Opportunities for One Health Integration of Community Animal and Community Health Workers

Scenario Workshop Implementation Guide

Community meeting in Northern Kenya

Acknowledgement

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Introduction

The Opportunities for One Health Integration of Community Animal and Community Health Workers Project conducted a series of 4 workshops that brought together stakeholders from the national to local level to discuss scenarios for the way forward on the integration of One Health (OH) services at the community level. The countries where workshops were held were South Sudan, Ethiopia, Niger and Somalia. This document was initially developed to help set the scene and describe the process for the workshops. It has been updated in light of the lessons on the implementation of the four workshops. The results of the discussion of each of the workshops is captured in a series of four workshop reports.

Background

The One Health Context

One Health recognizes the interconnectedness of humans, animals and the environment and the need for a holistic approach to assuring their well-being. A human-centric approach cannot achieve human health in the absence of healthy livestock, agriculture, ecosystems and biodiversity. Some 60% of the emerging infectious disease events in man are linked to animals and pathogen spillover is often linked to resource exploitation that infringes on natural ecosystems (Jones, Patel et al. 2008) and animal agriculture (Karesh, Dobson et al. 2012, Rohr, Barrett et al. 2019). Our food and nutritional security requires healthy, diverse and sustainable plant and animal ecosystems. Increasingly, emergencies are the result of natural events that have been linked to climate change such as floods, droughts, severe storms, heat waves. These events, combined with rapidly evolving landscapes, create crises that threaten lives and livelihoods. We now recognize that the geographic range and seasonality of pathogens, disease vectors, crops, fisheries and livestock production are changing.

Solutions to these health challenges require integrated approaches based on sound epidemiological, ecological and economic analysis that effectively targets interventions to the point where they will have the greatest impact in terms of safeguarding health. Frequently, interventions that reduce human exposure to pathogens, nutritional stress or environmental exposures will be much more effective than only treatment of clinical manifestations in people. At the level of service delivery, potential synergies exist where combined strategies that deliver human, animal and environmental interventions through one mechanism or agent can result in greater uptake of services, efficiency of delivery and impact on overall health. The advantages of the One Health approach are generally recognized today, but rarely yet implemented at scale.

Climate change, conflict, economic shocks and other stressors lead to emergencies that put human life and livelihoods at immediate risk. These situations require immediate action that is often in tension with routine approaches in non-emergency times. Development is all about building institutions, markets and resilience. Emergencies and humanitarian interventions directly disrupt development. The challenge is to identify interventions that save lives while preserving livelihoods and the markets, services and possessions that build resilience. In some cases, it is feasible to contribute to development as an emergency intervention. The history of community animal health programs in South Sudan are an excellent example. Emergency funding was used to build a community-based animal health program that eradicated rinderpest (Mariner, House et al. 2012). Success resulted from a plan and approach that met both emergency and development objectives. Various programs have experimented with approaches that involve markets and local service providers to deliver emergency aid as a means of reinforcing local enterprises that contribute to resilience (LEGS 2014). Emphasis is shifting from in-kind distribution to approaches that reinforce markets and empower beneficiaries by giving them choice and dignity (FAO 2016). Guidance on humanitarian responses includes 'reduce future vulnerability to disasters as well as meeting basic needs' as a core principle (Sphere 2018). The scenario workshop will look at both emergency and non-emergency contexts for service delivery and seek to strike a balance, or better yet identify synergies.

Progress has been made in terms of moving towards One Health approaches, but much more remains to be done. Initially, One Health was presented as the need for collaboration across disciplines and professions to capture synergies. Increasingly, national stakeholders are recognizing that One Health should move in the direction of integration of services, decision-making and funding of activities to achieve even greater impact (Thierry, Michael et al. 2017, Abbas, Shorten et al. 2022). The challenges are the existing institutional structures, institutional cultures and values, and the power of organizations and individuals involved. Health has its own political economy - an interaction of power and resources. These challenges exist at international and national level, but probably less so at the local and community level where practical needs are closer to guide decision-making.

