COUNTERING ZOONOTIC SPILLOVER OF HIGH CONSEQUENCE PATHOGENS IN SOUTHEAST ASIA

2024

INTRODUCTION

M O D U L E

01
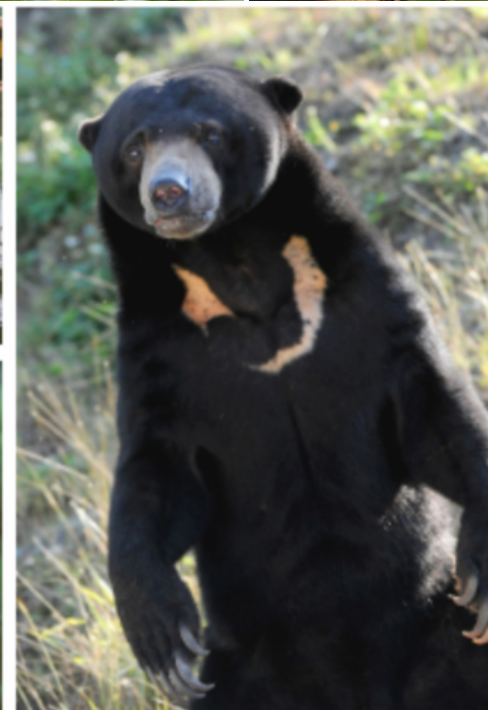
Introduction
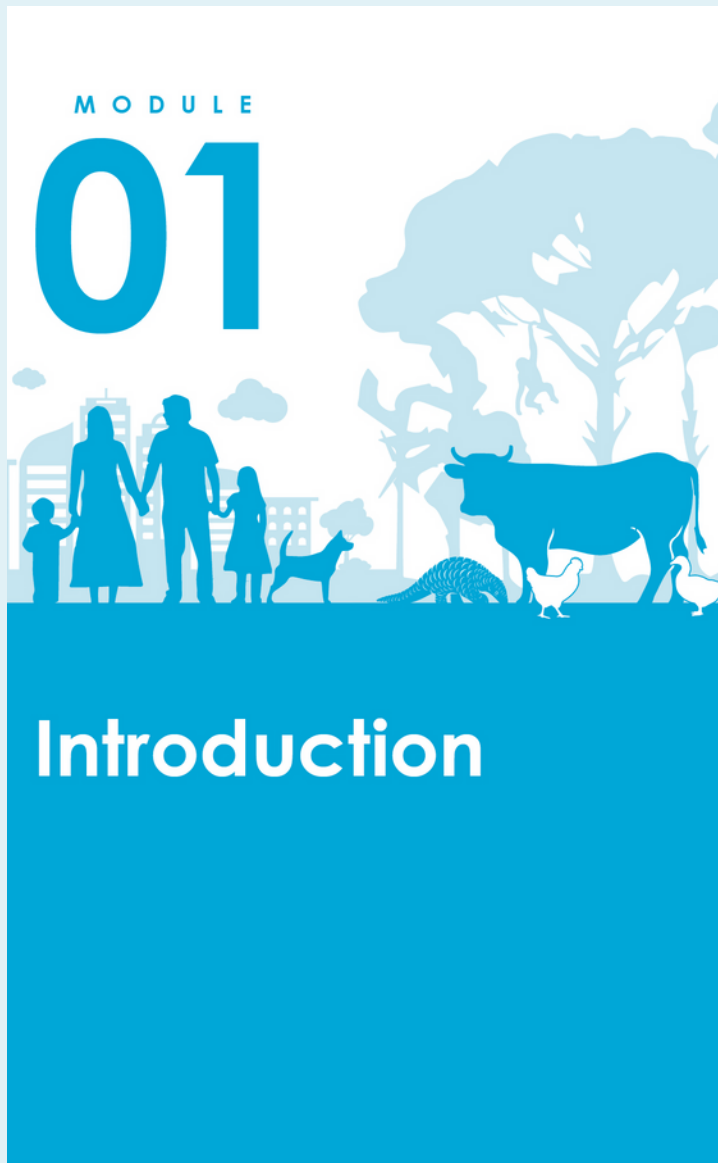
The Guidebook - who and why?

