a table consisting of Many rows and two columns. The first column shows the stakeholders involved in the event. The second column shows the timeline of their involvement. The mapping will be done from the left to the right.
Beginning at the center of the table on the left, insert the first stakeholder and the genesis of the public health event: i.e., an animal suspected of having rabies bites a child. Draw a square around this activity. In the left column enter community member as your stakeholder. Using an arrow, link up this activity to what happens next and the stakeholder involved in that next activity: for example, child goes to local health center and receives first aid, enter the second stakeholder in the next row - that would be the local Health center. Keep adding activities as they happen in a chronological order and all the stakeholders until you have a map linking up the stakeholders to each other and the activities happening. If you think there is any missing information put a question and star it for discussion.

Example of map
After mapping,

- Identify the process steps that may not be clearly understood or accepted; show discrepancies or differences in responses noted by stakeholders or duplication of functions.
- Note any significant stakeholders not included in the map: for example, in the Rift valley fever case: the environment department and entomologists were not included in the mapping showing a clear gap since these two groups play a major role in the surveillance for RVF.
- Mark interactions that are working well and how they might be made more effective.

Groups should present the maps to the rest of the class.

**With the karatu case study, they should answer the following questions**

- Have them read the case study and analyze it and have a discussion based on the questions below.
- Reflect on the following questions and record the answers on a flip chart.
- What is the problem?
- Who is affected?
- Is there a social, economic, political angle to this?
- What key One Health issues can be identified?
- What sectors are involved?
- Are there any policy implications?
- What measures can be done to protect the health of humans, animals and the environment?
- Can you give similar examples from your own background/work?
- How did you deal with it?

**The Lake Tshangelle group should answer the following questions**

- Given this scenario, what are the one health issues that arise and who are affected?
- Identify the multiple stakeholders or players in this scenario.
- Hold a meeting with stakeholders and discuss.
- Who would be your key players in the intervention strategy?
- What gender issues do you foresee?
**One Health Systems thinking Map**

Systems thinking from a One Health perspective allows us to solve “wicked complex problems” through a simplified process. It provides a means of analyzing the human-animal-environment interactions and the different disciplines engaged and how they work together as a system to solve complex health problems. It systematically covers the policies, processes, practices and people, the roles each play and how they interact to function effectively to solve public health threats.

The OH systems thinking uses the problem defining approach to identify and solve the problem.

As a next step, each group should use the below systems map to continue to think through engaging stakeholders and analyze their case study.

Groups should present their systems maps and briefly discuss the questions above. Summarize the session by stressing the need to simplify the problem and to solve it step by step.

Notes
Session 4. Overview: Have knowledge of gender and gender dynamics by systematically applying gender sensitive skills to One Health interventions in emerging pandemic, prevention, disease control, surveillance and response.

Men and women have different roles and perspectives that may impact differently in interventions of emerging pandemic diseases and their outcomes. In this session, learners will become more aware of different gender roles, dynamics and perspectives that will enable them to effectively apply gender sensitive approaches through systems thinking to solve emerging pandemic, prevention, disease control, surveillance and responses. In this session learners, will be exposed to gender concepts and dynamics and how to perform a gender analysis, in order to systematically integrate gender issues in multi-sectoral, multi-lateral systems thinking approaches to solving One Health interventions. The session will culminate in a simulation exercise and evaluation to deepen understanding of complex systems thinking processes, followed by a session on developing brief gender sensitive case studies that can be used as part of this training.

Learning objectives:

- Identify basic gender principles and concepts and dynamics
- Identify and analyze gender roles through Systems Thinking.
- Apply gender sensitive approaches in OH interventions based on systems thinking

Ensuring Gender sensitivity in a system thinking approach

When applying, systems thinking approaches, they should be all inclusive therefore considering gender issues, the culture, social-economic status of different stakeholders is important. Gender impacts intervention programs.

Divide into four groups and analyze the four scenarios given below:

Group 1: In this community, there is conflict between the people and the national parks because the community is collecting medicinal plants and firewood from the national parks- an area that is protected. The wildlife has also been destroying the villagers’ crops and killing their domestic animals. The national park management has been having meetings with the village men in the evening at the local men’s club to map out a strategy on how to solve the problem.