Institutional change creates anxiety and partners must build trust and transparency. Empowering One Health institutions means old centers of power must be willing to pass power and control over resources to new structures. This is part of what empowering One Health means. This is a process of evolution rather than revolution. Careful consultation and dialogue that examines the positive and untoward effects of proposed changes is required. This scenario workshop is one small step in the evolution to improved access to the full range of One Health at the community level in both normal and emergency settings.

Access to services

Community health and health services can be broken down into four main approaches.

1. **Fixed-point clinics:** This refers to fixed-point clinics or posts that offer a basic range of health services and refer more complicated cases to district centers or hospitals. These usually employ a paraprofessional with some level of formal training. Fixed point facilities have an effective range of 5 to 10 kms. If based in a market center, they may serve a broader community that utilizes the market. Resupply of fixed-point services is often a persistent problem.

2. **Mobile services:** Mobile clinics bring services to remote areas, may involve qualified professionals and offer a broader range of services than the fixed-point clinics or posts. The approach involves transportation costs and allowances that result in greater costs than most health systems can sustain without outside donor support.

3. **Community-level services:** Community service approach involves community agents trained to deliver basic services. The agents are selected from the local population and are trained and authorized to provide specific services that may include education, mobilization, surveillance, case referral and treatment of a short list of common uncomplicated diseases. In this model, the community agents are incentivized by the health system and are a form of government employee.

4. **Community-based services:** Community-based services are service networks owned by the community and at least in part funded by the community. The networks have a shared supervision system where community-based agents are technically supervised by formally trained health professionals while they are answerable to their communities. Increasingly, community-based networks are public-private-community partnerships (PPCP) where the public sector supervises surveillance and disease control functions while the private practitioners operate resupply and offer diagnostic support.

Trends in Synergies and Gaps - Observations from the Field

Mobility and access to services:

Many communities practice some form of pastoralism where a segment of the population moves with the livestock for a period of time. According to the distance, this can range from a small portion to the whole community. In some communities, the entire population moves between wet season and dry season grazing areas over an annual cycle. The distances involved may be from a few kilometers to 500 kilometers.

Community-based animal health usually stipulates that movement with the herds is a criterion for selection and training. Human community health programs tend not to emphasize mobility and most human health programs utilize sedentary models by which the community health workers are attached to a clinic or post.

Our research in pastoral communities in South Sudan has found that even though only a percentage of the community population is living in the cattle camps, the camps are the largest gap in human health care in terms of unmet need.

Resilience, dependency and sustainability

These are important concepts in emergency interventions and development. Often there is a fundamental tension between the need to save lives and the need to build resilience through sustainable approaches. We are searching for win-win scenarios!

Resilience is the ability of communities and individuals to overcome emergencies and shocks. Resilience depends on the availability of resources and access to services as well as flexibility and options in terms of alternate livelihoods in the face of change.

Figure 1: Dinka cattle near Bor, South Sudan

Dependency results when people are unable or unwilling to provide for themselves and become reliant on aid. This inability may result from factors external to the household or community such as the collapse of markets for inputs required for their livelihoods to function. Human and animal health markets are examples of markets critical to livelihoods success. **Sustainability** is the economic and social feasibility of an activity to be continued into the future.

Obviously, certain emergency interventions such as cash transfers are not sustainable and may contribute to dependency but are entirely appropriate to saving lives in an emergency. Providing free animal and human health (mobile) services is another example of common emergency interventions. These save lives and productive resources but disrupt or even bankrupt markets for those services in the future.

There are always options. Instead of supplying free services, cash transfers or vouchers can make the interventions available to those in need and at the same time will reinforce service markets and help to build resilience. Emergency interventions that support purchasing power and capacity building as immediate actions in all OH sectors may be a way to enhance resilience.

Public-private-community partnerships

The public-private-community partnerships (PPCP) approach seeks to mobilize a greater number of actors and resources in activities in order to increase availability, impact and sustainability of the activity. The initiative gains additional resources and investment and benefits from the broader ownership and commitment of the parties. Often, PPCP operate in fields which were once seen as primarily government responsibilities.