To better understand the key factors that can contribute to zoonotic spillover, INGSA- Asia chapter in partnership with the U.S. National Academies of Sciences, Engineering, and Medicine (NASEM) undertook a project to develop a guidebook with a goal to inform prevention and mitigation of zoonotic spillover originating in the live animal supply chain in the Southeast Asia region in the context of the One Health appraoch.

Who should use this Guidebook?

The guidebook is designed to be used by those working to reduce the risk of zoonotic spillover in SEA. It also serves as an inspiration and resource for other to adapt. Readers who seek to gain an overall understanding of the issues and strategies for addressing them can read the guidebook in sequence from beginning to end. Readers who are facing specific challenges, such as cross-border trafficking of wildlife, may prefer to access only specific modules or use this document to identify relevant reports and organizations that can provide assistance.

What is this Guidebook about?

This work reflects the joint efforts of INGSA, NASEM, and the participants who participated in the workshop series and writing of the guidebook. The modules may be accessed in order or piecemeal, depending on the needs of the user. The eight modules reflect partnerships in leadership and authorship among regional and technical experts.

GUIDEBOOK MODULES

MODULE

02

How the Past Informs the Future: Opportunities in Southeast Asia to Prevent and Respond to Zoonotic Spillover

This module addresses the pressing issue of zoonotic disease in the region and its overall impact on public health and other sectors. The goal of the module is to help the user develop semi-comprehensive strategies to address the challenges posed by zoonotic spillover events in the region in the context of the One Health approach. The module details how pandemic pathogens can infiltrate and proliferate within live animal supply chains (the eight steps to spillover), from reservoir hosts to wildlife trade to domesticated animals to humans. Effective interventions and real-life case studies discussed in this module help to identify and illustrate strategies to minimize pathogen persistence in live animal supply chains, especially those involving wildlife, as well as ways to reduce animal-human contact that could lead to spillover and protect individuals, particularly at risk.

Contents

Rat slaughter at a large market (left) and a rat vendor stall displaying live rats in cages in a large market (right) in Dong Thap province, October 2013. Source: Huong et al., 2020 © WCS Viet Nam.

Conditions that cause allostatic overload, or stress, on animals.

Ways to prevent mitigate zoonotic spillover

- Reduce persistence and amplification of a pathogen once it enters the wildlife trade.
- Control the pathogen contaminating the environment.
- Inter-species interactions: ways to reduce animal and human behaviors that increase exposure throughout the supply chain.
- Implementing regulations and enforcement measures to restrict wild animal sales in live animal markets.
- Improve hygiene standards and sanitation in live traditional markets to reduce the risk of zoonotic disease transmission.
- Market infrastructure and layout that increase disease transmission: High population-dense structures, stacked cages, and mixing of different animal species.
- Reduce probability of animals in allostatic overload throughout .

MODULE

03

Efforts to Prevent Transboundary Disease Outbreaks in the Southeast Asia Region

This module provides insights into the transformative potential of transboundary approaches to counter zoonotic spillover of high-consequence pathogens in the region. Recognizing that the implementation of control points cannot be achieved by a single discipline, ministry, or agency, this module emphasizes the need for collaborative efforts across the entire wild and domestic animal supply chain. Many global agreements and processes have been created to support domestic animal trade and minimize disease risk, while very few exist for wildlife. Wildlife trade often creates favorable conditions for the emergence and transmission of zoonotic diseases, leading to increased risks of epidemics at both regional and global levels. The module details solutions to address the interconnected goals of reducing biodiversity loss and sustaining public health. Key sections include the development of a comprehensive understanding of the concept of "transboundary" in the context of One Health, highlighting existing successful transboundary collaboration within the region, conceptualizing wildlife trade as a transboundary system in the region and advocating for a transboundary approach to regulate wildlife trade.

