



Workshop Summary

One Health Zoonotic Disease Prioritization & One Health Systems Mapping and Analysis Resource Toolkit™ for Multisectoral Engagement in Pakistan



Islamabad, Pakistan





Photo 1. Waterfall in Skardu.

TABLE OF CONTENTS

Participating Organizations	iv
Summary.....	1
Background	5
Pakistan’s National One Health Platform.....	5
One Health Zoonotic Disease Prioritization and One Health Systems Mapping and Analysis Resource Toolkit Workshop	7
Workshop Methods	8
One Health Zoonotic Disease Prioritization (OHZDP)	8
Criteria Selected for Ranking Zoonotic Diseases	9
One Health Systems Mapping and Resource Analysis Toolkit™ (OH-SMART).....	10
Plans and Recommendations.....	13
Specific Next Steps	15
APPENDIX A: Overview of the One Health Zoonotic Disease Prioritization Process	17
APPENDIX B: One Health Zoonotic Disease Prioritization Workshop Participants for Pakistan.....	18
Acknowledgements	21
APPENDIX C: Final Results of the One Health Zoonotic Disease Prioritization Workshop in Pakistan.....	22
APPENDIX D: Numerical Weights for the Criteria Selected for Ranking Zoonotic Diseases in Pakistan (short-term goal)	24
APPENDIX E: Key Stakeholder Interview Questions.....	26
APPENDIX F: Prioritized Zoonotic Disease Outbreak Response OH-SMART™ Map.....	27
APPENDIX G: Discrepancies, Resolutions, Action Steps by Prioritized Zoonotic Disease.....	37
APPENDIX H: OH-SMART™ Participant Feedback	42
References	44

PARTICIPATING ORGANIZATIONS

Field Epidemiology and Laboratory Training Program (FELTP)

Food and Agriculture Organization of the United Nations (FAO)

Ministry of National Food Security and Research (MoNFSR)

Ministry of Climate Change (MoCC)

Ministry of National Health Services, Regulations and Coordination (MoNHSRC)

National Institute of Health (NIH)

National Agricultural Research Centre (NARC)

Pakistan Agricultural Research Council (PARC)

Provincial Department of Health (DoH) of the following provinces:

Azad Jammu & Kashmir (AJK)

Balochistan (BN)

Directorate of Health Services (DHS) Federally Administered Tribal Areas (FATA)

Gilgit-Baltistan (GB)

Khyber Pakhtunkhwa (KP)

Punjab (PB)

Sindh (SD)

Provincial Livestock and Dairy Development Departments (L&DD) of the following provinces:

Azad Jammu & Kashmir (AJK)

Balochistan (BN)

Federally Administered Tribal Areas (FATA)

Gilgit-Baltistan (GB)

Khyber Pakhtunkhwa (KP)

Punjab (PB)

Sindh (SD)

Public Health England (PHE)

U.S. Centers for Disease Control and Prevention (CDC)

U.S. Department of Agriculture (USDA)

U.S. Department of State (DOS)

U.S. Agency for International Development (USAID)

University of Minnesota (UMN)

World Health Organization (WHO) Islamabad

World Organisation for Animal Health (OIE)

SUMMARY

Zoonotic diseases are diseases capable of spreading between animals and humans. Most known human infectious diseases and about three-quarters of newly emerging infections originate from animals. Some zoonoses pose a significant threat to human public health, while others may have tremendous agricultural and social or economic impacts. The cross-sector nature of zoonotic diseases has historically been a challenge in preparing for and responding to zoonotic disease threats at the animal-human-environment interface, highlighting the critical need for a multisectoral, One Health approach to address these emerging health threats.

To address zoonotic disease challenges in Pakistan, a joint One Health Zoonotic Disease Prioritization (OHZDP) and One Health Systems Mapping and Analysis Resource Toolkit (OH-SMART™) workshop was organized by the United States Centers for Disease Control and Prevention (CDC), United States Department of Agriculture (USDA), University of Minnesota, and the National Institute of Health in Pakistan during August 19–25, 2017, at the Marriot Hotel in Islamabad. This report summarizes the One Health processes used to prioritize the top zoonotic diseases for Pakistan that should be jointly addressed using a multisectoral, One Health approach including human, animal, and environmental health ministries and other sectors relevant to the prioritized zoonotic disease.

The purpose of first two days of the workshop was to use the OHZDP tool to identify zoonotic diseases of greatest national concern for Pakistan using equal input from representatives of human health, livestock, environment, wildlife, research, and higher education sectors. During the workshop, representatives identified a list of zoonotic diseases relevant for Pakistan, defined the criteria for prioritization, and determined questions and weights relevant to each criterion. Six zoonotic diseases were identified as a priority by participants using a semi-quantitative tool, the One Health



Zoonotic Disease Prioritization tool, developed and coordinated by CDC (Appendix A).^{1,2}

The prioritized zoonotic diseases for Pakistan were zoonotic influenza, brucellosis, *Salmonella*, rabies, Crimean-Congo hemorrhagic fever, and anthrax (Table 1). The final results of the One Health prioritization process and normalized weights for all zoonotic diseases discussed in Pakistan are shown in Appendix C.

After the disease list was determined, the following two days were spent applying the six OH-SMART™ steps to an outbreak scenario for each newly prioritized disease. The six steps include: stakeholder identification and mapping; focus group interviews; mapping of an outbreak scenario for each prioritized zoonotic disease selected by each group; identification of gaps and best practices; and identification of action steps to address the gaps. These steps helped each group think through existing areas of collaboration, and gaps in multisectoral coordination in terms of zoonotic disease surveillance, laboratory capacity, outbreak response, and workforce development.

In-depth discussion allowed participants to identify best practices in multi-agency collaboration, challenges faced during collaboration and obstacles that prevent collaboration. The groups identified and discussed communication and coordination points between sectors that are currently happening and that need to happen. Once the gaps were identified, the groups brainstormed specific action items that could make coordination, communication and collaboration among different agencies more formalized and effective.

This workshop brought together participants from multiple ministries and provincial level government interested in improving multi-agency collaboration and coordination. Some of the participants are also currently involved in the formalization of a National One Health Platform for Pakistan and some have not previously worked on an multisectoral basis. As a result, this workshop helped strengthen existing cross-agency relationships, and helped build new ones. It was a step forward in improving One Health capacity among critical stakeholders responsible for managing prevention, detection and response for the prioritized zoonotic diseases of Pakistan.



Photo 2. One Health Zoonotic Disease Prioritization workshop participants in Islamabad, Pakistan.

Table 1. Description of priority zoonotic diseases in ranked order selected in Pakistan by participants using a multisectoral process in the One Health Zoonotic Disease Prioritization workshop conducted in August 2017.

Zoonotic Disease	Causative Agent	Human Disease Burden	Animal Disease Burden	Diagnostics, Treatment, and Prevention
Zoonotic influenza Viruses	Viruses	An H5N1 outbreak was reported in 2007 resulting in one death. ³⁻⁵	H7N3, H9N2, H5N1, H3N1, H4N6 and H14N3 were reported in Pakistan. ⁶⁻⁸ H9N2 is considered endemic in Pakistan. ⁷ Since 1995 there have been 3 highly pathogenic H7N3 outbreaks affecting poultry with mortality rates up to 80%, ⁸ with the last reported outbreak in 2005. ⁹ There has only been one introduction of H3N1, ¹⁰ H4N6, ¹¹ and H14N3 ¹² reported in Pakistan between 2010–2012.	Globally, vaccines for swine influenza viruses available for both animals and humans. ¹³ In Pakistan, the influenza vaccine consists of H1N1 (swine flu) and H3N2. ¹⁴ Vaccines for H5N1 and H7N9 are globally available as preventive or adjunct control measures during an outbreak. In Pakistan, H5N1/ H5N2, H9N2 and H7N3 vaccines are used. ¹⁵ Treatment for humans includes supportive care and antiviral agents. ¹⁶
Brucellosis	Bacteria	Very few cases of human brucellosis are reported in Pakistan, but prevalence has been reported to be as high as 21.7% in high-risk populations like abattoir workers. ¹⁷⁻²⁰	Varying prevalence in many different species in Pakistan ²¹⁻²⁶ and the region ²⁷ with as high as 19% prevalence reported in some bovid herds. ²³	Vaccines are available for animals ^{28, 29} and treatment available for humans. ³⁰
Salmonella	Bacteria	Multiple studies have shown varying rates and types of <i>Salmonella</i> infection in humans in Pakistan and the region. ³¹⁻³⁶ One showed 46.4% of diarrhea cases were positive for <i>Salmonella</i> , of which 75% were isolated as <i>S. enteritidis</i> . ³⁵ The last reported outbreak was of typhoidal Salmonellosis in 2017. ³⁷	Eggs, poultry meat, and poultry droppings have tested positive for <i>Salmonella</i> in Pakistan. ³⁶ <i>Salmonella</i> also resulted in death (1 fatality/1,000 cases) in goats. ³⁸	Vaccine is available for poultry and there is effective treatment. ^{35, 39} Vaccine available for typhoidal and paratyphoidal <i>Salmonella</i> . ⁴⁰ No vaccine available for non-typhoid <i>Salmonella</i> . Effective treatment is available. ⁴¹
Rabies	Virus	No in country data available. Estimated annual incidence of 7–9.8 cases per million annually, ⁴² with 2,000–5,000 deaths per year. ⁴³	No data for Pakistan or neighboring countries, but known to be endemic in country. ^{43, 44} Models estimate that the probability of a dog being rabid in Pakistan is 0.67%. ⁴⁵	Effective animal vaccine exists and human vaccines are available. Post-exposure prophylaxis is available but treatment is not. ^{44, 46}

Zoonotic Disease	Causative Agent	Human Disease Burden	Animal Disease Burden	Diagnostics, Treatment, and Prevention
Crimean-Congo Hemorrhagic Fever	Virus	374 lab-confirmed cases from 2012 to September 2017, ⁴⁷ most recent cases reported from Karachi, Rawalpindi, Quetta city, and Balochistan. ⁴⁸ More cases reported around Eid-ul-Adha associated with animal slaughter, ⁴⁹ 8 nosocomial infections have also been reported. ⁵⁰	No country specific data, but known to be endemic in region. In Iran, prevalence has been reported as high as 77.5% in some herds. ⁵¹ Outbreaks are not reported since the virus is asymptomatic in animals.	Currently no human vaccines. Ribavirin is available as a treatment for humans, ⁵⁰ however no efficacy data exists and treatment remains supportive. ⁵²
Anthrax	Bacteria	Sporadic cases of cutaneous anthrax most common in Khyber Pakhtunkhwa and Federally Administered Tribal Areas. ⁵³ In FATA in 2017, 13 cases of cutaneous anthrax were diagnosed by a physician, laboratory tests were negative. ⁵⁴ Anthrax has been detected in 37.9% of soil samples in Lahore district. ⁵⁵ The regional incidence of anthrax is estimated at 0.014 cases/100,000 people. ⁵⁶ Of the 36 cases, 25 had lesions on extremities and 11 on face and neck. ⁵⁷ Soil samples within the district of Badin had an overall prevalence of 20% and 33.75% in soil, wool and hairs in district Tharparkar. ^{58,59}	Anthrax is endemic in certain parts of the country, but little prevalence information is available. ^{60,61} Last outbreak reported in June 2017. ⁶²	An effective animal vaccine and treatment for humans exists. ⁶³

*While anthrax was ranked number 3 and *Salmonella spp.* was ranked number 6 when utilizing the ranking from the OHZDP tool, voting members decided to switch the numerical positions of anthrax and *Salmonella spp.* The rationale behind the switch was that anthrax is endemic in only some remote areas in Pakistan and not throughout the country. Additionally, antimicrobial resistance is not an issue for anthrax, whereas antimicrobial resistance in *Salmonella* is an emerging issue within the poultry industry.