In animal health, community-based animal health programs are usually founded on PPCP principles wherein the community contributes through provision of personnel, investment and operating costs, the private sector manages resupply and support, and the public sector is active in oversight and coordination. Often, these programs contribute to the delivery of nationally coordinated animal health programs such as disease surveillance and control/eradication. Community-based animal health workers were the principal implementers of rinderpest vaccination responsible for rinderpest eradication in the most difficult areas in Ethiopia, Sudan and Uganda.

PPCP in human and public health are evolving. For example, private practitioners now implement childhood vaccination programs in some countries. Insurance schemes are evolving where the public pays minimal fees to be enrolled in national services. Private citizens often prioritize the quality and availability of services over free services and state that they prefer to go to private providers for these reasons.

How can we continue to leverage the participation of civil society to meet the demands for One Health services? The goal is to optimize the balance between cost, availability, and quality while we enhance the resilience of a community.

One Health services and the drivers of emergencies

Environmental degradation and climate change

Humanitarian emergencies are increasingly linked to environmental degradation and climate change. As ecosystems and wildlife are depleted, communities face fewer livelihood opportunities and are less resilient. Climate change is resulting in more dramatic weather events (floods, droughts, tropical storms, blizzards, etc.) that lead to humanitarian emergencies. Climate change is also leading to shifts in local ecology that result in unsuitable conditions for what were the predominant agricultural production practices in an area. Communities will need to adopt new crops and new practices. Often this requires new skills and investment, leaving the community vulnerable during the transition.

This suggests that the environmental health component of the One Health triad is increasing in relevance to the humanitarian sector. This is of interest both in terms of preventing and mitigating emergencies. As an example, the persistent flooding in Bentiu, South Sudan is driving the emergency there. Actions to understand and resolve the flooding are relevant to the emergency response and should shape the mitigation strategy. Flooding creates specific health threats to people and livestock and environmental monitoring should be considered a relevant activity for community health and animal health programs.

Competition for resources and political economy

Insecurity in developing countries is often driven by resource competition. Livestock and arable land are key resources. Instability and competition for resources are, in turn, also linked to environmental degradation and climate change. The decline of the resource bases of communities leads to conflict over what remains. Effective One Health services can protect livestock and environmental resources

Figure 2: Dikes holding back flood waters for two years in Bentiu

and help diffuse drivers of conflict. They may also reassure communities that have opportunities and redirect their energies away from destructive conflict and into measures to conserve and grow their resource base.

Geographic scope and range of services

One Health solutions to community health will not be a one-fits-all approach. It is important to consider geographic range when discussing solution implementation. Different geographic

Figure 3: Local Pharmacy contracted as thermotolerant PPR vaccine distribution hub to supply CAHWs in Karamoja, Uganda. Pharmacy remunerated based on the number of vouchers collected by the CAHW after vaccination

areas have their own cultural, political, and topographical variations, and each of these should be considered when considering an approach to health delivery. Population density and distance affect the economic and logistic feasibility of options. Geographical variation should especially be considered in terms of health service delivery in the context of a disaster, as disruptions to normal operations will have different impacts in different areas.

Range of services should also be considered on a geographical basis. How far from a community is reasonable for health access? Are there physical barriers such as mountainous terrain or rivers? Seasonal barriers such as flooding? What about mobile communities? What services are available and where? For humans, for animals, for the environment? What obstacles impede access to service? Do these factors change in a disaster context? How so? Distance from health access as well as what challenges face those trying to access them vary by community and

Figure 4: Thermotolerant PPR vaccine. No cold chain needed for 30 days. The CAHW is trained to organize the vaccination, rehydrate the vaccine, collect and record voucher payments in a mobile phone app. The CAHW is paid based on the vouchers collected and the app authorizes payment to distribution hub.

geographic area, but understanding the variations across this landscape can help us develop solutions that provide benefits across the board.

One Health Objectives at the Community Level

Identify and Agree on Goals for Health Services in a One Health Context

 A key takeaway from this workshop will be the identification of existing levels of health access available to humans, animals and their environment, as well as the prioritization of goals pertaining to each of these structures. Stakeholders will have the opportunity to discuss and advocate the needs of each sector and identify opportunities for collaboration, integration or dissociation between each model of health delivery to communities.

