Workshop Summary

One Health Zoonotic Disease Prioritization for Multisectoral Engagement in Bangladesh

Dhaka, Bangladesh

DEPARTMENT OF HEALTH & HUMAN SERVICES · USA

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

USAID
FROM THE AMERICAN PEOPLE

Food and Agriculture Organization of the United Nations

CS 315193-A

Photo1. Greater Flamingo (Phoenicopterus roseus), Bangladesh.

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Photo 2. Bangladeshi boats in Chittagong, a port city on the Indian Ocean and the largest port in Bangladesh.

PARTICIPATING ORGANIZATIONS

Members from the multiple sectors attended as voting members, observers, facilitators, and organizers. The list below indicates the participating organizations, however, a complete list of participants can be found in Appendix A.

BAU: Bangladesh Agricultural University

BFD: Bangladesh Forest Department

BLRI: Bangladesh Livestock Research Institute

BSMMU: Bangabandhu Sheikh Mujib Medical University

CDC, DGHS: Communicable Disease Control, Directorate General of Health Services

CDC: U.S. Centers for Disease Control and Prevention

CVASU: Chittagong Veterinary and Animal Sciences University

DLS: Department of Livestock Services

FAO: Food and Agricultural Organization

ICDDR,B: International Centre for Diarrheal Diseases Research, Bangladesh

ICD: Initiative Commune pour le Développement / Joint Initiative for Development

IEDCR: Institute of Epidemiology Disease Control and Research

NIPSOM: National Institute of Preventive and Social Medicine

OHS: One Health Secretariat

P&R: Preparedness and Response Project of USAID PREDICT

USAID: United States Agency for International Development

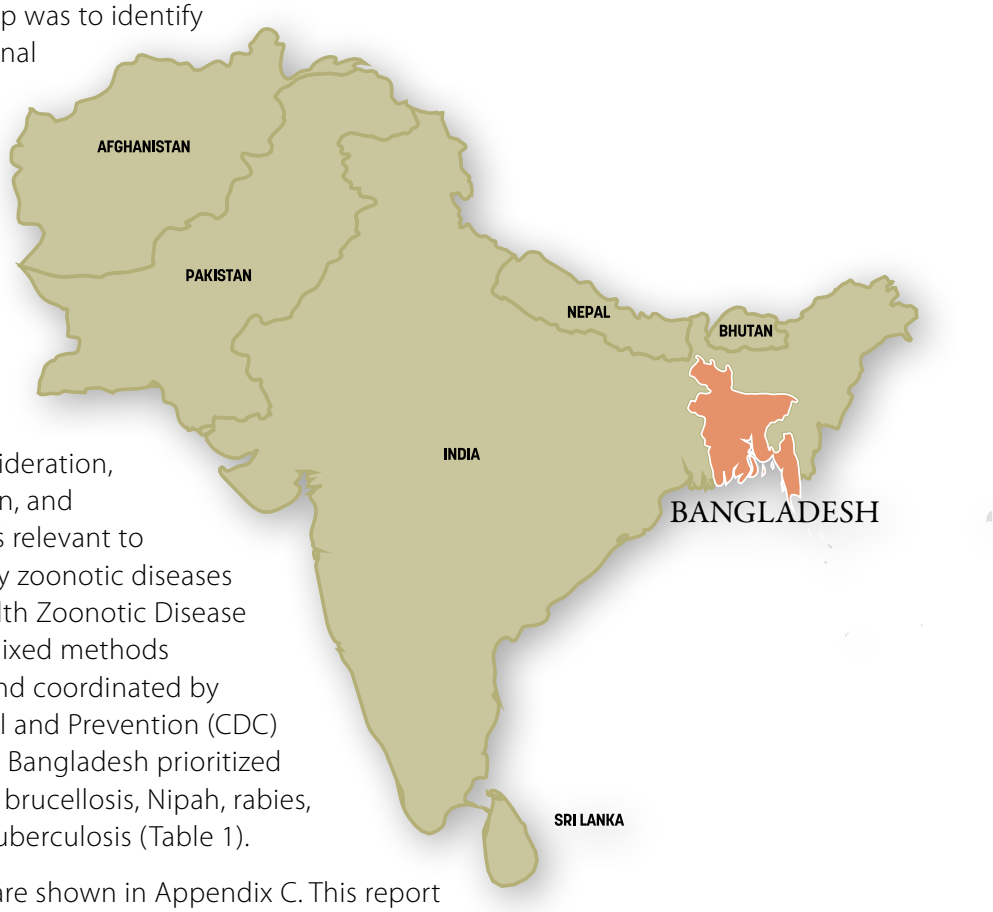
SAU: Sher E Bangla Agricultural University