Replica of illegal wildlife parts and products including rhino horns and tiger skulls on display at the Vientiane International airport to educate travelers about the illegality of buying and carrying these products.

Contents

- Examination of the concept of "transboundary" and its application to spillover risk reduction.
- Description of existing cases of transboundary collaboration to prevent spillover.
- Conceptualization of the wildlife trade as a transboundary system in the region and an examination of attempts to understand and regulate the system.
- Advocates for a transboundary approach to wildlife trade in Southeast Asia.

Rodents are commonly sold in local fresh markets along with fish, frogs, various insects and vegetables in Lao PDR, such as at this organic market in Vientiane city.

Ways to improve transboundary collaboration

- Continue harmonizing language and methods across disciplines, countries and regions to increase collaboration efforts on prevention and response.
- Continue connecting communities to national and regional strategies and networks to foster more participatory wildlife monitoring and health surveillance.
- Focus on fostering development and implementation of both high-level standards for and community-based examples of bio-social models of wildlife trade risk assessment and management.

MODULE

04

PATHOGENS

How to Identify and Characterize Priority Pathogens to Guide Efforts to Address Zoonotic Disease Spillover

The emergence and re-emergence of zoonotic diseases has been accelerating in the past 25 years. A majority of the agents responsible are RNA viruses from wildlife reservoirs spilling over directly or through intermediate animal hosts. The highlights of this module is the review and development of guidelines and important tools to identify and prioritize zoonotic pathogens in the region, especially those with pandemic potential, and their animal reservoirs, and the populations at highest risk. It presents case examples of potential new coronaviruses (CoV) that could emerge as WHO's "Disease X", guidelines for biosafety and biosecurity measures, information related to high-impact zoonotic pathogens and a discussion of possible target animals to monitor for CoV zoonoses based on historic and case examples of spillback and secondary spillover of SARS-CoV-2.

Contents

- Background, introduction and historical context for emergence and re-emergence of zoonotic pathogens
- Prioritization of high impact zoonotic pathogens with pandemic potential
- Common characteristics of pathogens with pandemic potential
- WHO "Disease X" and Pandemic Preparedness
- Host reservoirs and intermediate hosts for emerging/re-emerging human and porcine coronaviruses
- Spillovers, spillbacks and secondary spillovers of SARS-CoV-2: analytical and in vitro predictors
- Case examples of spillback and secondary spillover of SARS-CoV-2
- Case examples of targeted animal reservoirs and intermediate or bridging host species to monitor for surveillance of zoonotic coronaviruses.
- Host reservoirs, spillover and spillback for Influenza A virus
- Surveillance, laboratory biosafety infrastructure and capacity and national biosafety guidelines and regulations
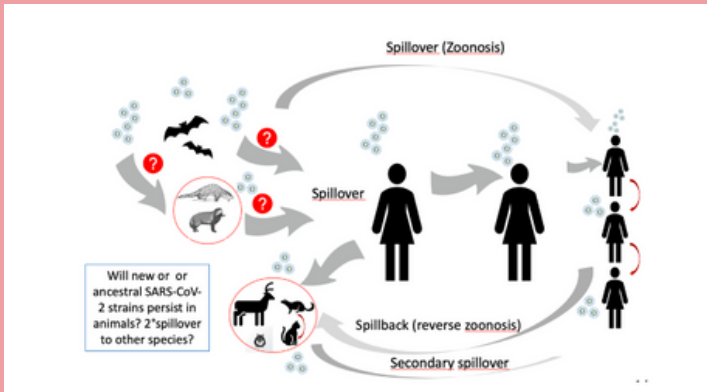
SARS-CoV-2 in animals: new host reservoirs for secondary spillovers to human
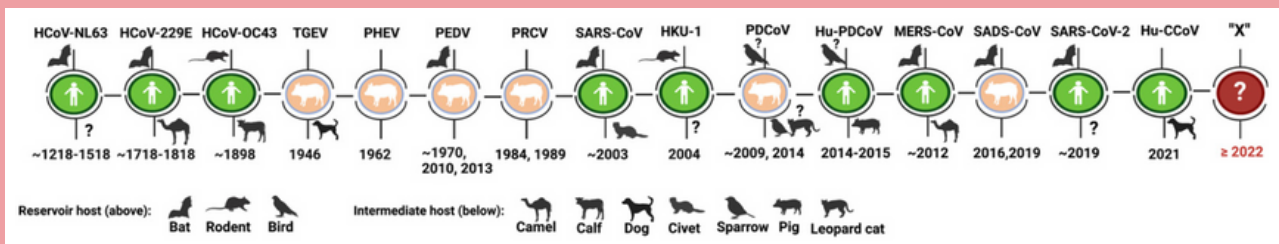
Timeline of the emergence of CoVs in people or swine over the past millennium.
(Keusch et al., 2022). Note: "X" denotes future unknown "Disease X".