BACKGROUND

Zoonotic diseases are diseases that are spread between animals and humans. Most known human infectious diseases and about three-quarters of newly emerging infections originate from animals. Agriculture and livestock sectors are major contributors to Pakistan’s economy—19% of GDP from a 2016–2017 economic survey of which 11% of the contribution came from the livestock sector specifically.³¹ Moreover, Pakistan has a large animal population which may serve as a potential source for zoonotic diseases.⁶⁴ The Ministry of National Food Security and Research estimates that there are 44 million cattle, 38 million buffalo, 1 million camels, 72 million goats, 30 million sheep, 400 thousand horses, and 147 million poultry (both commercial and backyard flocks).⁶⁵ Pakistan is bordered by Afghanistan and Iran to the West, China to the North, India to the East, and the Arabian Sea to the South. The country has a population of 208 million people.⁶⁶ Pakistan is very biodiverse and wildlife within the country vary based on the countries geography. The country is divided into three major geographical areas: the northern highlands, the Indus River plain in the center and the east of the country, and the Balochistan Plateau in the south and the west. The country’s lowest point is the Arabian Sea at 0 m and the highest point is K2 (Mt. Godwin-Austin), the 2nd tallest mountain in the world at 8,611 m.⁶⁷ Pakistan has 188 species of mammals, 666 migratory and resident species of birds, 174 species of reptiles, 16 species of amphibians, 525 species of fish, and 20,000 species of insects and vertebrates.⁶⁸

Zoonotic diseases that occur in large numbers can impact society in three main ways:

- Threaten the health of animals resulting in illness, loss of productivity, and death.
- Threaten the livelihood of a large segment of the population dependent on livestock as a major source of income.



- Threaten the health of people with ability to cause a large number of illness and death, which is associated with significant social and economic losses.

PAKISTAN’S NATIONAL ONE HEALTH PLATFORM

A One Health Hub has officially been established at Pakistan’s National Institute of Health (NIH) to prevent and control zoonotic diseases of national and international concern. The Hub is established in the Field Epidemiology & Disease Surveillance Division within the Surveillance Section of the Division. The staff includes medical and veterinary epidemiologists, entomologists, an environmental officer and support staff. The goal of the Hub is to enhance intersectoral coordination and collaboration between human, animal and environmental health departments in order to increase capacity for disease surveillance, diagnosis and response.

Between the time of the workshop and the publication of this report, Pakistan's NIH has signed a memorandum of understanding (MoU) with the National Agricultural Research Center (NARC). This MoU was signed to strengthen and maintain technical collaboration in order to support the public health system in achieving the objectives of the International Health Regulations (IHR) Roadmap through a One Health approach. An additional MoU has been signed between NIH and the Global Change Impact Studies Centre. This MoU was signed to promote health surveillance, monitoring of environmental health factors and linkages to public health, environmental health information network and data bank, and to contribute the development of guidelines and protocols for environmental risk factors, and commission research studies on climate change and its impacts on human health. Additionally, the Public Health Laboratories Division along with the NIH (Department of Virology and Bacteriology) are providing necessary diagnostic facilities for zoonotic diseases. The development of a reference zoonotic and entomology lab is in progress, which will improve laboratory capacity for disease detection. Initiatives have also been taken to establish provincial public health laboratories, including commissioning of a provincial public health laboratory in the KP region. It is expected that the Hub will be instrumental to conducting strategic research on the impact of zoonotic diseases and environmental changes on human health. A zoonotic entomology lab is also being equipped and laboratory staff will be undergoing training.

A Technical Working Group is being developed through participation of all the experts from sectors and a national consultative strategic One Health workshop will commence soon for the implementation of One Health in Pakistan.

Defined Terms of Reference for the One Health Hub include*:

1. Coordinate through Technical Experts Advisory Group (TEAG) for planning implementation and strategy to handle the zoonotic diseases of national and international concern
2. Strengthen a network for communication of stakeholders and professionals and streamline information of any zoonotic event
3. Share surveillance information
4. Play a key role during outbreak investigations and develop liaison between human, animal and environment health sectors & partners to detect and respond on events of zoonotic origin
5. Issue alerts, advisories and suggestions on zoonotic disease events
6. Provide technical support to provincial health management team to develop and implement provincial preparedness and response plans for zoonotic interventions
7. Support in training of provincial and district One Health teams
8. Provide platform of coordination to share and discuss the information, experiences and findings of zoonotic diseases and devise further strategies

***In the time between the workshop and the publication of this report, many of the activities mentioned in the Terms of Reference have already been developed in Pakistan.**

ONE HEALTH ZOOONOTIC DISEASE PRIORITIZATION AND ONE HEALTH SYSTEMS MAPPING AND ANALYSIS RESOURCE TOOLKIT WORKSHOP

To address zoonotic disease challenges in Pakistan, a joint One Health Zoonotic Disease Prioritization (OHZDP) and One Health Systems Mapping and Analysis Resource Toolkit (OH-SMART™) workshop was held August 19–25, 2017, at the Marriot Hotel in Islamabad.

This combined workshop was the first of its kind, though both OHZDP and OH-SMART™ tools have previously been successfully used independently to coordinate One Health activities. The specific goal of the workshop was to use a multisectoral, One Health approach through the OHZDP tool to prioritize endemic and emerging zoonotic diseases of major public health concern that should be jointly addressed by human, animal, and environmental health ministries and other relevant sectors. Then the OH-SMART™ tool was used to review and visualize the Pakistan One Health system—the procedures and processes for interdisciplinary coordination-around the prioritized zoonotic diseases and develop specific next steps for each prioritized disease. This effort was supported by the Government of Pakistan, CDC, USDA, and the University of Minnesota as part of achieving the objectives of the Global Health Security Agenda (GHSA).

The first three days of the workshop were dedicated to training in-country facilitators on the OHZDP and OH-SMART™ processes including One Health leadership and facilitation techniques. This was supported through funding provided by a grant from USDA to the University of Minnesota. In order to build in-country capacity, 11 Field Epidemiology and Laboratory Training Program (FELTP) fellows and alumni representing the human and animal health sectors from both the national and provincial levels were selected as facilitators. They were trained by an OH-SMART™ Master

Facilitator from the University of Minnesota as well as facilitators from CDC.

The training was followed by four days of implementing a combined OHZDP and OH-SMART™ workshop with 27 voting members representing the human, animal, and environmental health sectors at both provincial and ministry levels (Appendix B). There were an additional 18 stakeholders present to observe the workshop and provide input during open discussion (Appendix B).



Photo 3. Tent pegging is a famous game of rural Punjab in Pakistan.

WORKSHOP METHODS

ONE HEALTH ZOOONOTIC DISEASE PRIORITIZATION (OHZDP)

The zoonotic disease prioritization process involved a semi-quantitative tool developed by CDC. The methods have been described in detail in Appendix A.^{1,2} The first step of the process was to identify a country-specific list of potential zoonotic diseases of concern. A disease was selected if it was known to be passed between animals and people and thought to occur in Pakistan or the surrounding region. A list of 33 zoonotic diseases, shown in Table 2 of Appendix C, was considered during the prioritization workshop.

Next, the workshop participants jointly identified five criteria for quantitative ranking of these 33 zoonotic diseases. Once the five criteria were chosen, the voting members were divided into 11 groups: eight provincial Departments of Health (DoH) and Livestock and Dairy Development Departments (L&DD) and three national level ministries representing human, animal, and environmental health sectors. Each voting group (Table 2) then indicated their preferences for the relative importance of each criterion to help generate a final group of weights for each criterion. The criteria and weights assigned to each criterion are listed in Appendix D.

Table 2. Voting Groups for OHZDP Workshop.

Group	Sector Names
1	Provincial Department of Health (DoH)—Punjab and Azad Jammu & Kashmir (AJK)
2	DoH—Gilgit-Baltistan (GB) and Islamabad Capital Territory (ICT)
3	DoH—Khyber Pakhtunkhwa (KP) and Directorate of Health Services Federally Administered Tribal Areas (FATA)
4	DoH—Sindh and Balochistan
5	Provincial Livestock and Dairy Development Departments (L&DD)—Punjab and Azad Jammu & Kashmir (AJK)
6	L&DD—Gilgit-Baltistan (GB) and Islamabad Capital Territory (ICT)
7	L&DD—Khyber Pakhtunkhwa (KP) and Federally Administered Tribal Areas (FATA)
8	L&DD—Sindh and Balochistan
9	Ministry of National Food Security and Research (MoNFSR)
10	Ministry of National Health Services, Regulations, and Coordination (MoNHSRC)
11	Ministry of Climate Change (MoCC)

One categorical question for each criterion was developed through group discussion. All questions had ordinal multinomial (1–5%, 5–10%, 10–20%, etc.) answers. The ordinal nature was necessary for the scoring process, and was determined by the participants based on the data available. Available data was determined prior to the workshop through an extensive literature search for each disease using publications and information from WHO, OIE, ProMED, and other relevant websites. Incidence, prevalence, morbidity, disability-adjusted life years (DALYs), and mortality data were collected for each disease. If disease information for a particular

zoonotic disease was not available for Pakistan, data for the neighboring countries was used. If regional data was not available, global disease data on prevalence, incidence, morbidity, mortality, and DALYs was used, as well as subject matter expertise. Over 221 articles were collected that included disease-specific information on prevalence, morbidity, mortality, and DALYs for Pakistan and neighboring countries. These articles were saved as PDFs, loaded onto an external storage device (USB key), and given to the workshop participants for reference on the first day of the workshop.

Next, Microsoft Excel™ was used to create a decision tree to determine the final disease ranking. Each weighted criterion was applied across all diseases, and scores were assigned based on the response to each question. Country-specific, regional, and global data compiled previously for all zoonotic diseases under consideration were used to determine appropriate responses for each question. The scores for all five questions were summed and then normalized such that the highest final score was 1. See Appendix C for a complete listing of normalized scores for all zoonotic diseases that were considered in the workshop.

The list of zoonotic diseases and their normalized scores was presented to the group for discussion. 27 voting members from human, animal, and environmental health sectors, voted on a final list of six zoonotic diseases (Table 1). During the group discussion, it was decided to switch *Salmonella* and anthrax, so salmonella went from the sixth spot on the rank list to third and anthrax was moved to sixth. The rationale behind the switch was that anthrax is endemic in only some remote areas in Pakistan and not throughout the country. Additionally, antimicrobial resistance is not an issue for anthrax, whereas antimicrobial resistance in *Salmonella* is an emerging issue within the poultry industry.

CRITERIA SELECTED FOR RANKING ZOO NOTIC DISEASES

The criteria for ranking zoonotic diseases selected by the voting members in Pakistan are listed in order of importance below. See Appendix D for the weighting of criteria.

1. The impact of the disease on human and animal populations

The most important criterion was the impact on both human and animal populations. Diseases with either a high mortality rate (CFR $\geq 10\%$) or evidence of long-term disability in humans and loss of production in animals received the full weight score of 2. Diseases with either a high mortality rate (CFR $\geq 10\%$) or evidence of long-term

disability in humans or loss of production in animals received a score of 1. Diseases associated with a lower mortality rate (CFR $< 10\%$), no long-term disability, and no loss in animal production received a score of 0.

2. The disease burden and epidemic potential in either humans or animals in Pakistan

The second most important criterion was whether a disease has a prevalence of 5% or greater and has caused an epidemic in humans or animals in Pakistan in the prior 10 years. Diseases that have both a high burden ($\geq 5\%$) and have caused an outbreak in Pakistan in either humans or animals received the full weight score of 2. If a disease has either a high burden ($\geq 5\%$) or has caused an outbreak, but not both, in either humans or animals it was given a score of 1. Diseases that had both a low burden ($< 5\%$) and had not caused an epidemic in Pakistan in the last 10 years were given a score of 0.