Interactive definition of the objectives of the three components of One Health.

One Health is a collaborative, unifying approach to balance and optimize the health of people, animals and ecosystems. One Health approaches are multi-sectoral and transdisciplinary in nature and aim to reduce threats at the human-animal-ecosystem interface (OHLLEP 2021).

Figure 5: Community Animal Health Worker recording PPR vaccinations and entering voucher details for payment on a mobile phone app

Many roles of community-level health service delivery already promote the inherent resilience of the communities they serve. These roles increase access to various health interventions and services, including vaccines, which improve the overall health of a population and reduce risk of disease transmission. Further, community health is often a trusted role within the community, making its practitioners valuable mobilizers for social response to threat.

One key benefit of integration of these delivery models are increased client-centered services at the community-level, such as awareness campaigns of locally relevant health issues in both humans and animals, including zoonoses and the signs of infectious disease, as well as access to treatment, medications, preventative measures, and other education and public health services, such as maternal health, family planning, WASH and palliative healthcare guidance.

Fundamentally, community-level health workers act as the frontline for disease surveillance both in the human and animal populations, especially in remote communities that have historically under-reported outbreaks, particularly the neglected zoonotic diseases which are often endemic to the areas of high pastoral movement.

How do community-level services shift between normal conditions and emergencies?

Emergency settings are those unexpected events that impose serious health, economic, or political threats, and require special considerations for mitigation beyond routine procedures or resources. Under this umbrella, large-scale disease outbreaks, natural disturbances such as drought, flood, fire or earthquake, climate-related emergencies, as well as human-caused disturbances such as war, genocide or mass migration can be considered disasters creating an emergency setting, each having diverse implications on One Health at the community level.

In both normal and emergency contexts, community-level health workers already play a vital role in communication of and education on important One Health concepts to hard-to-reach communities, and with high levels of local knowledge, prioritize implementations most culturally and geographically relevant to their community. This is especially valuable during a disaster, in which access to these communities is often disrupted, under-prioritized or neglected entirely.

Depending on the scope of the emergency, human health is often prioritized over that of non-human animals or the environment, but for many pastoral or semi-nomadic communities, these elements are inextricably linked. Further, stressors to one over the other can often have unforeseen consequences such as increased disease spillover risk or negative effects on the environment. One Health approaches that balance attention to human, animal and environmental health risks will have the most overall success.

What are the benefits and untoward impacts of emergency measures on development and resiliency?

Community-level health response during a disaster can bridge resilience gaps by filling service gaps during and after emergencies. Healthcare workers during an emergency or outbreak are overwhelmed and disproportionately affected by disease, rapidly decimating the workforce available for response. If the emergency response reinforces local service provision and input supply markets, it will reinforce resiliency rather than erode it

Further, when healthcare professionals cannot access the community due to a security or disease event, community-level healthcare providers can maintain coverage of their area keeping access to basic health services open for their community.

Appropriately trained community-level health workers can not only bolster health professionals during an emergency response but will also stay to work in their communities following a response, when the healthcare workforce is most depleted.

Scenario Workshop Process

Participant Selection

Workshop participants have been identified as key stakeholders at the national, regional and community levels of human, animal and environmental health. Representatives from the national government, ministries of health, agriculture and environment, and their regional counterparts are accounted for, as well as representatives from existing community human and animal health structures, representatives of various non-profit organizations operating in this space, professionals from research and academic institutions in the human and animal health fields. From the community level, representatives have been selected by the community or community mobilizers to be in attendance. Community representation in the discussion is essential to developing ideas that will work at the community level. Efforts have been made to reach a good gender representation and ensure women, particularly from the community level, take part in the discussion and contribute with their needs and perspectives.

Identifying key stakeholders in each of these realms and ensuring that each level of hierarchical structure is well represented are essential to successful workshop implementation. Without meaningful input from each level, functional One Health solutions cannot be reached. At the same time, the number of participants has been capped to encourage a high level of interactive discussion. The goal is to have an open and frank dialogue that leads to practical, innovative solutions that change the game.