Conclusions

- To improve promote biosafety and biosecurity various agencies (ASEAN, CDC, WHO, etc) have described criteria, tools and approaches to prioritize the high-impact zoonotic pathogens specific to each country in the region .
- Certain animal species can be used to monitor for zoonotic pathogen spillover at the human-animal-environmental interface based on their susceptibility to the priority pathogens and the associated risk assessments (discussed in module 5).
- Preparation for pandemics of unknown emerging zoonotic diseases (WHO disease X) can use agnostic detection methods (NGS, etc) as well as development or sourcing of broadly reactive pan-virus family vaccines and antiviral therapeutics.

How to Design and Conduct Risk-Based Surveillance at the Human-Animal Interface

The "Tripartite" collaboration between WHO, FAO, and WOAH has emphasized the imperative for coordinated surveillance systems to combat infectious diseases at the human-animal-environment interface. While traditional risk-based approaches are valuable, the incorporation of One Health principles enhances the effectiveness of surveillance and intervention strategies. This module promotes the combination of traditional surveillance methods with the engagement of communities in participatory surveillance approaches to foster improved reporting, accelerated detection, and enhanced response. This module also describes innovative initiatives such as mobile phone and community-led surveillance networks that demonstrate the potential for more local-level involvement in disease surveillance.

Contents

- One Health surveillance at the human-animal interface
- Syndromic surveillance
- Laboratory surveillance
- Seroepidemiological studies
- Environmental surveillance
- Event-based surveillance
- Risk-based approaches
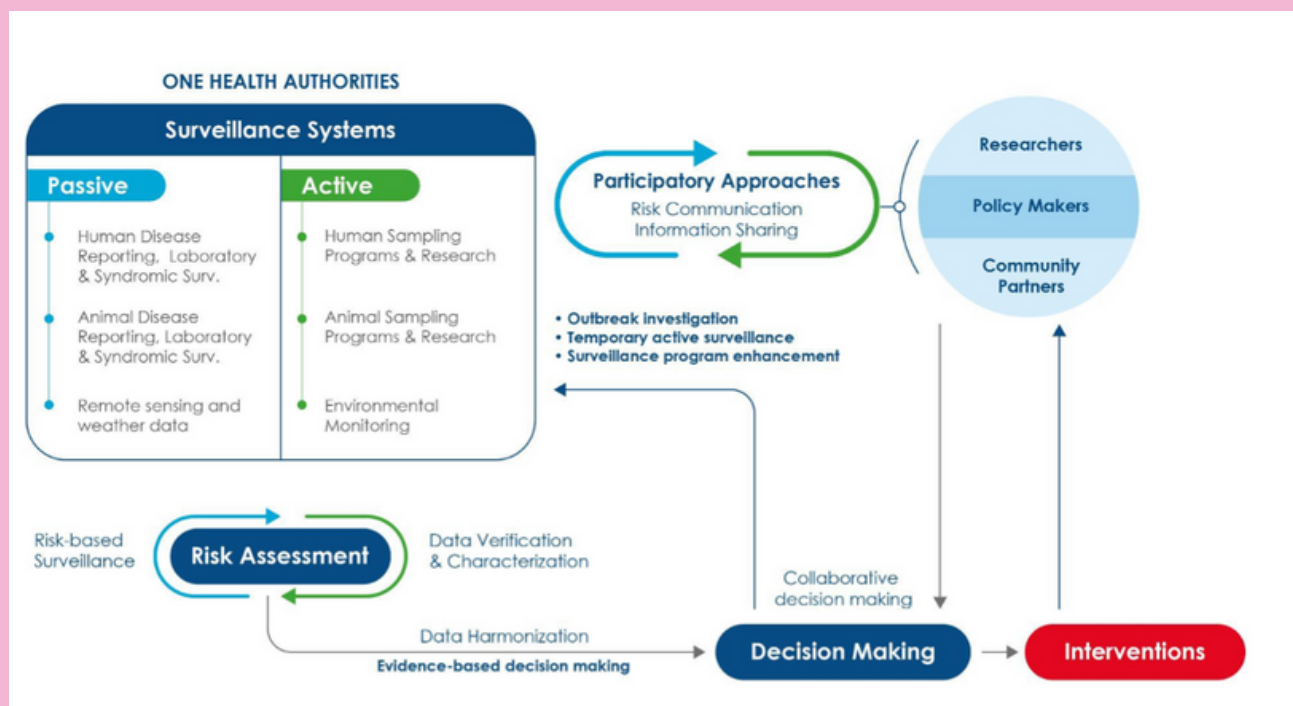