3. The capacity to prevent, detect, and control diseases in Pakistan

The local capacity to prevent, detect, and control a zoonotic disease in either animals or humans was the third most important criteria. Prevention was defined as the local availability of a vaccine. Detection was the ability to perform laboratory testing and report the diseases (including case, event, and indicator based surveillance) in either humans or animals. Control of a disease was the availability of treatment in humans or animals and the ability to cull, stamp-out, or quarantine animals.

If there were available for all three prevention, detection, and control strategies for both humans and animals in Pakistan, the diseases was a full score of 6. If fewer capacities were available for either humans or animals, lesser scores were given—based on the number of available capacities and in what population. If no capacity was available for diseases in both humans and animals, a score of 0 was given.

4. Coordination between relevant sectors

The existence of formal or informal mechanisms for data sharing (either epidemiologic or laboratory data) between the MoNFSR and the MoNHSRC was the fourth criterion. MoNFSR and MoNHSRC were determined to be the only relevant sectors needed for data sharing on zoonotic diseases since the MoCC coordinates wildlife efforts (investigations and testing) with MoNFSR.

If there was a formal mechanism in place for sharing either epidemiologic or laboratory data and data is actually being shared between the relevant sectors, the zoonotic disease received the full weight score of 3. If there was a formal mechanism in place, but data was not shared the disease received a score of 2. If there was no formal mechanism in place, but data was informally shared, the disease received a score of 1. If there was no mechanism in place and no sharing of data between sectors, the disease received a score of 0.

5. Bioterrorism potential

The potential of the disease to be used as a bioterrorist agent was the fifth criterion. If the disease was included in the 2004, WHO guidance: Public health response to biological and chemical weapons, the disease was given the full weight score of 1. If the disease was not included on this list, it was given a score of 0.

ONE HEALTH SYSTEMS MAPPING AND RESOURCE ANALYSIS TOOLKIT™ (OH-SMART)

After the disease list was agreed upon, facilitators applied the 6 steps of the OH-SMART™ process to review and visualize the Pakistan One Health system—the procedures and processes for interdisciplinary coordination-around the prioritized zoonotic diseases (complex problems). The OH-SMART™ tool was co-developed by the USDA and the University of Minnesota and has been used in 19 countries for One Health action planning. This

was the first time the OH-SMART™ tool was used in conjunction with the OHZDP tool to decide upon action items and next steps following the determination of a prioritized list of zoonotic diseases. The OH-SMART™ stakeholder mapping process identified key stakeholders, existing areas of collaboration and gaps in multisectoral coordination in terms of zoonotic disease surveillance, laboratory capacity, outbreak response, workforce development and other areas that needed improvement. It led to a robust group discussion on recommendations to improve these systems and agreed upon next steps to strengthen One Health coordination.

The group consensus was to focus on the steps of an outbreak response for each prioritized disease. Participants were divided into five groups. Four groups were specified by province and included human and animal health sector representation and the fifth group included both human, animal, and environmental health representatives from the ministry level (Table 3). There were six diseases on the prioritized disease list, so the Ministry group initially split into two groups to cover zoonotic influenza viruses and anthrax, however in the final steps, the group elected to focus on zoonotic influenza viruses and not include anthrax for the purpose of the mapping exercise. Two trained FELTP facilitators, one from the animal health sector and one from the human health sector, worked with each group.

Over the next two days the facilitators worked with the groups to apply the six OH-SMART™ steps to an outbreak scenario. The six steps include: stakeholder identification and mapping; focus group interviews; mapping of an outbreak scenario for each prioritized zoonotic disease selected by each group; identification of gaps and best practices; and identification of action steps to address the gaps. These steps helped each group think through existing areas of collaboration, and gaps in multisectoral coordination in terms of zoonotic disease surveillance, laboratory capacity, outbreak response, and workforce development (Table 4).

OH-SMART™ Objectives

- To bring together major stakeholders from the Provincial and Ministry levels in human health, livestock, environment, and wildlife sectors.
- To identify next steps to follow the outcomes of the concurrent One Health Zoonotic Disease Prioritization Workshop that identified zoonotic diseases of greatest national concern for Pakistan, including:
 - Zoonotic influenza, brucellosis, *Salmonella*, rabies, Crimean-Congo hemorrhagic fever and anthrax
- To use the OH-SMART™ Resource Toolkit to:
 - Map the current status of collaboration between sectors for each prioritized disease.
 - Identify opportunities for system improvement through stakeholder discussion groups.
 - Identify specific next steps to address identified gaps and improve multisectoral collaboration.

Mapping Scenario- Prioritized Zoonotic Disease Outbreak Response

Four of the five groups were combined at the Provincial levels and one group was comprised of Ministry level representatives. Each group included representatives from the human, animal, and environmental health sectors:

Table 3. Voting Groups for OHZDP Workshop.

Group	Sector Names
Rabies Virus	Punjab (PB) and Azad Jammu and Kashmir (AJK)
Salmonellosis	Gilgit-Baltistan (GB) and Islamabad Capital Territory (ICT)
Brucellosis	Khyber Pakhtunkhwa (KP) and Federally Administered Tribal Areas (FATA)
Crimean-Congo Hemorrhagic Fever Virus	Sindh (SD) and Balochistan (BN)
Influenza Virus	Ministry of National Food Security and Research (MoNFSR) Ministry of National Health Services, Regulation and Coordination Ministry of Climate Change (MoCC) National Institutes of Health (NIH) National Agricultural Research Center (NARC) Pakistan Agricultural Research Council (PARC)

Stakeholder interviews (Appendix E)

Stakeholder mapping was used to identify stakeholders and their relationships in zoonotic disease surveillance and response for each disease. Then stakeholder interviews were conducted in order to review existing multisectoral coordination and collaboration, identify areas where coordination was productive (best practices) and where agency coordination was lacking or confusing (discrepancies). This helped reveal areas of opportunity for improvement. The interviews were conducted within each group between the animal and human health sectors using a list of

questions designed to prompt respondents to share information regarding their organization’s role in zoonotic disease outbreak prevention, detection and response.

Results of the focus group interviews are included in Appendix E: Key Stakeholder Interviews.

Multi-stakeholder mapping (Appendix F)

The participants used the stakeholder maps as references for constructing a multi-stakeholder system process map of their chosen prioritized disease (Appendix F). Participants drew shapes and arrows within and between lanes to indicate

existing systems for flow of information, decisions, or actions taken among agencies for their given scenario. As maps were drawn, when questions arose or when people noted a discrepancy in understanding, participants flagged it for further analysis with an asterisk. Facilitators then encouraged participants to review the process maps and mark with an asterisk, areas where:

1. Agencies disagreed on what steps were being taken at any given point (discrepancies);
2. Agencies felt there was a gap or lack of information as to what the appropriate step should be for agency coordination or collaboration (discrepancies); or
3. Points where agencies were coordinating well that were not institutionalized in official regulations or policies (best practices).

Discrepancies, Resolutions, Actions (Appendix G)

Marked areas were then collected on the Step 4 List of Discrepancies form. Participants reviewed each listed discrepancy and best practice and agreed as a group on potential resolutions for each one. These were listed in the Step 5 Resolutions column (Appendix G). Once resolutions were agreed upon, groups worked together to develop specific actionable steps to achieve the resolution. These agreed upon action steps were recorded on the Step 6 Action Steps document (Appendix G).

Table 4. Key Discussion Points for Prioritized Zoonotic Diseases.

Disease	Coordination	Surveillance	Laboratory	Other Gaps
Influenza	Lack of intersectoral collaboration/ coordination	Surveillance is event based	Vet public health lab network not in place	Sustainable Funding
Brucellosis	Lack of intersectoral collaboration/ coordination	Surveillance is event based	Lack of specific tests for diagnosis, frequent misdiagnosis, diagnostics in animal health is regionally based (no sharing of data)	Lack of awareness in the community and at health care facilities
Salmonella	Lack of intersectoral collaboration/ coordination Lack of national guidelines for the prevention, control and treatment (antibiotics) of salmonellosis	Lack of screening of food handlers in restaurants No regular surveillance in live animals or eggs- screening is only for farmers who wish to get their birds diagnosed. No surveillance system for screening of suspected birds other than in an outbreak scenario	Presumptive diagnosis based treatment; Lab infrastructure needs improvement with education/trainings at all levels	Threat of AMR (antimicrobial resistance)

Disease	Coordination	Surveillance	Laboratory	Other Gaps
Rabies	Currently no rabies control program	Currently scarce logistics and finances to prevent and control diseases outbreaks	Currently, there is no markable diagnostic capacity with provinces and districts in animal health side Human rabies cases are diagnosed on the basis of clinical signs and history of dog bite	No legislation for pet vaccination and stray dog control Lack of new or updated legislation Training gaps for surveillance officers Lack of HR Lack of capacity building
Crimean-Congo Hemorrhagic Fever (CCHF)	Lack of intersectoral coordination for surveillance and outbreak response	Currently event based surveillance with good coordination in Punjab, but not the rest of the country- outbreak response and surveillance is rarely coordinated between human and animal health department	NIH Islamabad has capacity for lab confirmation of human samples and the University of Veterinary and Animal Sciences, Lahore has capacity to test ticks and animal samples, but these efforts are not integrated	Legislation is required to involve all stake holders local district government, law enforcement agencies, animal health and human health sector, environmental and wildlife sector Both animal and human health professionals are at highest risk of being at the frontline of a CCHF outbreak, but trainings are not part of animal health professional services or the curriculum

PLANS AND RECOMMENDATIONS

After finalizing the list of priority zoonotic diseases and completing the mapping and analysis exercises, the workshop participants discussed recommendations and further actions that could be taken to address the prioritized zoonotic diseases.

A summary of the most prominent recommendations organized by theme follows:

• Existing Multisectoral Collaboration

- During the OH-SMART™ mapping and analysis exercise, lack of coordination was noted for the top 5 priority diseases. There is an International Health Regulation (IHR) task force housed in the National Institute of Health (NIH). This task force meets approximately quarterly, and jointly discusses avian influenza, CCHF and brucellosis. However, there is currently no formal One Health mechanism for communicating with provincial focal points.

- **Recommendation:** The national level One Health Hub could house coordination with collaboration and input from the provinces. Develop a National One Health Strategic Framework that includes coordination mechanisms for all priority diseases including at the provincial level.

• Laboratory Capacity

- Diagnostic capacity appears to be in place for all prioritized diseases at the national level but not at the provincial level. This leads to misdiagnosis, inappropriate treatment, antimicrobial resistance, and poor health outcomes as well as having a negative economic impact. There is a need for coordination and collaboration among federal and provincial diagnostic facilities so that diagnostic facilities and capacities may be standardized.