WHO: World Health Organization

Photo 3. Boats on the outskirts of Dhaka, the capital of Bangladesh.

SUMMARY

The purpose of this 2-day workshop was to identify zoonotic diseases of greatest national concern for Bangladesh using a One Health approach with input from representatives of human health, animal health, and forest and wildlife sectors. In preparation for the workshop, representatives identified a list of zoonotic diseases relevant for Bangladesh to prioritize. During the workshop, representatives refined the list of diseases for consideration, defined the criteria for prioritization, and determined questions and weights relevant to each criterion. Bangladesh's priority zoonotic diseases were identified using the One Health Zoonotic Disease Prioritization (OHZDP) Process, a mixed methods prioritization process developed and coordinated by the U.S. Centers for Disease Control and Prevention (CDC) (Appendix B) [1, 2]. At the workshop, Bangladesh prioritized the following six diseases: anthrax, brucellosis, Nipah, rabies, zoonotic influenza, and zoonotic tuberculosis (Table 1).



The results of the OHZDP Process are shown in Appendix C. This report summarizes the OHZDP process used to prioritize the top zoonotic diseases for Bangladesh that should be jointly addressed using a multisectoral, One Health approach including human, livestock, and forest/wildlife sectors

Table 1. Prioritized zoonotic diseases selected in Bangladesh during the One Health Zoonotic Disease Prioritization Workshop in July 2017 *(Listed alphabetically and not in ranked order)*

Zoonotic Disease	Causative Agent	Human Disease Burden	Animal Disease Burden	Diagnostics, Treatment, and Prevention
Anthrax	Bacteria	Anthrax is present in Bangladesh and in some years hundreds of human cases are reported [3].	Between 2010-2012, nearly 6,000 animals were diagnosed as suspect anthrax cases and 800 animals died due to anthrax based on secondary surveillance data [4].	Effective animal vaccine and treatment for humans exist [5].
Brucellosis	Bacteria	In serological surveys in Bangladesh, human exposure varied according to profession [6, 7], ranging up to 18.6% among dairy milkers.	Brucellosis is present in animal populations of Bangladesh, with nearly 10% of cattle and 20% of goats showing serological evidence of infection [6, 7].	Effective treatment for humans is available. Brucellosis is prevented in humans by controlling the infection in animals and by boiling or pasteurizing milk and dairy products. Effective animal vaccines exist for brucellosis [8].
Nipah	Virus	In Bangladesh, Nipah virus has a human case fatality rate of >70% [9]. The country has experienced recurrent outbreaks since 2001 [7].	*Pteropus* fruit bats are the reservoir host for Nipah virus; however, livestock can also be infected. One serosurvey found 44% of pigs near a bat roost had serological evidence of infection [10].	There are no vaccines or specific treatments to prevent or cure infection by Nipah virus [11].
Rabies	Virus	It is estimated that Bangladesh has 2,000-2,500 human cases of rabies each year [12].	Rabies is endemic and under-reported in animal populations in Bangladesh [4].	Effective animal vaccine exists. Post-bite management for humans is very effective and available. Once symptoms begin in humans, almost all patients have died [13].
Zoonotic influenza	Viruses	Strains of zoonotic influenza virus have caused human infections in Bangladesh; there were eight H5N1 cases from 2008-2016, including one death and several cases (3) of H9N2 [14].	Zoonotic influenza strains routinely circulate in Bangladesh. The country experienced a major H5N1 poultry outbreak in 2007, resulting in 2.6 million birds culled, 3 million eggs destroyed, $3.88 million paid to the farmers as compensation [15], and an estimated loss of Tk 55 billion ($757.9 million) [7].	Treatment for humans is mainly supportive [5]. Specific antiviral is also available.
Zoonotic Tuberculosis	Bacteria	Bangladesh is one of the highest tuberculosis burden countries in the world [7]; however, the proportion due to zoonotic tuberculosis is not known. Globally it is estimated that *M. bovis* results in >120,000 human cases and >10,000 deaths annually [16].	The burden of zoonotic tuberculosis in animals around the world is largely unknown. Studies in Bangladesh have shown evidence of infection in cattle herds [7]. No surveillance data are available.	Effective treatment exists for humans. New candidate vaccines are being tested [17].