This figure details how interactions among partner groups and iterative activities, like risk assessment and decision-making using participatory approaches can improve disease surveillance. Within surveillance systems, disease reporting and laboratory networks may rely on established mandatory reporting requirements at multiple levels of governance or institutional structure, whereas syndromic surveillance may use emerging technologies, such as text data mining and artificial intelligence (AI) based systems. Sampling programs may be part of established initiatives, such as occupational health surveillance, or may rely on clinical populations and research initiatives for some or all of the data.

Conclusions

- Methods developed for risk-based approaches can help prioritize resources and target high priority areas and populations.
- Coordination of surveillance activities using human health, animal health, and environmental health bolsters pandemic preparedness.
- Repurposing and/or maintaining existing diagnostic capacity and broad virologic assays can be employed to detect emerging zoonotic threats.
- Engagement of experienced stakeholders can identify how people are in direct or indirect contact with animals and animal products.
- Interoperability of One Health data will be essential to increase preparedness.

MODULE

06

— STAKEHOLDERS —

Strategies to Engaging Diverse Stakeholders Across the Live Animal Value Chain to Address Risk

This module elaborates on the process of identifying and engaging a wide range of stakeholders, from individuals and local communities to broader populations, who play pivotal roles in creating, assessing, and managing risks across both domestic and wild live animal value chains. The module highlights critical points of contact facilitating transmission of zoonotic diseases and explores various stages of the animal and animal products value chain offering a set of culturally tailored, collaborative, and interdisciplinary solutions and recommendations to combat zoonotic disease spillover. The approach advocated within this module offers a holistic, collaborative, and inclusive perspective on zoonotic disease management, that could benefit populations throughout the region and beyond.
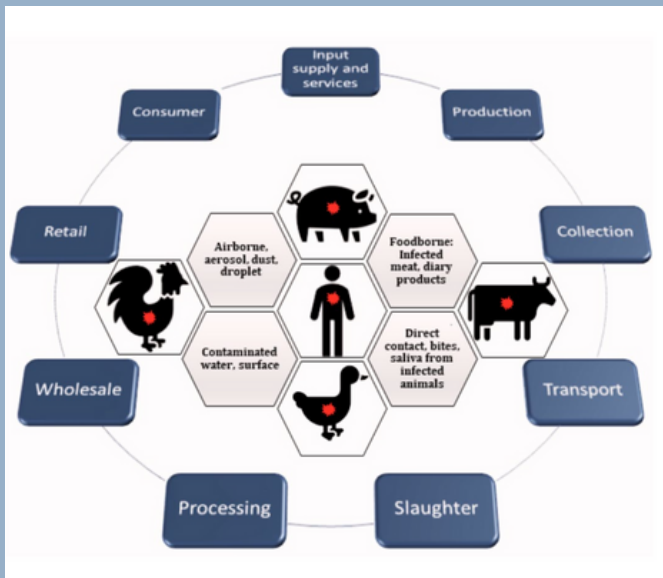
The figure shows the sequence of processes along a value chain from input to consumer associated with livestock-derived commodities