- **Note:** The 2017 JEE identified laboratory capacity as an area needing improvement and several partners will be supporting improved capacity. Laboratory capacity assessment is scheduled for August 2017.
 - **Recommendation:** Improve diagnostic capacity for prioritized zoonotic diseases for both agriculture and health at the provincial level and improve data sharing across sectors.
 - **Surveillance**
 - All prioritized zoonotic diseases have some form of surveillance capacity on either the animal or health side. At the provincial level this capacity is mainly event or case-based surveillance within each sector and it is not currently linked to other sectors. There is a need to improve current surveillance capacity and link data across sectors.
 - **Notes:** An Integrated Disease Surveillance and Response framework is being renewed in the country with NIH; there are plans to incorporate the DHIS-2 platform both at the NIH and FSR.
 - **Recommendation:** Coordinated disease surveillance of zoonotic diseases under the One Health hub at District level under the control and supervision of Provincial One Health Hub. IDSR framework review report may be shared with partnering and collaborating ministries, departments and agencies.
 - **Outbreak Response**
 - Currently outbreak response plans exist for CCHF and Avian Influenza.
 - › The CCHF plan was created this year with input from both NIH and NARC, but have not been shared broadly with all provincial IHR focal points.
 - › The AI contingency plans were created in 2005 and separately for human health and animal health. After 2010, data sharing decreased within sectors and remained uncoordinated between sectors. There is a need to revisit the current plans to improve joint coordination and sharing of data.
 - **Recommendation:** Develop new One Health preparedness and response plans for remaining prioritized zoonoses and update current plans for CCHF and Influenza.
- **Workforce**
 - Currently NIH holds rapid response trainings with both medical and veterinary professionals with a focus on AI and hemorrhagic diseases like CCHF. Additionally, biosafety and biosecurity trainings have been held with laboratorians from both animal and human sectors as well as academic institutions. A few key ministry officials have received One Health training from Massey University training in 2010, however, there is a need to increase this capacity in-country.
 - There is a need to increase the training opportunities in zoonotic disease outbreak prevention, control and response for veterinarians in all provinces.
 - **Recommendation:** Include One Health training at the national and district level for medical and veterinary officers, especially for all 6 prioritized diseases.



Photo 4. A bridge in Phandar Valley.

SPECIFIC NEXT STEPS

Finally, each government ministry involved in the decision process and the collaborating agencies who observed the process were given an opportunity to make suggestions for specific next steps that ministries could take to improve the multisectoral development of laboratory capacity, surveillance, joint outbreak response activities, and prevention and control strategies. A summary of the next steps suggested by each sector follows:

- **Ministry of National Health Services, Regulations and Coordination (MoNHSRC)**

- Strengthen communication strategies around the list of prioritized zoonotic diseases
- Develop national action plans for the prioritized zoonotic diseases in collaboration with other sectors
- Establishing an MOU among MoNFSR, MONHSRC, and MoCC

- **National Institute of Health (NIH) One Health Hub**

- Operationalize National One Health Hub within the NIH Field Epidemiology and Disease Surveillance Division including obtaining a permanent administrator for the National One Health Platform
- Develop a National Framework/Strategic Plan for the One Health Hub
- Strengthen laboratory capacity for the prioritized diseases within both animal and human sectors
- Develop a national rabies elimination plan
- Share CCHF outbreak preparedness plans with all IHR focal points.

- **Ministry of National Food Security and Research (MoNFSR)**

- Notifications of Focal Persons
- Development of new proposals/PC-I to address IHR related activities
- Strengthening of prioritized zoonotic disease surveillance and research

- Implementation of AMR surveillance network through National Veterinary Laboratories and National Reference Laboratory for Poultry Diseases (NRLPD)
- Establishing an MOU among MoNFSR, MONHSRC, and MoCC

- **National Agriculture Research Centre (NARC)**

- Implementation of Disease Surveillance Network in Poultry Sector through NRLPD
- Implementation of coordinated sentinel surveillance of AMR in poultry sector
- Strengthen disease reporting and laboratory networking in coordination with provincial poultry institutes and private poultry sector
- Capacity building of provincial and regional field and laboratory persons in field epidemiology and laboratory diagnostics
- Coordinate with NIH and FELTP-Pakistan to train veterinary professionals for field epidemiology and outbreak investigation using One Health concept
- Strengthen research on vaccine development for prioritized and emerging diseases
- Coordinate with Public Health under One Health Concept

- **National Veterinary Laboratories (NVL)**

- Implementation of Disease Surveillance Network in livestock sector
- Implementation of coordinated sentinel surveillance of AMR in livestock sector
- Strengthen disease reporting and laboratory networking in coordination with provincial/regional livestock departments, academia, and NARC
- Coordinate with Public Health under One Health concept

- **Ministry of Climate Change (MoCC)**

- Improve outbreak response capabilities
- Nomination of a focal person for One Health coordination
- Establishing an MOU among MoNFSR, MoNHSRC, and MoCC

- **Field Epidemiology and Laboratory Training Program (FELTP)**
 - › Provide courses to front-line veterinarians on prioritized zoonotic diseases
 - › Transitioning FELTP from the CDC to NIH and NARC
- **Provincial Department of Health (DoH) and Livestock and Dairy Development Departments (L&DD)**
 - › Further inclusion and coordination with the national One Health Hubs
 - › Development of Provincial level One Health Hubs
 - › Identification of focal person at provincial and district levels for One Health units
 - › Provision of resources to operate these One Health units at provincial level
- **International Partners**
 - › **Food and Agriculture Organization of the United Nations (FAO)**
 - › Provide technical support and assistance on the prioritized zoonotic diseases
 - › **Public Health England (PHE)**
 - › Strengthen and integrate multisectoral surveillance capacity
 - › **U.S. Centers for Disease Control and Prevention (CDC)**
 - › Provide technical support and assistance on any of the prioritized zoonotic diseases
 - › Support the development of a national One Health strategic plan
 - › Support the strengthening of multisectoral, One Health coordination capacity
 - › **U.S. Department of Agriculture (USDA)**
 - › Provide technical support and capacity building on any of the prioritized zoonotic diseases
 - › Develop a project plan and budget for mapping a One Health approach to brucellosis
 - › Support the development of a national One Health strategic plan
 - › **World Health Organization (WHO) Islamabad**
 - › Support the development of a national One Health strategic plan
 - › Conduct laboratory assessments and provide capacity support for both animal and human health sectors including the prioritized zoonotic diseases
 - › Support the strengthening of multisectoral, One Health coordination capacity
 - › **World Organization for Animal Health (OIE)**



Photo 5. The Great White Egret (*Ardea alba*).

APPENDIX A: Overview of the One Health Zoonotic Disease Prioritization Process

BEFORE THE WORKSHOP

STEP

1

PREPARE FOR THE WORKSHOP

- Contact the CDC One Health Office at least 60 days before the workshop
- Work with in-country leadership to identify 8 to 12 voting members from all relevant sectors to participate in facilitated group work
- Clearly define the purpose and goal of the workshop with all sectors to be represented
- Generate a list of all endemic and/or emerging zoonoses to be considered for ranking; include input from all represented sectors
 - » Note: Involves gathering reportable diseases lists

DURING THE WORKSHOP

STEP

2

DEVELOP CRITERIA

- Identify 5 criteria that will be used to define the relative national importance of the list of zoonoses; criteria should be locally appropriate and agreed upon by voting members

STEP

3

DEVELOP QUESTIONS

- Develop one categorical question for each of the selected criteria

STEP

4

RANK CRITERIA

- Each voting member individually ranks the selected criteria; individual scores are combined to produce an overall ranked list of criteria

STEP

5

PRIORITIZE ZOOONOTIC DISEASES

- Score each zoonotic disease based on the answers to the categorical questions for each weighted criterion using the One Health Zoonotic Disease Prioritization Tool
- Discuss next steps for multisectoral, One Health engagement for prioritized zoonoses

WORKSHOP OUTCOMES

OUTCOMES

- Prioritized list of at least 5 zoonotic diseases that are agreed upon by all stakeholders at the end of the workshop
- Discussions about next steps for the prioritized zoonoses in terms of identifying areas for multisectoral engagement in developing control and prevention strategies
- Workshop summary that includes the details of the process, the list of prioritized zoonoses, and discussions and recommendations by the participants on how to jointly address capacity building, prevention, and control of prioritized zoonotic diseases
- Final report, approved by all ministries representing core voting members, within a few months of workshop completion

For more information, visit www.cdc.gov/onehealth

APPENDIX B: One Health Zoonotic Disease Prioritization Workshop Participants for Pakistan

Voting Members

Name	Organization	Title/Position
Dr. Muhammad Sabir Abbasi	DoH—AJK	Director Public Health/CDC
Dr. Siraj-ud-Din	DoH—FATA	Medical Specialist
Dr. Fawad Khalid Khan	DoH—ICT	Medical Officer
Dr. Bashir Ahmad	DoH—PB	Director CDC/Public Health
Dr. Waqar Memon	DoH—SD	Addl. Director Public Health
Dr. Shafqat Mehmood	LD&D—AJK	Senior Research Officer/IHR focal Person
Dr. Zia-ud-Din	LD&D—FATA	Deputy Director/IHR Focal Person
Dr. Muhammad Tariq Shah	LD&D—KP	Senior Veterinarian, in charge Zoonotic Cell
Dr. Parkash Dewani	LD&D—SD	Senior Research Officer
Mohammad Hussain Khan	MoCC	Deputy Director (Climate Change)
Dr. Waheed Ahmed Lashari	MoNHSRC	Assistant Director
Dr. Shafi Malik	MoNHSRC	Program Director
Dr. M. Athar Abbas	NARC	Senior Scientist
Dr. AmanUllah	NARC	Senior Scientist
Dr. Jamil Ahmed Ansari	NIH	Senior Scientific Officer, Acting Chief FEDSD
Dr. NajamUllahBaig	NIH	Senior Scientific Officer, Focal person One Health
Dr. Aitbar Khan	L&DD—BL	Director/IHR Focal Person
Dr. Muhammad Javed Arshed	NVL	Senior Scientific Officer
Dr. Zahida Fatima	PARC	Deputy Director
Dr. Nasseem Akhtar	PIMS Islamabad	ID specialist Physician
Dr. AnisaAfridi	DoH—FATA	Director Public Health
Dr. Muhammad Akram	DoH—GB	Assistant Director
Dr. Ehtisham-ul-Haq Khan	LD&D—Punjab	Disease Investigation Control Officer/IHR Focal Person Punjab
Dr. Sabeen Afzal	MoNHSRC	Deputy Director
Dr. Munir Ahmed	DoH—Punjab	Director CDC/Public Health
Dr. Muhammad Tahir	DoH—ICT	District Health Officer
Dr. Kalsoom Khattak	L&DD—KP	Veterinary Officer

Observers

Name	Organization	Title/Position
Ms. Mina Dowlatchahi	FAO	FAO Representative
Dr. Muhammad Afzal	FAO	FMD Management Specialist/Project Coordinator
Mr. Muhammad Akram	OIE	Assistant Animal Husbandry Commissioner
Dr. E Anne Wilson	PHE	First Secretary & Team Lead
Mr. Moin Iqbal	NIH- Pakistan	Veterinary Epidemiologist
Dr. Rana Jawad	U.S. CDC—Pakistan	FELTP Resident Advisor
Mr. Ahmad Liban	U.S. CDC—Pakistan	Acting Country Director
Mr. Emaad Hassan	U.S. CDC—Pakistan	Acting Country Director
Rhiannon M. Bramer	U.S. DOS	Environment, Science, Technology & Health Officer
Ms. Gul-E-Afshan	U.S. DOS	Economic Specialist
Dr. Muhammad Ahmed Isa	USAID	Senior Technical Advisor
Ms. Sangita Patel	USAID	Director, Health Office
Mr. Asmat Raza	USDA—Pakistan	Senior Agricultural Specialist
Ms. Lottie Erikson	USDA—Pakistan	US Department of Agriculture
Mr. David Williams	USDA—Pakistan	US Department of Agriculture
Dr. Farah Sohail	WHO—Pakistan	National Professional Officer (IHR, AMR, One Health)
Dr. Uzma Bashir	WHO—Pakistan	PHL Consultant
Dr. Assai Ardakani	WHO—Pakistan	WHO Representative