Group 2: There is an outbreak of avian influenza in this community. The government decides passes a policy that to completely eradicate this disease, they will slaughter all birds be they ducks or chicken and bird owners with more than 50 birds will be compensated. Backyard poultry farmers are not compensated because most of them do not have more than 50 birds. The disease continues to spread.
Group 3: The government in the country you work in wants to target farmers for training in poultry production and management on Avian Influenza prevention and control. They are focused on implementing a training policy and ask the animal health workers in the communities to identify people for training. Since men are the heads of households and the decision makers, they are selected to attend the training.

Group 4: There is an outbreak of brucellosis in this community. Humans have been presenting at the health center with undulating fevers. They also have increased abortions among their animals. The disease is transmitted through contaminated milk and milk products. The department of human decides to create awareness by informing people through the radios that they should boil their milk and cook the meat thoroughly. They are puzzled when the outbreak continues.

Think specifically about gender issues and share similar experiences. Think about ways in which a system thinking approach is gender sensitive

Review the following Ebola and gender case study and answer the following questions.

Case Study: Ebola Epidemiology and Gender Issues

In the 2001–2002 Ebola outbreak that occurred in the Congo and Gabon, more men than women were infected during the early stages of the outbreak, a situation that was reversed during the later stages of the outbreak. In contrast, the number of female cases exceeded the number of male cases for the duration of the outbreak of 2000–2001 in Gulu, Uganda. During an outbreak, health officials usually compare the cumulative distributions of male and female cases. Cumulative distributions can sometimes mask potentially informative fluctuations in numbers of cases over the course of an outbreak. For the outbreak in Gulu, for example, the cumulative distribution was greater in females throughout, whereas in the outbreak in Gabon it switched from predominantly male to predominately female.

If only the cumulative distribution had been plotted for the outbreak in Gabon, the switch in incidence from an excess of male cases to an excess of female cases would not have been seen until later in the outbreak when the total number of females infected was greater than the total number of males infected. Interestingly, the outbreaks in Sudan are notable exceptions. Although no published data are available on the proportion of female cases in a relatively large outbreak that occurred in 1976, it has been reported that males predominated. The 1979 outbreak in Nzara and Yambio, Sudan was also unusual, in that despite its small size, a large proportion of those infected were female (69%).
Questions
1. Why do you think in the 2001-2002 outbreak of Ebola in Congo and Gabon more men than women were infected in the early stages of the outbreak?
2. Why do you think the cases of women later outnumbered the cases of men in this outbreak?
3. Why is it that the female cases exceeded the number of male cases for the duration of the outbreak of 2000–2001 in Gulu, Uganda?
4. Explain why in the outbreak of 1976 in Sudan, there were more men cases than women.
5. In the 1979 outbreak in Nzara and Yambio, and Sudan, why is it that a large proportion of those infected were women?
6. How do you ensure that the scenario portrayed in the case study is avoided?
7. Ask the class to identify the different disciplines represented in the clip.
8. What disciplines are missing?
9. What roles would the missing discipline have played to improve the situation.
10. Ask the learners if they spotted elements of systems thinking or the lack of it.
11. Discuss in a plenary what the consequences are of not thinking the problem through systematically.

The case demonstrates interconnectivity of health challenges and the benefits of a multidisciplinary systems thinking approach to their mitigation.

Key concepts include:
- Health emergencies are not limited to one sector.
- Human activity, agricultural practices and gender roles can contribute to disease transmission.
- The benefits of cross-sectoral cooperation and the sharing of resources leads to the prevention of disease at the root cause which is economic and can save lives. Primary health strategies need to include education about disease and disease transmission.

Debrief, reflection and conclusion of work shop
Take a few minutes to reflect on the training - what key concept did you learn this week? What else would you have liked to see covered in the workshop?

Fill out the post-test and OHCEA evaluation form. If a guest speaker is invited to close the ceremony and give out certificates, then that should conclude the workshop. Any logistics issues should also be dealt with.
Motes
References

9) A system is composed of parts with links or interrelationships between the parts that hold them together, and a boundary, or the limit defines what is inside and outside of the system (Williams, 2011)
12) Kanter, Beth. System Mapping for Non-Profits