Contents

- The animal and animal products value chain within Southeast Asia: Structure and Components
- General stakeholder mapping activities and engagement best practices
- Establishing trusted networks in a fragmented system
- Critical points of contact between humans and animals in the value chain in Southeast Asia and associated complex risk factors
- Small-scale agrarian socio-economy and zoonotic disease risks in Southeast Asia

Example of an Animal Value Chain for the Poultry Food System
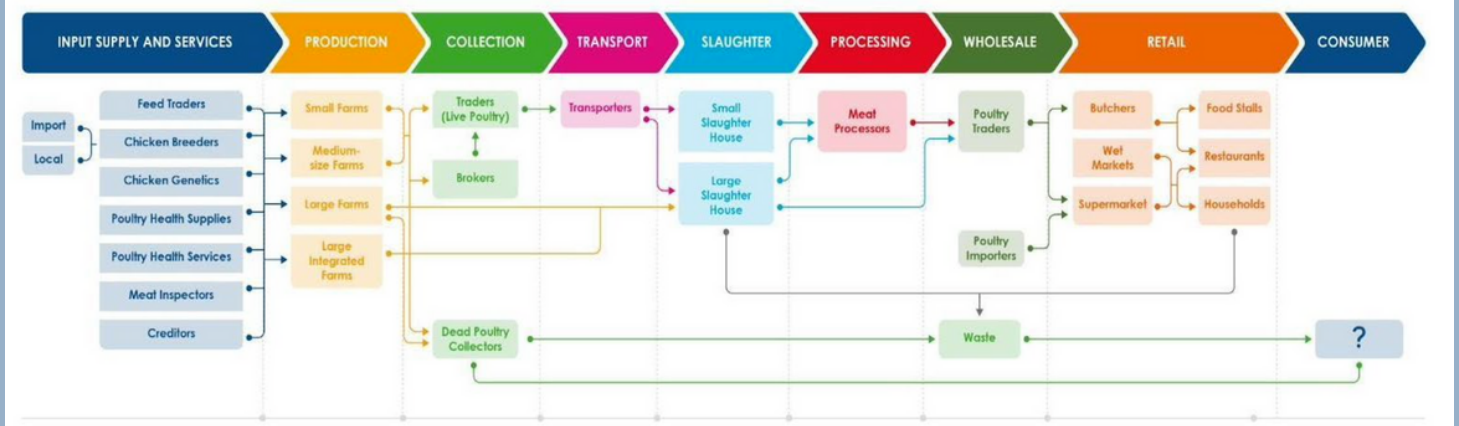
Conclusions

- Recognizing and understanding the multifaceted local contexts and their impact on pandemic risks is the foundational step towards crafting effective risk mitigation strategies.
- The engagement of a wide set of stakeholders is imperative to foster co-production of knowledge that empowers them to take ownership of the interventions.
- The dynamic nature of socio-ecological systems can be used to design creative solutions to the prevention of zoonotic spillover.

MODULE

07

BARRIERS

How to Enhance Zoonotic Disease Management by Addressing Knowledge Gaps and Implementation Barriers

This module discusses practical actions to address technical, coordinated, collaborative, and institutional challenges that hinder the effective implementation of One Health integrative public health strategies. It is structured around nine key barriers and actionable plans to address these barriers within the summarized framework for enhancing resilience against zoonotic disease threats in the region. Several case studies are included to illustrate how individuals and organizations have overcome barriers and improve outcomes. The cases span local, national, and regional interactions, emphasizing an integrated approach for preventing and mitigating zoonotic spillover.