Facilitators

Name	Organization	Title/Position
Maj Dr. Eisha Mansoor	Army Medical Core, Rawalpindi	FCPS Community Medicine Trainee
Dr. Zakir Hussain	DoH—GB	Provincial Manager
Dr. Jhangir Khan	DoH—ICT	Medical Officer
Dr. Ambreen Chaudhry	DoH—Punjab	Medical Officer
Dr. Asif Sayed	DoH—SD	Technical support Officer FELTP
Dr. Ibrar-ul-Hussain	LD&D—KP	Veterinary Officer
Dr. Hina Ali	LD&D—KP	Veterinary Officer
Dr. M. Farooq Tahir	LD&D—Punjab	Research Officer
Dr. Saima Dil	LD&D—Punjab	Veterinary Officer
Dr. Muhammad Wasif Malik	NIH	Scientific Officer
Dr. Mumtaz Ali Khan	NIH	Senior Scientific Officer
Dr. Stephanie Salyer	U.S. CDC—Atlanta	Veterinary Epidemiologist; OHZDP facilitator trainer
Ms. Grace Goryoka	U.S. CDC—Atlanta	Health Scientist; OHZDP facilitator trainer
Dr. Kate Varela	U.S.CDC—Atlanta	Veterinary Medical Officer; OHZDP facilitator trainer
Dr. Agus Suwandono	UMN/INDOHUN	OH-SMART workshop facilitator trainer; Senior Technical Officer

Other Participants

Name	Organization	Title/Position
Brig. Dr. Aamer Ikram	National Institute of Health, Islamabad	Executive Director
Dr. Ali Akbar Soomro	Livestock—Sindh	Director General
Dr. Khalid Naeem	FELTP Project-NARC	One Health Expert
Dr. Ghulam Muhammad Gill	L&DD Punjab	Director General (Extension)
Dr. Ghulam Hussain Jafar	L&DD Balochistan	Director General
Dr. Matloob Hussain Raja	Department of AH, AJK	Director General
Dr. Sher Muhammad Khan	L&DD KP	Director General (Extension)
Faisal Zahoor	Health Directorate, Lahore (Punjab)	Director General, Health Services
Akhlaque Khan	Health Directorate, Hyderabad (Sindh)	Director General, Health Services
Dr. M. Bashir Chaudhry	Health Department Punjab	Director CDC, Punjab

Workshop Organizers

Name	Organization	Title/Position
Ms. Lottie Erikson	USDA—Pakistan	Agriculture Science Officer
Mr. Ahmad Liban	U.S. CDC—Pakistan	Acting Country Director
Mr. Emaad Hassan	U.S. CDC—Pakistan	Acting Country Director
Dr. Rana Jawad	U.S. CDC—Pakistan	FELTP Resident Advisor
Dr. Stephanie Salyer	CDC Atlanta	Veterinary Epidemiologist; OHZDP Facilitator
Ms. Grace Goryoka	CDC Atlanta	Health Scientist; OHZDP Facilitator
Dr. Kate Varela	CDC Atlanta	Veterinary Medical Officer; OHZDP Facilitator
Dr. Casey Barton Behraves	CDC Atlanta	Director, CDC One Health Office
Dr. Aim Prasarnphanich	UMN	OH-SMART Facilitator
Ms. Linda Valeri	UMN	OH-SMART Facilitator
Dr. Agus Suwandono	UMN/INDOHUN	OH-SMART Facilitator; Senior Technical Officer
Dr. Katey Pelican	UMN	OH-SMART Facilitator
Dr. Michael Mahero	UMN	OH-SMART Facilitator
Dr. Deborah Hamilton	USDA/APHIS/FAS	International Program Specialist
Dr. Eric Coleman	USDA/APHIS	Director, International Technical and Regulatory Capacity Building Center
Dr. Karla Martinez-Garcia	USDA/APHIS	Project Manager, International Services
Dr. Sharon Williams	USDA/APHIS	APHIS Attache New Dehli, India

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- Dr. Shabnum Sarfraz, Punjab Public Health Agency, Primary and Secondary Healthcare Department, Government of Punjab, Chief Executive Officers
- Ehsan Gul, Punjab Public Health Agency, Primary and Secondary Healthcare Department, Government of Punjab, Manager Technical Services
- Dr. Mohammad Hayat Roohnjho, Provincial Health Directorate Balochistan Quetta, Director Health Services (Public Health)
- Dr. Jawad Habib Khan, Directorate of Health Services FATA, Director
- Dr. Malik Ayaz Wazir, Directorate of Livestock and Dairy Development Department, FATA Secretariat Peshawar, Director Livestock FATA
- Dr. Mobin Ahmed Memon, Directorate General, Health Services Sindh, Director Admin & Accounts



Photo 6. View of Islamabad capital of Pakistan and Margalla hills.

APPENDIX C: Final Results of the One Health Zoonotic Disease Prioritization Workshop in Pakistan

Zoonotic diseases considered for prioritization in Pakistan: Final results of prioritization and normalized weights for 33 zoonotic diseases. The top prioritized zoonotic diseases selected by the voting members representing all ministries active in zoonotic disease work are shown in **bold**.

Rank	Disease	Raw Score	Normalized Final Score
1	Zoonotic influenza viruses (including avian and swine)	0.912053614	1
2	<i>Brucella spp.</i>	0.855935172	0.938470237
3	<i>Bacillus anthracis</i> (Anthrax)	0.854536581	0.936936785
4	Rabies virus	0.735662988	0.806600596
5	Crimean-Congo Hemorrhagic Fever virus	0.679494972	0.745016478
6	<i>Salmonella spp.</i>	0.652691991	0.715628973
7	<i>Yersinia pestis</i> (plague)	0.594323795	0.65163252
8	<i>Cryptosporidium spp.</i>	0.579603923	0.635493259
9	Leishmaniasis	0.579603923	0.635493259
10	<i>Burkholderia mallei</i> (Glanders)	0.535692871	0.587348006
11	West Nile virus	0.522634318	0.573030259
12	<i>Chlamydia psittaci</i>	0.506377409	0.555205748
13	Japanese Encephalitis virus	0.506377409	0.555205748
14	Dengue virus	0.476251791	0.522175214
15	<i>Escherichia coli</i>	0.474902774	0.520696116
16	<i>Mycobacterium bovis</i>	0.464854557	0.509678981
17	<i>Coxiellaburnetii</i> (Q fever)	0.419282186	0.459712214
18	<i>Toxoplasma gondii</i>	0.419282186	0.459712214
19	Streptobacillosis (Rat-bite fever, Haverhill fever, Sodoku)	0.406486361	0.445682529
20	<i>Shigella flexneri</i>	0.395890715	0.434065179
21	<i>Campylobacter jejuni</i>	0.3487066	0.382331252
22	<i>Leptospira spp.</i>	0.3487066	0.382331252
23	Echinococcosis	0.3202423	0.351122232
24	MERS-CoV	0.317992547	0.348655542
25	Malaria	0.299861165	0.32877581
26	Pox viruses (Cow, Camel, Buffalo, Sheep, Goat)	0.290926839	0.318979974
27	<i>Giardia spp.</i>	0.261611377	0.286837717
28	<i>Listeria monocytogenes</i>	0.232558643	0.254983522

Rank	Disease	Raw Score	Normalized Final Score
29	Hepatitis E virus	0.183713208	0.20142808
30	Sarcoptes Mange	0.174778881	0.191632245
31	Dermatophytosis (Ringworm)	0.145463419	0.159489987
32	<i>Orientiatsutsugamushi</i> (Scrub Typhus)	0.070575586	0.077380962
33	Ameobiasis	0.058630924	0.064284515

*While anthrax was ranked number 3 and *Salmonella spp.* was ranked number 6 when utilizing the ranking from the OHZDP tool, voting members decided to switch the numerical positions of anthrax and *Salmonella spp.* The rationale behind the switch was that anthrax is endemic in only some remote areas in Pakistan and not throughout the country. Additionally, antimicrobial resistance is not an issue for anthrax, whereas antimicrobial resistance in *Salmonella* is an emerging issue within the poultry industry.



Photo 7. Lower Kachura Lake, Skardu.

APPENDIX D: Numerical Weights for the Criteria Selected for Ranking Zoonotic Diseases in Pakistan (short-term goal)

1. Impact of Disease (criterion weight = 0.406486361)

Question: Does the disease have a significant impact on human or animal populations?
CFR \geq 10% or evidence of associated long term disability (human indicator)
Loss of production (animal indicator)?

Answer: (score)

- Yes for both humans and animals (2)
- Yes to either humans or animals (1)
- No to both humans and animals (0)

2. Burden and Epidemic Potential (criterion weight = 0.232295915)

Question: Is the disease prevalence \geq 5% and/or has it caused any epidemic/outbreak among humans or animals in the last 10 years in Pakistan?

Answer: (score)

- Yes to both (prevalence and epidemic) (2)
- Yes to one (prevalence or epidemic) (1)
- No to both (0)

3. Country Capacity (criterion weight = 0.175892772)

Question: Does the country have capacity in terms of (i) prevention (vaccine), (ii) detection (lab testing and reporting (case based, indicator/routine, event) and (iii) control (treatment, culling, stamping out, quarantine)?

Answer:	Human	Animal
<input type="checkbox"/> Yes to all	3	3
<input type="checkbox"/> Yes to two	2	2
<input type="checkbox"/> Yes to one	1	1
<input type="checkbox"/> No to all	0	0

4. Bioterrorism Potential (criterion weight = 0.070575586)

Question: Is the disease listed as a bioterrorism agent according to the WHO guidance document?⁶⁹

Answer: (score)

- Yes (1)
- No (0)

5. Coordination (criterion weight = 0.114749366)

Question: Does any mechanism exist for sharing of epidemiology or laboratory data among relevant stakeholders (Ministry of Health and Ministry of Agriculture)?

Answer: (score)

- Yes, both formal mechanism in place and data is shared (3)
- Yes, formal mechanism in place, but data is not shared (2)
- No formal mechanism in place, but data is informally shared (1)
- No mechanism in place and no data is shared (0)



Photo 8. A view of the mountains in Pakistan.

APPENDIX E: Key Stakeholder Interview Questions

For this section, the participants were divided in to two groups:

- Group 1- Sindh, AJK, Punjab, Balochistan, ICT
- Group 2- KP, FATA, GB, ICT

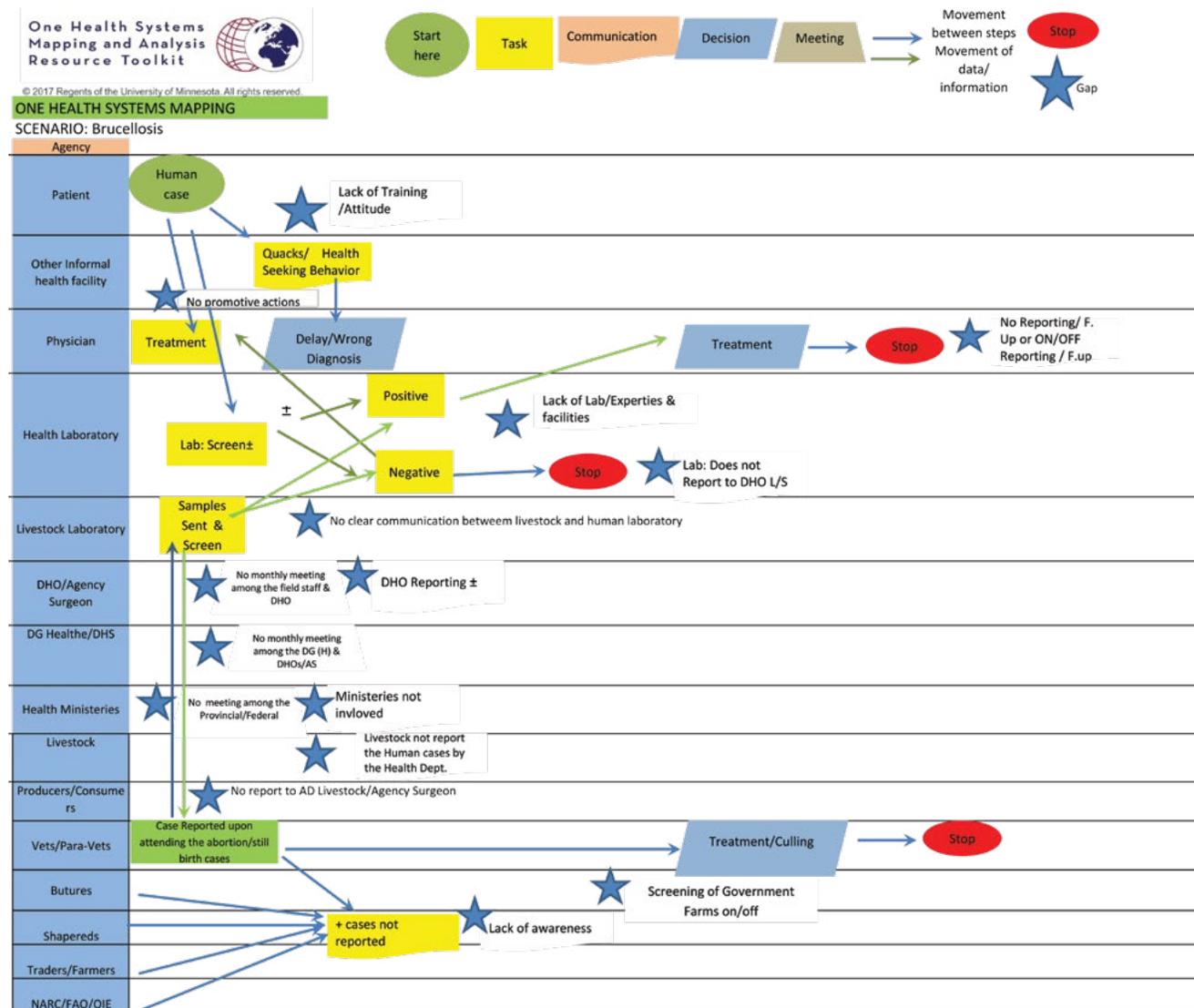
Each group included human, animal and environmental representatives and discussed the stakeholder interview questions from the perspectives of each sector. The two groups then came together to synthesize the results.

Synthesis of Key Stakeholder Interviews

Question	Response
What are best practices?	<ul style="list-style-type: none"> • System in place • Meeting are held • MOU's with national/international organizations • Committees and focal person notified • Action plans exist <ul style="list-style-type: none"> » i.e. National Action plan for AMR—includes provinces and national • Collaboration exists between human and animal health (IHR–5 year plan) • Robust leadership
What are some of the roadblocks or challenges you have faced?	<ul style="list-style-type: none"> • Varying levels of commitment • Lack of legislation • Financial issues • Finding the right person for the right job • No accountability • No recognition/reward • Well defined TOR's are not in place • Lacking infrastructure
Is there something you think the organizations could do differently to be more effective?	<ul style="list-style-type: none"> • Well defined SOP's • Monitoring should be there • Need for trained personnel • Regular evaluations • Sharing and publications • More frequent, formal meetings <ul style="list-style-type: none"> » End with minutes, decisions made, responsible persons identified • Designated units for one health without turn over • Decreased political interference • Increased logistics and financial support
What are some useful training programs for infectious disease prevention, detection and response? What are certain skills/ capacities needed?	<ul style="list-style-type: none"> • FELTP • Trainings by NARC/NIH- specialized training conducted on influenza, CCHF, <i>Brucella</i>, biosafety • Training by provincial departments/ministry on vertical programs like WHO/NIH- sample collection training and transportation

- The MOH would also do screening for the poultry workers, the positive results would be also be reported to WHO.
- If any of the specimens had a positive result, the MOH would declare an outbreak of AI in the area in which the positive specimen was located and spread out through media. The MOH also instructed the DHO to carry out AI response programs such as epidemiologic investigation, health promotion, vaccination and isolation as well as treatment of the patient (if any).
- In livestock cases, usually the farmers report to the informant or journalist or they went to the local veterinarian provider. The informant and journalist reported in the media about the livestock mortality or the outbreak. The local veterinarian took the postmortem specimen and sent it to district laboratory for PCR examination. The positive result would be sent to the Province Lab for serology and molecular examination, The positive results would be reported to local veterinary provider and District Administrator. The positive specimen would be also referred to the National Referral Laboratory for all lab examination. If the result was positive for HPAI, the National Referral Laboratory would send confirmation to the Province Laboratory, National Focal Person/CVO/AHC, Ministry of Agriculture and OIE. The Ministry of Agriculture would inform and coordinate with Ministry of Health concerning the positive HPAI livestock case in that district.
- National Focal Person/CVO/AHC would facilitate District Administrator to implement the HPAI response in that district such as culling the livestock, vaccination, epidemiology investigation, community health education, etc
- There were 3 stars in the HPAI map. These showed priority problems or gaps identified by the trainees related to HPAI control program. They were as follows:
 1. Disease surveillance was project-based, sector-specific and federally driven. No routine and coordination between human and animal health.
 2. Lack of coordination and collaboration at all levels (between human health and animal health sectors and their providers).
 3. Veterinary Public Health Laboratory network not functioning in a proactive manner.

Map 2. Brucellosis Outbreak Scenario



Description of Brucellosis Integrated Map: (as a result of OH SMART Step 4)

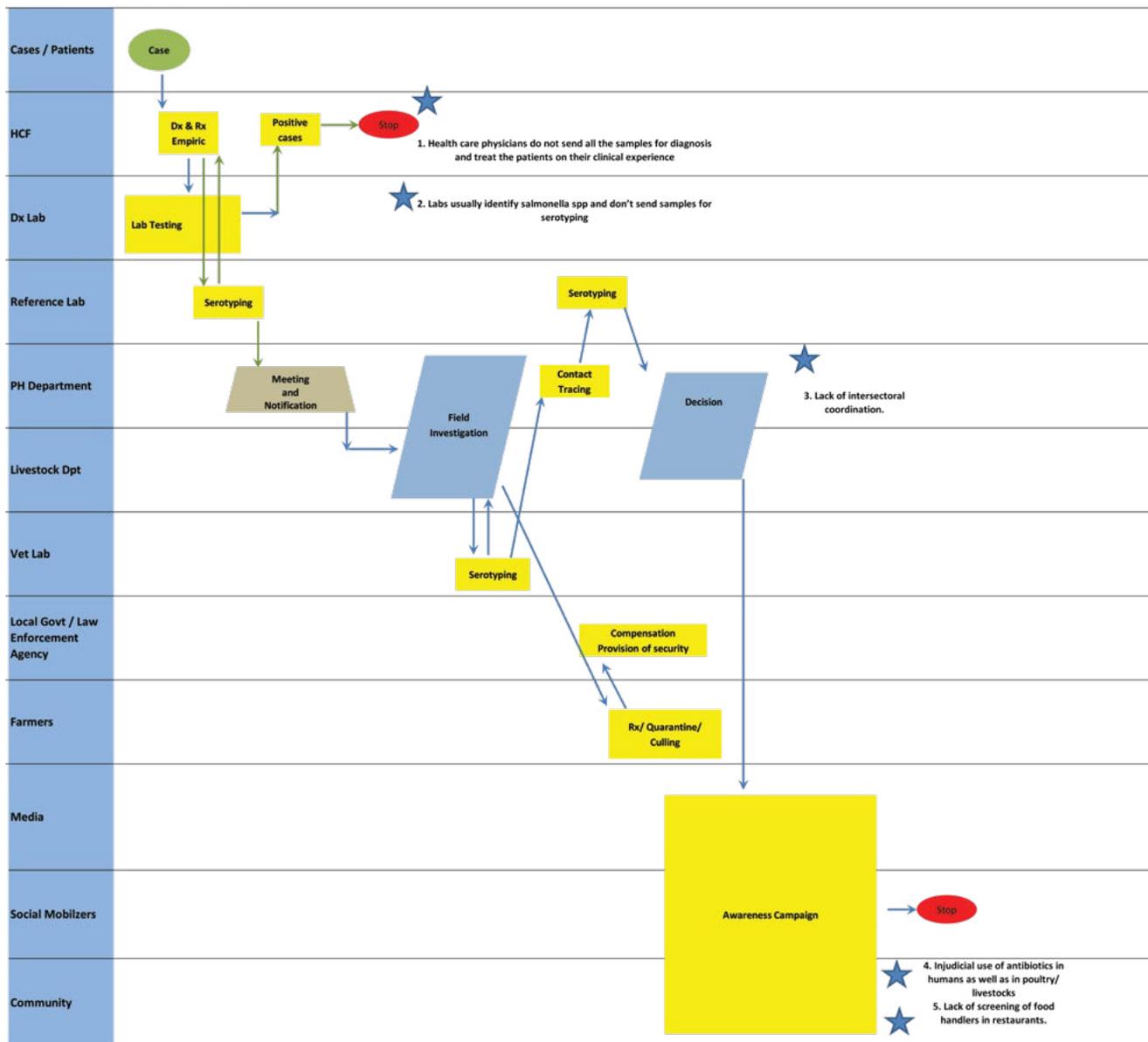
- The brucellosis cases could be human or animal cases.
- In human cases, some of them went to the physician in hospital or private practice to get treatment. The physician usually took the human specimen and sent to health laboratory for Brucella identification.
- The result of laboratory examination could be positive or negative. If the result was positive, the treatment would be continued until the patient got well. If it was negative then treatment would be stopped.
- However, many patients went to informal health facilities (traditional or others), resulting in misdiagnosis and mistreatment. Or after the case was not cured and getting serious, then the patient would go to formal health services, i.e., a hospital or physician’s private practice. So, he or she would be delayed to be treated or in some serious cases could be further treated and passed away.
- In livestock, the initial case was identified through veterinary medical or para veterinary medical services or clinics. Most brucellosis cases in livestock are usually found in livestock with abortions or still births.
- The veterinary medical or para veterinary medical services or clinics would treat the cases and take the specimen to the livestock laboratory (different with human health laboratory).

- Similar to the human cases, the laboratory result could be positive or negative. If the result was positive, the treatment would be continued until the livestock got well. However, if it was negative then treatment was stopped and the livestock would be culled.
- The brucellosis livestock cases found by butchers, shepherds, traders, farmers, FAO, OIE, etc. mostly were not reported to the veterinary medical facilities.
- There are 15 stars in the brucellosis map. These showed problems or gaps identified by the trainees related to brucellosis control program. They are as follows:
 1. Lack of training and attitude
 2. No promotive action
 3. Lack of laboratory expertise and facilities
 4. No reporting and follow up of brucellosis cases or if any they are irregular (on/off)
 5. Laboratory does not report to District Health Office (DHO)
 6. No clear communication between human and livestock laboratories
 7. No monthly meeting among field staff and DHO
 8. Irregular DHO reporting
 9. No monthly meeting between DG OH and DHO/AS
 10. No meeting among Province and Federal Office
 11. Ministries not involve
 12. Livestock not report the human cases to the Health Department
 13. No report to AD/Agency Surgeon
 14. Lack of awareness to report the brucellosis cases
 15. Irregular screening of government farms
- Among the problems/gaps, 3 were prioritized to be solved and put into plan of action in OH SMART step 5 and 6.