Opening Session

Objectives Setting and Community One Health Integration Presentations are two short presentations to set the scene. They will describe the objectives and activities of the project as well as outline preliminary observations from the background literature research and field visits of the project. The observations shared in this presentation will be intended to spark discussion, rather than present conclusions.

Thereafter, the participants will be asked what they would like to get out of the workshop in order to refine and clarify the objectives of the workshop.
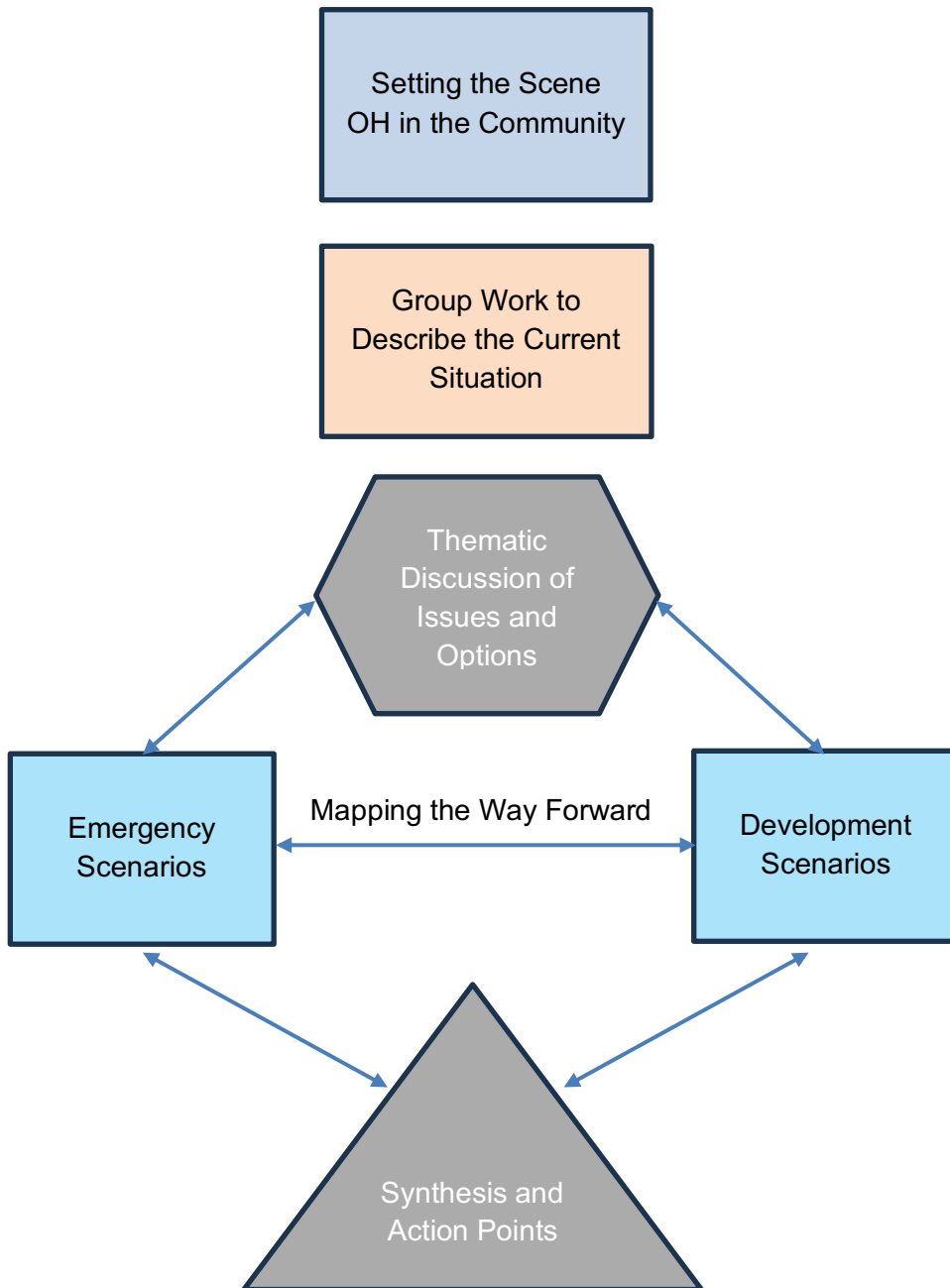
Figure 6: The Scenario Workshop Process

Overview of Current Health Service Models

This will be an interactive session to overview current health service models in the country, in a One Health context. Observations from the field and interviews with stakeholders will be presented to workshop participants to provide a synthesis of what we understand to be the current state of health service delivery to communities and the goals for the future that have so far been identified.