This figure shows the 9 key barriers and gaps to fill to prevent zoonotic spillover.

Contents

- Resource constraints
- Operationalizing One Health
- Communication, collaboration, and coordination
- Data management, sharing, and security
- Transboundary disease surveillance
- Human behavior and consumption
- Workforce and human capacity development
- Laboratory capacity and biosafety
- Engagement of commercial entities
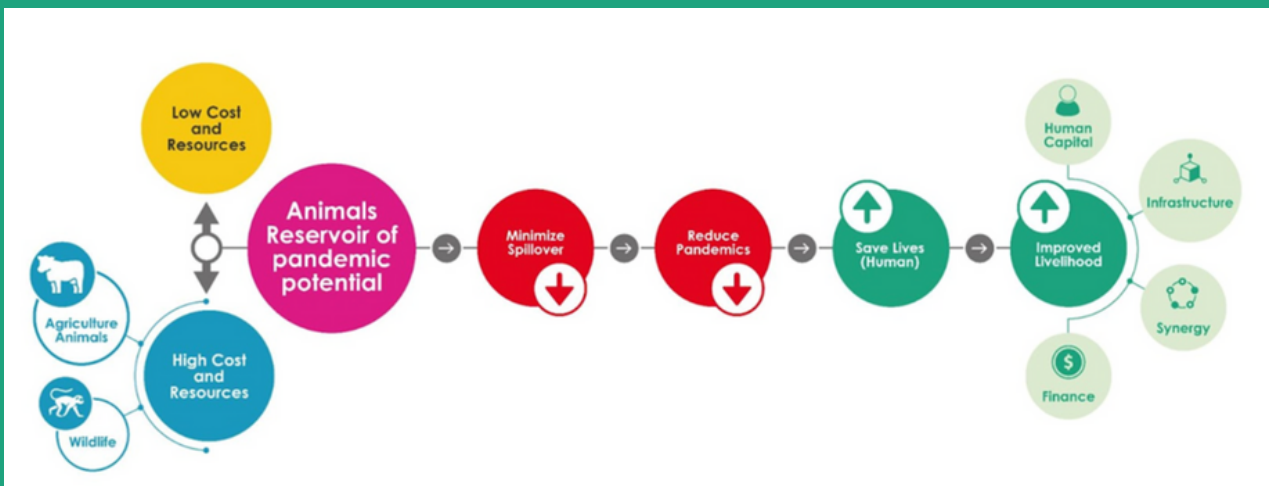
One Health operational framework. Derived from FAO

Conclusions

- Harmonizing activities across diverse sectors and agencies responsible for human health, domestic and wild animal health, and environmental health can lead to coordinated action and improved outcomes.
- Efficient resource allocation is essential to overcome inadequacies and variation, such as weak and varied surveillance systems, services, research, conducting transboundary, cross-country comparisons, as well as substantial underreporting of diseases.
- Expertise pooling can be accomplished by sustaining a reservoir of skilled professionals adept at addressing the interface of human, animal, and environmental health in the region.

MODULE

08

— PARTICIPATORY —

Applying Participatory Methodologies to Countering Zoonotic Spillover

The cultural, social, economic, environmental, and political contexts of the country, region, or organization must be carefully accounted for when seeking to develop useful and effective guidelines. This is particularly essential for the richly diverse region of Southeast Asia region. Modules 2-6 discuss strategies to improve current and future practices and policies related to One Health and zoonotic spillover. Essential to any improvement is a change in human behavior. This module details "participatory approaches" to engage diverse actors across all points of the live animal value chain. Such approaches to implementation not only ensure a more holistic and contextualized process but can pave the way to better ownership, salience, and legitimacy of the outcomes of implementation. The module outlines the key components of the the participatory approach implementation process, including how to take into account cultural, social, economic, political, and environmental contexts, and how to recognize and respect the characteristics of the people involved. (The development of this guidebook used several of the participatory approaches that are described). Finally it illustrates the necessity of a blend of methodologies, including implementation science, participatory research, and other social sciences to improve the uptake of the spillover prevention methods and outcomes.