Map 3. Salmonella Outbreak Scenario



ONE HEALTH SYSTEMS MAPPING SCENARIO: Salmonellosis Outbreak

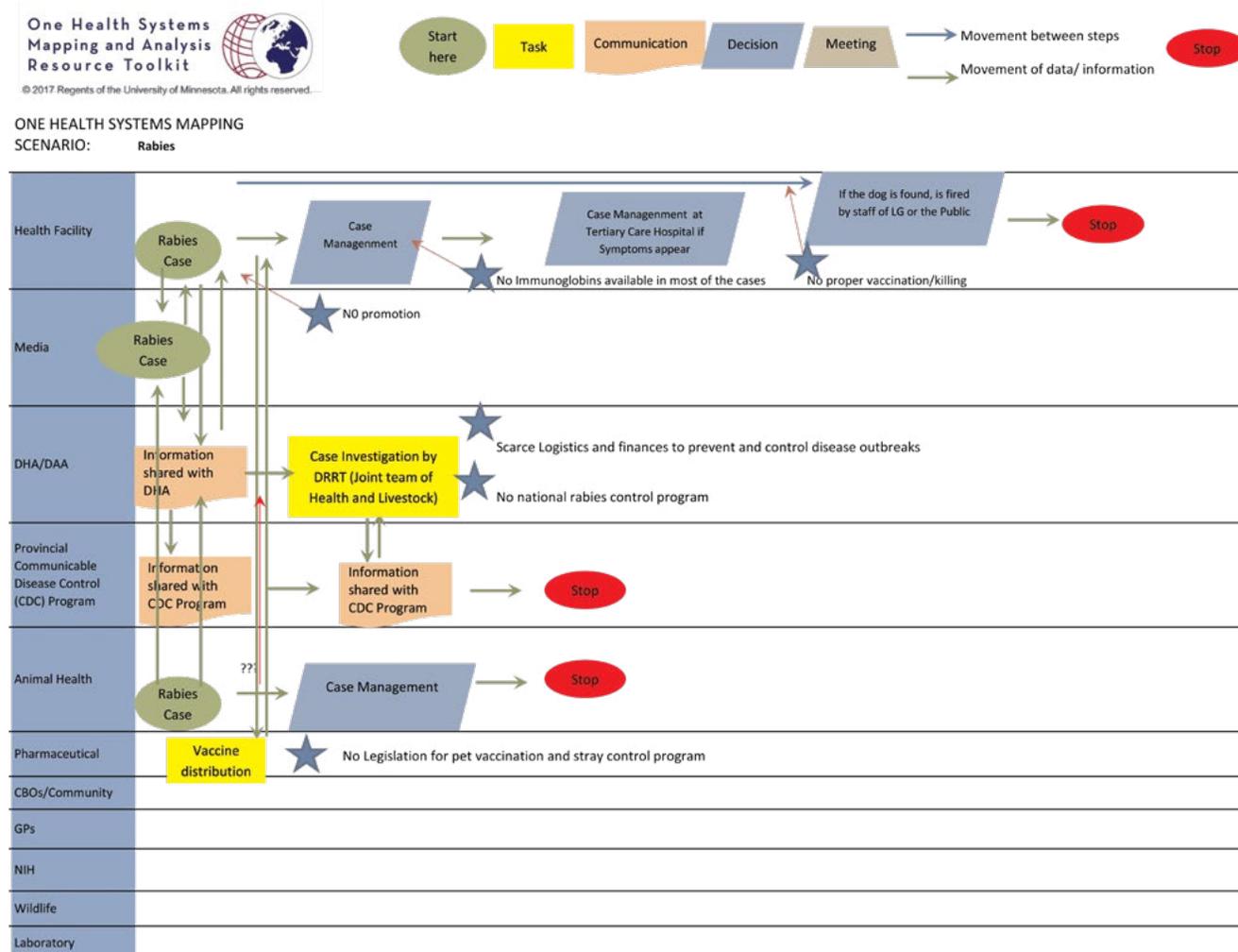


Description of Salmonella Integrated Map: (as a result of OH SMART Step 4)

- After a patient was diagnosed as a salmonellosis suspect in a Health Care Facility (HCF), the patient got initial or empirical treatment and his/her specimen would be examined in the laboratory (it could be HCF laboratory or other Dx laboratory outside of HCF)
- The specimen was also sent to the reference laboratory for serotype examination. The results would be sent back to the HCF for improving status of a suspect case to be a confirmed case.
- The serotype result would also be sent to Public Health Department (PH Dep) for follow up action. The PH Dep once notified would call a meeting with Livestock Department to carry out field investigation (case tracing and serology specimen examination)

- The results would be used for decision of further salmonellosis control actions such as culling and its compensation, quarantine, awareness campaign, social mobilization, media release e.t.c to the farmers and community in general.
- There were 5 stars in the salmonellosis map. These showed problems or gaps identified by the trainees related to salmonellosis control program. They were as follows:
 1. Health care physicians did not send all the samples for diagnosis and treatment of the patients on their clinical experience
 2. Laboratories usually identified *Salmonella* species and did not send samples for serotyping
 3. Lack of intersectoral coordination.
 4. Injudicial use of antibiotics in humans as well as in poultry/livestock
 5. Lack of screening of food handlers in restaurants.

Map 4. Rabies Outbreak Scenario

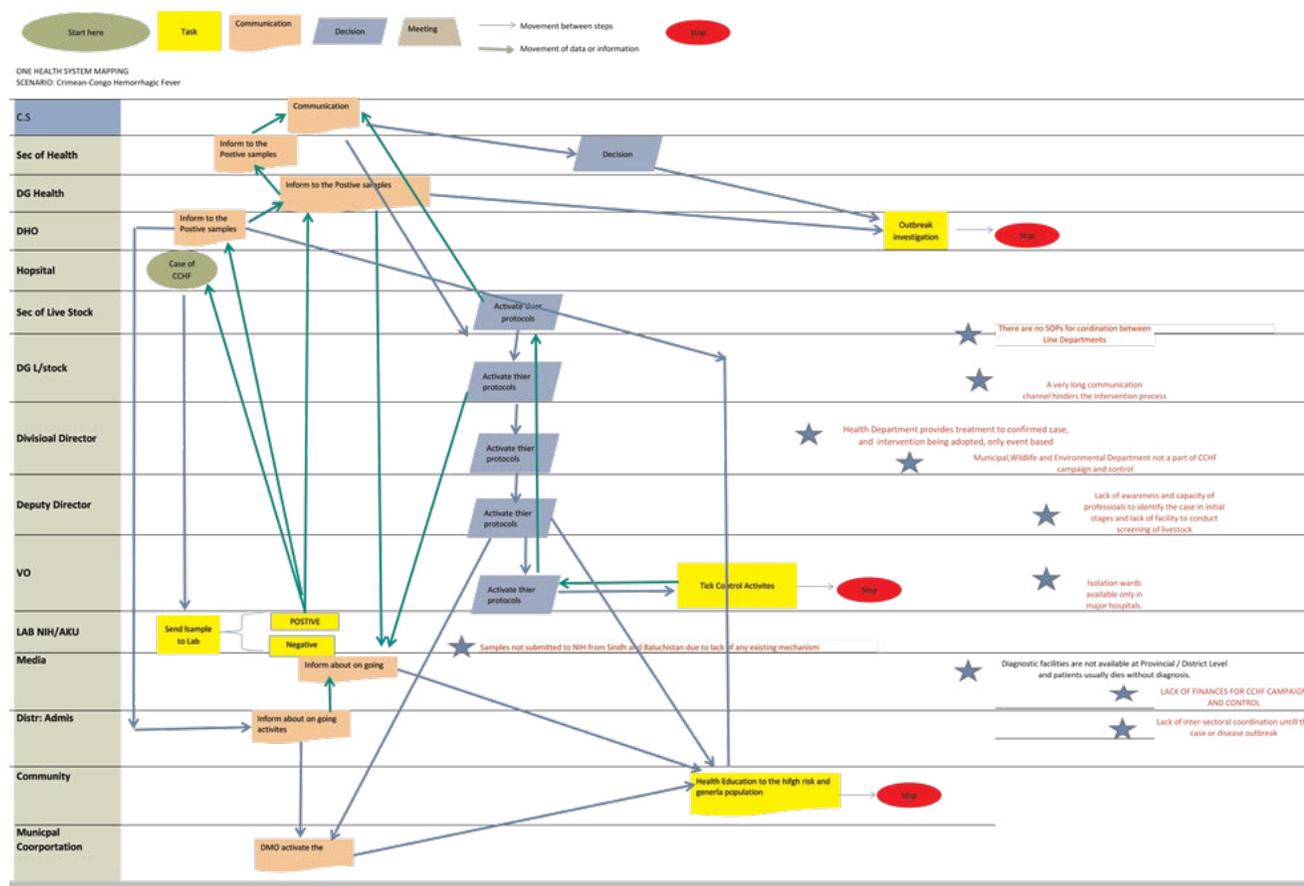


Description of Rabies Integrated Map: (as a result of OH SMART Step 4)

- The map was started by three reports, the first one was of a suspect rabies patient presenting at a Health Facility. Second report was from a local Animal Health Clinic concerning a suspect canine rabies patient. The third report was from social media concerning rabies in human or dog.
- The local Health Facility and Animal Clinic would carry out rabies case management based on their respective Standard Operation Procedures. In the human case, if the local Health Facility were unable to manage it, the patient would be referred to a higher level Health Facility
- The Health Facility would send their staff to look for the infected dog and if found, it would be killed (burned) either by the staff or community
- The Health Facility would also report this to the District Health Authority (DHA) and District Animal Authority (DAA)
- After which, a case investigation is carried out by DRRT (Joint team of Human and Livestock Health). At the same time a request is sent to the Pharmaceutical Division for rabies vaccine distribution to the Health Facility and Animal Health Clinic.
- DHA would also report to the Provincial CDC Program requesting their support in the case investigation carried out by DRRT
- The media would release public statements concerning the rabies cases and provide warnings to the community about the risk of rabies

- There were 6 stars in the rabies map. These showed problems or gaps identified by the trainees related to rabies control program. They were as follows:
 1. No promotion program towards rabies problem
 2. No Immunoglobulin available in most of the cases
 3. No proper vaccination program and dog killing procedures
 4. Scarce logistics and finances to prevent and control rabies or other disease outbreaks
 5. No national rabies control program
 6. No legislation (law or regulation) for pet vaccination and stray control program

Map 5. Crimean-Congo Hemorrhagic Fever Outbreak Scenario



Description of Integrated Map: Crimean-Congo Hemorrhagic Fever (CCHF), as a result of OH SMART Step 4

- The scenario started with a suspected CCHF diagnosis of a patient by the hospital physician based on clinical signs. The hospital would take the specimen sample of the suspect patient and send it to the NIH (National Institute of Health)
- The result would be positive or negative, if it was positive CCHF, the NIH would send the result to the Hospital, DHO, and DG Health. DHO would then communicate with DG Health and DG Health would inform and communicate with Secretary of Health to initiate and to coordinate an outbreak investigation with Secretary of Live Stock. Who then instructs the DG Live Stock. Divisional Directors, Deputy Director and Veterinary Office to activate the protocol for CCHF epidemiology investigation and control in livestock.
- The Veterinary Office would carry out the protocol of Tick Control Activity
- DHO also reported the positive case to the District Administrator and District Administrator would communicate and inform Media and Municipal Corporation to carry out health education to the community particularly in the high risk area
- There were 10 stars identified by the trainees as problems or gaps in the map, they were as follows:
 1. No SOP for coordination between line departments (related department for CCHF control)
 2. Very long communication channels that hinder the intervention processes
 3. Health Department provides treatment to confirmed cases and intervention being adopted only event based
 4. Municipal Wild Life and Environment Department is not a part of CCHF campaign and control
 5. Lack of awareness and capacity of professionals to identify the case in initial stages and lack of facility to conduct screening of livestock

6. Isolation wards available only in major hospitals.
7. Diagnostic facilities are not available at Provincial/District Level and patients usually dies without diagnosis.
8. Samples not submitted to NIH from Sindh and Baluchistan areas due to lack of any existing mechanism
9. Lack of finances for CCHF campaign and control
10. Lack of inter-sectoral coordination until the case or disease outbreak
11. The above 10 problems or gaps were discussed and prioritized in OH SMART Step 5 and 6 to be priority program and POA that should be carried out.