The next phase of the discussion will ask participants to go into breakout groups and identify strengths and challenges in the existing models. Participants from the One Health professions and the different hierarchical structure levels will be mixed across groups so that divergent views can be shared.

Thematic Discussion Session

Thereafter, a series of thematic discussion will be held on topics that are integral to the design and delivery of effective One Health services. Themes will be refined as the workshop progresses. Below is the preliminary list of discussion topics. This may be slightly adapted to the settings of the different scenario workshops.

- Approaches to integration
  - One network with different staff specializations
  - Selected shared responsibilities
  - Cross training of staff
- Appropriate activities for implementation of CHW and CAHW programs
- Mobile vs village-based services
- The impact of incentive systems on service availability and implementation

Workshop Scenarios

The workshop will present participants with several scenarios and challenge them to collaborate in identifying practical solutions that address the needs of human, animal and environmental health. Scenarios will be presented in both a normal and a disaster context, to elucidate the need for an adaptive approach to One Health delivery models. Discussion will follow each scenario asking participants to identify key differences and commonalities between the scenarios under normal and disaster contexts and how existing health service delivery models can be adapted, or new models designed and implemented, to address the needs identified in each.

The scenario problem statement will be developed or refined during the workshop based on the observations from the field as well as discussion and issues identified during the first day

and a half. In this way, the scenario sessions will directly relate to the challenges participants face.

Some examples of normal potential scenarios:

- Communities face annual floods that cut off road access for prolonged periods and air transport is not economically viable.

- Communities practice transhumant production that takes them to remote areas with low population density and no permanent settlements.

Climate change may be causing shifts in patterns for both these.

Some examples of emergency scenarios

- Insecurity prevents access by national and international professional service providers and leads to recurrent theft/destruction of resources and infrastructure.

- Severe drought results in the failure of crops and lack of grazing resources.

- Unusual severe floods or floods resulting in long term disturbances lasting more than one annual cycle.

Climate change may have an impact on all of these. Climate change contributes to resource insecurity and competition over resources.

Scenario Group Work

Once the scenario has been described, the meeting will be asked to break into groups that mix national and local participants from different sectors to discuss One Health intervention strategies that mitigate the challenge described in the scenario. A series of questions relative to the scenario will be provided to help stimulate discussion and the facilitators will check in on progress. The goal will be for the participants to identify approaches that have the potential to be effective, achievable and sustainable within each scenario and that address all three components of One Health in a balanced approach. The groups will also be asked to discuss the enabling environment required to make the approach successful such as policies, skills, knowledge and funding. Each group will outline their approach on flip charts as they develop it.

Synthesis

In the synthesis session each group will summarize their map towards solving the problem presented in the scenario. Thereafter, a plenary discussion will work to develop a consensus

around a core strategy. Once the strategy is agreed upon, the meeting will be asked to identify action points for implementation.

Mapping the Way Forward

The final afternoon of the workshop will be spent synthesizing the goals and priorities identified throughout the workshop discussions to map the way forward and reach an agreed-upon actionable consensus that addresses the current human, animal and environmental gaps in health access both in times of normalcy and those of crisis.

The needs of each sector will be considered in this approach, with the overall goal being to develop a plan prioritizing access to health for remote or mobile communities, their animals and the environment in which they live, as they have been identified as the segment of society in which the largest gaps to health services currently exist.

Defining Next Steps

By the end of the workshop, participants will have defined a list of achievable action items in order to implement their agreed-upon One Health approach. Next steps may include strategies to address any unmet needs in order to implement the plan, specific buy-in needed from relevant unrepresented stakeholders and how to pursue it or drafting of a proposal for implementation of this plan and listing the steps needed to put it into action. Next steps should be specifically adaptive or inclusive of how this strategy would be implemented in event of an emergency or disaster.