Different levels of human organizational structures.

Contents

- Context from multiple levels
- Characteristics of the people engaged
- A participatory approach to implementation
- Practical ideas on how to foster genuine engagement
- Characteristics of best policies and practices
- Best strategies for implementing zoonotic prevention measures
- The vision of a participatory approach to implementation
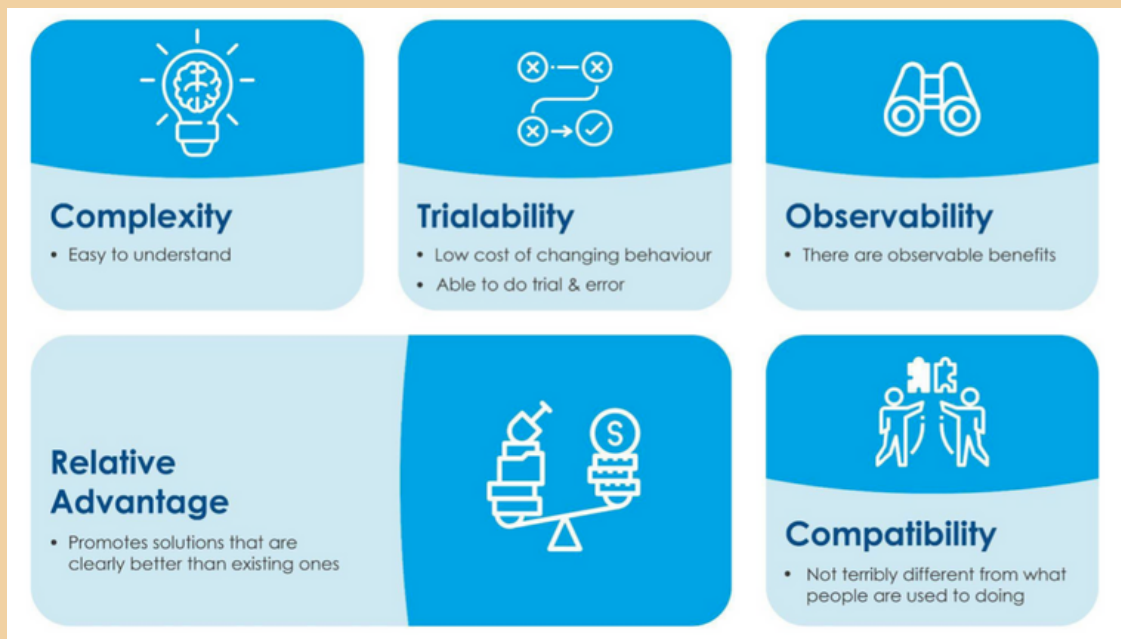
Characteristics of a successfully implemented guideline

Strategies for Implementing Zoonotic Prevention Measures

- Keep messages simple
- Focus on compatibility across sectors
- If it works, make sure the results are plain to see
- Develop guidelines that include practices and policies that are going to be perceived as "better" than what is currently in place.
- Ensure "low risk" by allowing for the possibility that practices and policies are flexible according to circumstances and that adopters can "back out" of their commitments

Countering Zoonotic Spillover of High Consequence Pathogens (HCP): Workshop Series

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NASEM and INGSA Data Gathering Workshops

Workshop #1 (Virtual, over Zoom)
May 2022

Workshop #2 (Virtual, over Zoom)
July 2022

Workshop #3 (In person, Bangkok)
September 9-11, 2022

Workshop #4 (In-person, Singapore)
November 11-13, 2022

Workshop #5 (In-person, Kuala Lumpur)
June 1-3, 2023

Project affiliates and workshop participants.

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