INTRODUCTION

Zoonotic diseases are diseases that spread between animals and people. It is estimated that more than 6 out of every 10 known infectious diseases in people are spread from animals, and 3 out of every 4 new or emerging infectious diseases in people are spread from animals [18].

GEOGRAPHY AND POPULATION

Bangladesh is in South Asia along the Bay of Bengal and is bordered by India to the north and west, and by Myanmar to the east. It is located in between 20o 34′ and 26o 38′ north latitude and between 88o 01′ and 92o 41′ east longitude, covering an area of 147,570 sq. km. There are three geographic regions of Bangladesh. The country is largely dominated by the Ganges-Brahmaputra Delta. The northwest and central parts of the country were formed by the Madhupur and Barind plateaus. The northeast and southeast are home to evergreen hill ranges. Bangladesh is home to one of the world's longest sea beaches in Cox's Bazar with 120 miles of coastline. As one of the most densely populated countries in the world, Bangladesh has a population density of 1,077/sq. km [19]. The current population of Bangladesh is estimated at over 158.9 million with expected population growth of 1.37% annually [19].

Photo 4. Sunrise at Kuakata, Bangladesh.

Photo 5. Hanuman langur, also known as a Gray Langur, are found throughout Bangladesh.

ENVIRONMENT AND BIODIVERSITY

Bangladesh has strong biodiversity with important economic, technological, and social implications. There are several national parks within Bangladesh, as well as the Sundarbans, one of the world's largest mangrove forests. The extensive national parks, wetlands, mangrove forests, and the marine and freshwater systems make Bangladesh one of the world's greatest reservoirs of biodiversity. Bangladesh is home to at least 53 species of amphibians, 19 species of marine reptiles, 139 species of reptiles, 380 species of birds, 116 species of mammals, and 5 species of marine mammals [20]. Most of the ecosystems, terrestrial or aquatic, are deteriorating with decreasing capacity to provide essential services. A significant number of species are on the decline and some of them are even on the brink of extinction, including animals such as the Bengal tiger. Twenty-five percent of Bangladesh is less than a meter above sea level and is therefore at high risk of flooding on a regular basis. Monsoons, mudslides, and cyclones occur regularly. Ecosystems such as forests, wetlands, and mangroves are transformed, and in some cases, irreversibly degraded.

Photo 6: A woman walking down the road in Srimangal, Bangladesh.

AGRICULTURE

Agriculture, livestock, forestry, and fisheries together contribute over 15% of GDP and account for over 40% of total employment [21]. In rural areas, about 87% of households rely on agriculture for at least part of their income [22]. Livestock production is one of the major agricultural activities in Bangladesh. Population growth and economic growth are both rapidly increasing the demand for protein of animal origin, which is driving the intensification of livestock production, especially in the poultry sector. Bangladesh has a large livestock population, composed of 23.9 million cattle, 25.93 million goats, 3.40 million sheep, 275.18 million chickens [23], and 54.01 million ducks [24]. In Bangladesh, 83.9% of total households own livestock of which about 45.9% of households own bovine stock and 76.3% own poultry. On average, each household owns 1.52 bovine animals, 0.9 goats and sheep, and 6.8 chickens and ducks [25]. Traditional breeds and processes dominate the Bangladesh livestock sector. Non-descript desi cattle are the most widespread cattle breed in the nation. However, there is a growing trend of rearing crossbred cattle considering higher yield. The majority of cattle are reared under a semi-intensive system though intensive dairying based on stall feeding is gaining popularity. A small number of cattle are reared in a bathan system, which has similarities to ranches. Sheep and goats are widely distributed and adapted to many agro-ecological zones. Most livestock in Bangladesh is produced in extensive production and smallholder systems where they may mix with wildlife. The context in Bangladesh is characterized by rich biodiversity coexisting side by side with livestock and humans, especially in rural areas, which provides a perfect setting for the emergence and spread of zoonotic diseases.