References:

Abbas, S. S., et al. (2022). "Meanings and mechanisms of One Health partnerships: insights from a critical review of literature on cross-government collaborations." Health Policy and Planning **37**(3): 385-399.

> Complex health policy challenges such as antimicrobial resistance and other emerging infections are driven by activities in multiple sectors. Therefore, addressing these also requires joint efforts from multiple sectors as exemplified in the One Health approach. We undertake a critical review to examine the different ways in which multisector partnerships have been conceptualized across multiple disciplines and thematic areas. We started with a set of six articles from the disciplines of health, nutrition and public administration that reviewed conceptual frameworks within their respective fields. We conducted backward citation tracing using the bibliography of the six articles to identify other articles in the same and related fields that conceptualized multisector partnerships. We identified 58 articles published from 1967 to 2018 from the fields of global health, infectious diseases, management, nutrition and sustainability sciences indicating that multisector partnerships have been a topic of study across different fields for several decades. A thematic analysis of the 58 articles revealed that multisector partnerships assume a variety of forms and have been described in different ways. Partnerships can be categorized by scope, scale, formality and strength. Multisector partnerships emerge in conditions of dynamic uncertainty and sector failure when the information and resources required are beyond the capacities of any individual sector. Such partnerships are inherently political in nature and subsume multiple competing agendas of collaborating actors. Sustaining collaborations over a long period of time will require collaborative approaches like One Health to accommodate competing political perspectives and include flexibility to allow multisector partnerships to respond to changing external dynamics.

FAO (2016). Livestock-related interventions during emergencies – The how-to-do-it manual. Rome, FAO.

Jones, K. E., et al. (2008). "Global trends in emerging infectious diseases." Nature **451**(7181): 990-993.

> Emerging infectious diseases (EIDs) are a significant burden on global economies and public health. Their emergence is thought to be driven largely by socio-economic, environmental and ecological factors, but no comparative study has explicitly analysed these linkages to understand global temporal and spatial patterns of EIDs. Here we analyse a database of 335 EID 'events' (origins of EIDs) between 1940 and 2004, and demonstrate non-random global patterns. EID events have risen significantly over time after controlling for reporting bias, with their peak incidence (in the 1980s) concomitant with the HIV pandemic. EID events are dominated by zoonoses (60.3% of EIDs): the majority of these (71.8%) originate in wildlife (for example, severe acute respiratory virus, Ebola virus), and are increasing significantly over time. We find that 54.3% of EID events are caused by bacteria or rickettsia, reflecting a large number of drug-resistant microbes in our database. Our results confirm that EID origins are significantly correlated with socio-economic, environmental and ecological factors, and provide a basis for identifying regions where new EIDs are most likely to originate (emerging disease 'hotspots'). They also reveal a substantial risk of wildlife zoonotic and vector-borne EIDs originating at lower latitudes where reporting effort is low. We conclude that global

resources to counter disease emergence are poorly allocated, with the majority of the scientific and surveillance effort focused on countries from where the next important EID is least likely to originate.

Karesh, W. B., et al. (2012). "Ecology of zoonoses: natural and unnatural histories." <u>The Lancet</u> **380**(9857): 1936-1945.
> Summary More than 60% of human infectious diseases are caused by pathogens shared with wild or domestic animals. Zoonotic disease organisms include those that are endemic in human populations or enzootic in animal populations with frequent cross-species transmission to people. Some of these diseases have only emerged recently. Together, these organisms are responsible for a substantial burden of disease, with endemic and enzootic zoonoses causing about a billion cases of illness in people and millions of deaths every year. Emerging zoonoses are a growing threat to global health and have caused hundreds of billions of US dollars of economic damage in the past 20 years. We aimed to review how zoonotic diseases result from natural pathogen ecology, and how other circumstances, such as animal production, extraction of natural resources, and antimicrobial application change the dynamics of disease exposure to human beings. In view of present anthropogenic trends, a more effective approach to zoonotic disease prevention and control will require a broad view of medicine that emphasises evidence-based decision making and integrates ecological and evolutionary principles of animal, human, and environmental factors. This broad view is essential for the successful development of policies and practices that reduce probability of future zoonotic emergence, targeted surveillance and strategic prevention, and engagement of partners outside the medical community to help improve health outcomes and reduce disease threats.