APPENDIX G: Discrepancies, Resolutions, Action Steps by Prioritized Zoonotic Disease

Zoonotic Influenza Virus (avian and swine)

Discrepancy	Resolution	Action Steps	Resources Needed	Responsible Entity	Time Frame	Focal Person
Disease surveillance is project based, sector specific and federally driven	National AI control program under ONE HEALTH approach in place with the provision of central & provincial Dashboards (PK-Epinet)	<ul style="list-style-type: none"> • Advocacy (Decision Makers) • Develop Proposal (PC-I) 	Technical & Financial	<ul style="list-style-type: none"> • M/o NFSR • M/o NHSRC • M/o Climate Change • Provincial livestock, health, and environment departments 	1 Year	AHC, DG Health, IHR FPs
Veterinary Public Health Laboratory network not functioning in a proactive manner	VPHL network established (F/P/D) & linked with public health labs through PK LIMS	<ul style="list-style-type: none"> • Advocacy • Develop Proposal • Up-gradation of LIMS/DRS and linkages between Vet & PH 	Technical & Financial	<ul style="list-style-type: none"> • M/o NFSR • M/o NHSRC 	2–3 Year	NRLPD, NIH, Provincial Labs, IHR FPs
Lack of coordination and collaboration at all levels	Establishment of OH Secretariat with clear TORs and dedicated skilled HR (Federal and Provincial OH sec)	<ul style="list-style-type: none"> • Advocacy • Defined TORs and NORMs for coordination 	Financial	<ul style="list-style-type: none"> • M/o NFSR • M/o NHSRC • M/o Climate Change 	1–2 Year	NARC, NIH, AHC, DG Health, IHR FPs

Brucellosis

Discrepancy	Resolution	Action Steps	Resources Needed	Responsible Entity	Time Frame	Focal Person
Lack of intersectoral collaboration and coordination Specifically, lack of upstream/downstream reporting between livestock farmers, traders and shepherds and the livestock department as well as between the field staff and health departments	Integration amongst different stakeholders i.e., Health, livestock, wild life departments and local government through a One Health coordinating mechanism	<ul style="list-style-type: none"> • Meeting arrangement amongst the stake holders identified • Mechanism for coordination meetings to be developed & implemented • Enact legislation that includes FATA • Enact legislation that requires reporting to DHO/Agency Surgeon, L&DD from field staff 	<ul style="list-style-type: none"> • Necessary funds for conducting meetings. • Letter from concerned Ministry/ Department 	Federal & Provincial Ministry (Health and L&DD)	1 year	IHR Focal Person
Misdiagnosis of the disease	Establishment & Up-gradation of labs Improve training	<ul style="list-style-type: none"> • Assessment of existing labs on PHRL standards • Up-gradation of existing • Establishment of PHRL 	<ul style="list-style-type: none"> • Funding • Technical support 	Federal & Provincial Ministry	2–3 years	Lab Focal Person
Lack of awareness among community, physicians, veterinarians and other health professionals	Improve training	<ul style="list-style-type: none"> • Identify training gaps at graduate and professional school level • Implement continuing education for practitioners 	<ul style="list-style-type: none"> • Funding • Technical support 	Federal & Provincial Ministry	1–2 Year	IHR Focal Person

Salmonella

Discrepancy	Resolution	Action Steps	Resources Needed	Responsible Entity	Time Frame	Focal Person
Presumptive diagnosis based on response to treatment and not lab confirmed diagnostics	Improve lab infrastructure and training of laboratorians	<ul style="list-style-type: none"> • Increase labs in public sector • Trainings of Doctors and Lab technicians 	<ul style="list-style-type: none"> • Financial • Human • Equipment 	<ul style="list-style-type: none"> • Dept of Health • Dept of Livestock 	1–3 Years	DG Health, DG L&DD
Lack of intersectoral coordination and collaboration	Development of OH Secretariat	<ul style="list-style-type: none"> • Identification and Notification of OH secretariat from all sectors • Nomination of FPs 	<ul style="list-style-type: none"> • Financial • Human 	<ul style="list-style-type: none"> • Dept of Health • Dept of Livestock • EPA (Environmental Protection Agency) • Dept of Food Authority 	1 Year	Ministries and DGs (Health and L&DD)
Anti-microbial resistance (AMR)	Increase awareness among doctors and community <ul style="list-style-type: none"> • Antimicrobial stewardship training • Awareness campaigns in community 	Development of antibiotic use guidelines and best practices	<ul style="list-style-type: none"> • AMR Action Plan • Financial 	<ul style="list-style-type: none"> • Human (Technical) • Dept of Health • Dept of Livestock 	1–2 Years	Ministries and DGs (Health and L&DD)
Lack of screening of food handlers who may be carrying pathogens	Legislation regarding food handlers	Passage and implementation of legislation to screen food handlers for potential food borne pathogens	<ul style="list-style-type: none"> • Financial 	Ministries of Health and Livestock	1 Year	Ministries and DGs (Health and L&DD)
Lack of national guidelines for the prevention, control and treatment of salmonellosis	Sensitization of political leaders and policy makers regarding zoonotic disease	Advocate, develop, pass and implement national guidelines	<ul style="list-style-type: none"> • Financial • Human • Technical 	Ministries of Health and Livestock	2–3 years	Ministries and DGs (Health and L&DD)

Rabies Virus

Discrepancy	Resolution	Action Steps	Resources Needed	Responsible Entity	Time Frame	Focal Person
No national rabies control program	Develop a Comprehensive National Rabies Control Program	<ul style="list-style-type: none"> • Comprehensive project planning by Health, Veterinary and local government • Initiate program 	<ul style="list-style-type: none"> • Realignment of existing resources. • Financial allocation • Infrastructure 	<ul style="list-style-type: none"> • DGs of concerned departments 	18 months	IHR Focal Person, AHC, and DG Health
No Legislation for pet vaccination and stray control program	Advocate for legislation (for rabies vaccination requirements?)	<ul style="list-style-type: none"> • Proposal by concerned departments. • Human Resources 	Hiring of law consultant	Secretaries of Departments	24 months	IHR Focal Person, AHC, and DG Health
Scarce Logistics and finances to prevent and control disease outbreaks	Advocacy for Stakeholders	<ul style="list-style-type: none"> • Advocacy workshops with stakeholders 	Finances	Vet and human Health Departments	24 months	IHR Focal Person, AHC, and DG Health
Training Gaps	Initiate training programs for physicians and veterinarians <ul style="list-style-type: none"> • Include in undergraduate curriculum • On the job training 	<ul style="list-style-type: none"> • Revision of undergraduate curriculum. • Plan for in service trainings 	<ul style="list-style-type: none"> • Consultants • Finances 	<ul style="list-style-type: none"> • PMDC • PVMC • Heads of educational institutions • Concerned departments 	24 months Revision on regular basis	IHR Focal Person, NVL, NARC, and NIH

Crimean-Congo Hemorrhagic Fever

Discrepancy	Resolution	Action Steps	Resources Needed	Responsible Entity	Time Frame	Focal Person
Lack of Intersectoral Coordination	Improve intersectoral coordination through One Health units operating at each level	<ul style="list-style-type: none"> Identify focal person at provincial and district levels for One Health units Include Provincial Ministry representatives at Federal Ministry One Health meetings Improve interprovincial coordination 	<ul style="list-style-type: none"> Yes-resources (financial) needed to operate One Health units at each level 	Provincial and Federal Ministries	1 year	IHR Focal Person in health and livestock departments
Training Gaps in diagnostic laboratory capacity, physician and animal health	Provide training opportunities for all stakeholders to be able to recognize, diagnose and prevent disease	<ul style="list-style-type: none"> Training at provincial level on zoonotic diseases and One Health 	<ul style="list-style-type: none"> Financial Technical 	Provincial and Federal Ministries	1–2 years But is also an ongoing process	IHR Focal Person in health and livestock departments, NARC, NVL, NIH, and FELTP
Lack of financial resources	Legislation providing funding	Develop new or update existing legislation for combating zoonotic diseases and integrating One Health Projects	<ul style="list-style-type: none"> Financial Technical 	Provincial and Federal Ministries	2–3 years	IHR Focal Person in health and livestock departments, AHC, MoNFSR, MONHSRC, Provincial DGs/Directors

APPENDIX H: OH-SMART™ Participant Feedback

Pre-Workshop Questionnaire (18 out of 27 participants responded to the pre-workshop assessment)

Question	Summary of answers
Describe how you and your agency work and communicate with people from other sectors. Please provide an example and as much detail as possible. Please indicate how often you/your organization: a) identify and work with another agency or sector b) Work with another agency/organization to discuss specifics about how you might work together c) Work with a colleague from another agency/organization to develop guidelines or procedures for cross-sectoral engagement	The responses ranged from no regular communication to collaborative meetings at provincial and district level with follow up correspondence. Four had no response. The majority (10) indicated that there is no regular communication between sectors, however most noted that communication does occur in the case of a disease outbreak or when a coordinated response is needed. The frequency of times that participants identified working with another agency, discussing how they might work together or actually working across sectors with a colleague from another agency also varied from none to once or twice a year. The majority stated that it is not often done in practice except in case of a disease outbreak response.
What other agencies do you currently partner with? When do you coordinate with them and what does this relationship look like?	<ul style="list-style-type: none"> • Partner with non-governmental organizations in public health. • Coordinate with NIH for diagnosis and control of CCHF, Dengue, and Brucellosis. This includes outbreak investigation and response, research plans, and disease alerts. • Coordinate with livestock and dairy development for case-based response. • Partner with NARC.
What would help you to identify and partner more effectively with other partner agencies?	The overwhelming majority of responses cited increased commitment for collaboration under a One Health platform as a way to partner more effectively with other agencies.

Post Work-Shop Questionnaire (13 out of 27 participants responded to the post-workshop questionnaire)

Question	Summary of answers
How has this workshop affected the way you understand and work with people from other sectors?	Many participants noted that this workshop was the first time they had engaged with a different sector and it was a great opportunity to learn about the areas of potential collaboration and coordination. It also helped them understand the gaps within the system.
Are there additional agencies you would want to partner with? Please give a few examples of which agencies you might develop new partnerships with, and under what circumstances.	Additional ministries include the Ministry of Finance, Ministry of Environment, and Ministry of Wildlife. More local university representatives should be involved. Many felt that the International Livestock Research Institute (ILRI), International Center for Agriculture in the Dry Areas (ICARDA) and CIMMYT should be included. Finally, including community representatives would make future achievements of targets easier.
What would help you to identify and partner more effectively with other partner agencies?	The majority of respondents cited a National One Health platform, such as a Secretariat, would help identify partner agencies and promote collaboration between sectors. This would include more regular, formal meetings including coordination at the provincial level.

Question	Summary of answers
How will this business process improvement/system mapping method help you to operationalize the One Health approach? What types of tangible changes would you like to see to plans, policies or relationships going forward?	The workshop helped identify gaps in multisectoral, One Health collaboration as well as specific actions to improve the system. Multiple respondents noted that both the disease prioritization tool (OHZDP) and the mapping tool (OH-SMARTTM) could be used at the District level to prioritize diseases locally and identify opportunities for better collaboration. Overall, the responses were positive that the workshop will help support the continued growth of a National One Health platform (or Secretariat).



Photo 9. Decorated truck on the Karakoram highway in Pakistan.

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Photo 10. Markhor (*Capra falconeri*) is the national animal of Pakistan.

<http://www.cdc.gov/onehealth>