Photo 7. A woman walking along water channels and the rice fields.

Photo 8. Blooming mustard flowers in a field.

Photo 9. Chickens at an outdoor market in Bangladesh.

ONE HEALTH IN BANGLADESH

One Health is the multisectoral, transdisciplinary approach to confronting the threat of infectious diseases, including zoonotic diseases, at the human-animal-environment interface. Efforts to organize and implement One Health activities in Bangladesh started in 2008 with the establishment of a think-tank, One Health Bangladesh. In 2012, the Government of Bangladesh developed and validated the Strategic Framework for One Health to address infectious diseases in Bangladesh. This framework identified that a major challenge in implementing the One Health approach in Bangladesh is weak linkage among different ministries and agencies responsible for human health, animal health, and the environment. An inter-ministerial and multi-agency approach to policy making, surveillance, outbreak response, prevention, and control could define steps towards institutionalizing an effective One Health collaboration within the Government of Bangladesh and partners.

The goals of the Strategic Framework for One Health were to:

1. Establish necessary institutional arrangements to enable effective collaboration between sectors involved,
2. Develop necessary capacity and technical procedures to prevent and control targeted emerging infectious diseases, and
3. Apply sound environmental principles when ecosystems with potential disease or health interfaces with humans and animals are involved in control strategies.

In June 2016, an inter-ministerial meeting involving relevant stakeholders for the institutionalization of One Health formed an Inter-ministerial Steering Committee on One Health and One Health Secretariat. Seconded staff from the Directorate General Health Services (DGHS), Department of Livestock Services (DLS), and the Bangladesh Forest Department (BFD) run the One Health Secretariat, which is responsible for routine coordination mechanism across One Health departments of ministries and beyond. The inter-ministerial steering committee is the overarching supervisory body for guiding and monitoring One Health activities in the country.

Photo 10. Water buffalo grazing in a field in Bangladesh.

ZOONOTIC DISEASES

Zoonotic diseases that occur in large numbers primarily impact society in the following ways:

- Threaten the health of animals resulting in illness, loss of productivity, and death and thus threaten the livelihood of a large segment of the population dependent on livestock as a major source of income.
- Threaten national economic stability through loss of tourism, trade bans, and quarantine.
- Threaten the health of people with the ability to cause significant numbers of illnesses and deaths, which is associated with significant social instability and economic losses.

A One Health Zoonotic Disease Prioritization was identified by national representatives in Bangladesh as the first step toward addressing the public health challenges associated with zoonotic disease threats using a One Health approach. To begin to address these challenges, an OHZDP Workshop was conducted July 13-14, 2017, at the Institute of Epidemiology, Disease Control and Research (IEDCR), Mohakhali, Dhaka, Bangladesh. The purpose of this workshop was to identify zoonotic diseases of greatest national concern for Bangladesh using input from representatives of human health, livestock, environment/wildlife, research, and higher education sectors. The goal of the OHZDP process was to use a multisectoral, One Health approach to prioritize endemic and emerging zoonotic diseases of major national concern that should be jointly addressed by ministries responsible for human, animal, and environmental health. This workshop was supported by the Government of Bangladesh, U.S. CDC, USAID, and the Preparedness and Response (P&R) project as part of the Global Health Security Agenda (GHSA). To build in-country capacity to conduct future One Health prioritization workshops, three local government representatives from the human, animal, and environmental health sectors were trained by CDC as facilitators and served as the facilitators during the workshop. The in-country facilitator training took place July 10-12, 2017, at the office of the Food and Agriculture Organization (FAO) at the Department of Livestock Services (DLS), Dhaka, Bangladesh.