LEGS (2014). Livestock Emergency Guidelines and Standards. Rugby UK, Practical Action Publishing.

Mariner, J. C., et al. (2012). "Rinderpest eradication: appropriate technology and social innovations." <u>Science</u> **337**(6100): 1309-1312.
> Rinderpest is only the second infectious disease to have been globally eradicated. In the final stages of eradication, the virus was entrenched in pastoral areas of the Greater Horn of Africa, a region with weak governance, poor security, and little infrastructure that presented profound challenges to conventional control methods. Although the eradication process was a development activity rather than scientific research, its success owed much to several seminal research efforts in vaccine development and epidemiology and showed what scientific decision-making and management could accomplish with limited resources. The keys to success were the development of a thermostable vaccine and the application of participatory epidemiological techniques that allowed veterinary personnel to interact at a grassroots level with cattle herders to more effectively target control measures.

OHLLEP (2021). "Joint Tripartite (FAO, OIE, WHO) and UNEP Statement
Tripartite and UNEP support OHHLEP's definition of "One Health"." Retrieved June 11, 2023, 2023, from https://www.fao.org/3/cb7869en/cb7869en.pdf.

Rohr, J. R., et al. (2019). "Emerging human infectious diseases and the links to global food production." <u>Nat Sustain</u> **2**(6): 445-456.
> Infectious diseases are emerging globally at an unprecedented rate while global food demand is projected to increase sharply by 2100. Here, we synthesize the pathways by

which projected agricultural expansion and intensification will influence human infectious diseases and how human infectious diseases might likewise affect food production and distribution. Feeding 11 billion people will require substantial increases in crop and animal production that will expand agricultural use of antibiotics, water, pesticides and fertilizer, and contact rates between humans and both wild and domestic animals, all with consequences for the emergence and spread of infectious agents. Indeed, our synthesis of the literature suggests that, since 1940, agricultural drivers were associated with >25% of all - and >50% of zoonotic - infectious diseases that emerged in humans, proportions that will likely increase as agriculture expands and intensifies. We identify agricultural and disease management and policy actions, and additional research, needed to address the public health challenge posed by feeding 11 billion people.

Sphere (2018). "The Sphere Handbook: Humanitarian Charter, Minimum Standards in Humanitarian Response." Fourth Edition. Retrieved June 8, 2023, 2023, from www.sperestandards.org/handbook.

Thierry, N., et al. (2017). "Implementing One Health as an integrated approach to health in Rwanda." BMJ Global Health **2**(1): e000121.
It is increasingly clear that resolution of complex global health problems requires interdisciplinary, intersectoral expertise and cooperation from governmental, non-governmental and educational agencies. 'One Health' refers to the collaboration of multiple disciplines and sectors working locally, nationally and globally to attain optimal health for people, animals and the environment. One Health offers the opportunity to acknowledge shared interests, set common goals, and drive toward team work to benefit the overall health of a nation. As in most countries, the health of Rwanda's people and economy are highly dependent on the health of the environment. Recently, Rwanda has developed a One Health strategic plan to meet its human, animal and environmental health challenges. This approach drives innovations that are important to solve both acute and chronic health problems and offers synergy across systems, resulting in improved communication, evidence-based solutions, development of a new generation of systems-thinkers, improved surveillance, decreased lag time in response, and improved health and economic savings. Several factors have enabled the One Health movement in Rwanda including an elaborate network of community health workers, existing rapid response teams, international academic partnerships willing to look more broadly than at a single disease or population, and relative equity between female and male health professionals. Barriers to implementing this strategy include competition over budget, poor communication, and the need for improved technology. Given the interconnectedness of our global community, it may be time for countries and their neighbours to follow Rwanda's lead and consider incorporating One Health principles into their national strategic health plans.