Photo 11. A woman holding her child.

WORKSHOP METHODS

The prioritization process involved the application of CDC's OHZDP process [1, 2]. Organizers began preparations more than two months in advance and activities were coordinated by the CDC One Health Office. The first step of the process was to identify a country-specific list of potential zoonotic diseases of concern. This was achieved by reviewing literature, Bangladesh's list of notifiable zoonotic animal diseases, and the list of diseases reported to the Management Information System (MIS) of the Director General of Health Services (DGHS). An initial list was compiled from these sources, which was then shared with all participating organizations. Through multiple revisions with subject matter experts from these ministries and departments, the list was refined to 41 zoonotic diseases for prioritization. There was discussion during the workshop about the inclusion of vector-borne diseases for the purpose of prioritization, however, it was decided by voting members that only vector-borne diseases with a substantial animal component in the life cycle would be considered in this prioritization. This formed the final list of zoonotic diseases for prioritization during the workshop. See Appendix C for a complete list of the zoonotic diseases used for prioritization and their ranked scores.

During the workshop, voting members jointly identified five criteria for quantitative ranking of these zoonotic diseases. The five criteria were: intervention availability, severity of disease, economic burden, response capacity, and transmissibility. Once criteria were chosen, each voting member individually ranked the relative importance of each criterion to help generate a final group of weighted criteria. One categorical question for each criterion was selected through group discussion. All questions had either yes/no answers or ordinal multinomial answers, with weights assigned to each answer. These were developed and agreed upon through group consensus. Data for answering the questions for each of the 41 zoonotic diseases were identified through an extensive literature search that took place in preparation for the workshop. The literature search included information from the Government of Bangladesh, WHO, OIE, FAO, CDC, USAID, and online sources such as ProMED and Health-Map. If disease information was not available for Bangladesh specifically, regional and/or global data were used.

A decision tree tool developed within Microsoft Excel™ was used for determining the final disease ranking. Each weighted criterion was applied across all diseases, and scores were assigned based on the response to each question. The scores for all five questions were summed and then normalized such that the highest final score was 1. See Appendix D for the weighted criteria, corresponding questions, and answers.

The list of zoonotic diseases and their normalized scores was presented by facilitators to the group on the second day of the workshop for discussion. After much discussion among voters and observers, the voting members from all represented government departments agreed on a final list of priority zoonotic diseases or disease groups for Bangladesh: anthrax, brucellosis, Nipah virus, rabies, zoonotic influenza, and zoonotic tuberculosis.

Criteria Selected for Ranking Zoonotic Diseases

The criteria for ranking zoonotic diseases selected by the voting members in Bangladesh are listed in order of importance below. See Appendix D for the weighted criterion, questions, and answers.

1. **Severity of Disease.** Diseases that are more likely to cause death in human populations were deemed to be the most important. Diseases with a high case fatality ratio (CFR) (50%-100%) received the fullest weight score of 3. Diseases with a moderately high CFR (10%-<50%) were given a score of 2. Diseases with a slightly lower CFR (5%-<10%) were given a score of 1. Diseases that did not cause death, or only caused death in a small proportion of people (<5%) received a score of 0.
2. **Intervention Ability.** The ability to control a zoonotic disease was the second most important criterion. Diseases that had a vaccine or treatment available in both humans and animals received the fullest weight score of 3. Diseases that had a vaccine or treatment for only animals received a score of 2. Diseases that had a vaccine or treatment in only humans received a score of 1. Diseases that did not have any vaccine or treatment available for humans or animals received a score of 0.
3. **Economic Burden.** The economic impact of the disease was considered the third most important criterion in ranking. Diseases that caused high mortality and morbidity in animals as defined by case fatality ratio (CFR) and production loss (>5% CFR in animals, ≥20% production loss) received the full weight score of 3. Diseases with a high CFR and low production loss (>5% CFR in animals, <20% production loss) received a score of 2. Diseases with a low CFR and high production loss (<5% CFR in animals, ≥20% production loss) received a score of 1. Diseases with a low CFR and low production loss (<5% CFR in animals, <20% production loss) received a score of 0.
4. **Transmissibility.** The ability of the disease to be transmitted easily within a population was the fourth most important criterion in ranking. Diseases with sustained human-to-human transmission received the full weight score of 2. Diseases with rare human-to-human transmission received a score of 1. Diseases with no potential for human-to-human transmission received a score of 0.
5. **Response Capacity**. Whether or not there was capacity in Bangladesh to detect and respond to a disease was considered the fifth criterion for ranking the zoonotic diseases. Diseases for which there was an established surveillance system in Bangladesh in place for humans and animals received the full weight score of 3. Diseases for which there was human surveillance but no animal surveillance received a score of 2. Diseases for which there was animal surveillance but no human surveillance received a score of 1. Disease for which there was no surveillance system in place, for humans or animals, received a score of 0.

PLANS AND RECOMMENDATIONS

Following the agreement of the prioritized diseases, the workshop participants identified next steps and further actions that could be taken by each sector to engage in a multisectoral, One Health approach. Participants were asked to make general recommendations for how to approach the priority diseases without considering the constraints. They were then asked to identify specific activities that could be accomplished by each sector and organization. The recommendations for additional actions are

described below. In addition, after the OHZDP Workshop, the results were presented at the 9th Bangladesh One Health Conference in Dhaka, September 17-18, 2017.

Coordination and Communication

- All sectors should conduct joint simulation exercises to strengthen inter-department relationships and procedures for coordination.
- All sectors should develop joint programs between departments that will have formalized plans for implementation.
- Prioritized diseases must be reflected in each department's action plans including project preparation and routine work.
- Existing resources should be devoted to these joint activities including lab, surveillance, and outbreak investigation.
- Each sector will have focal points for establishing the linkage between the sectors.
- Strong coordination is needed from the top level to the root level.
- Effective communication to policy makers is essential.
  - The The One Health Secretariat will communicate to its respective departments on this prioritization process.
  - The National One Health Steering committee will advocate for this prioritized list in order to develop programs based on these prioritized diseases.
  - Voting members will also communicate to their respective Director Generals about the outcome of this meeting.
- Advocacy for prioritized zoonotic diseases developed with a One Health approach will also be necessary for securing additional funding from donors, e.g., the World Bank, with an existing example present in the agriculture sector.

Prevention and Control

- There must be cooperation between departments to generate evidence and a body of data about the prioritized zoonotic diseases.
- For some diseases (e.g., brucellosis and zoonotic tuberculosis) there are gaps in knowledge and a need to generate evidence for all sectors.
- Surveillance coordination is needed across departments with attention to using shared case definitions for each disease.
- There should be established procedures to implement joint outbreak investigations.
- There should be established procedures that will enable information sharing across organizations.

Laboratory

- Laboratory capacity for prioritized diseases must be strengthened across sectors.
- Bangladesh should establish a linked network of laboratories across sectors that are capable of receiving and analyzing specimens for these prioritized diseases.

Training

- A workforce should be developed to address the prioritized diseases across all sectors.
- A One Health curriculum that will train students and young professionals about One Health and cooperation across sectors will be created.
- In addition to the curriculum on One Health, all sectors must prepare and engage with the next generation in One Health activities (such as conducting joint outbreak investigations and response, disease surveillance, etc.).

Photo12. Sunrise in the Sundarbans, a mangrove area in the delta formed by the confluence of the Ganges, Brahmaputra and Meghna Rivers in the Bay of Bengal, Bangladesh.

APPENDIX A: Participants of the One Health Zoonotic Disease Prioritization Workshop, Dhaka, Bangladesh

Voting Members

#	Name	Organization	Title/Position
1	Professor Dr. Tahmina Shirin	IEDCR	Chief Scientific Officer
2	Dr. M. Salim Uzzaman	IEDCR	Principal Scientific Officer
3	Dr. Mahbubur Rahman	IEDCR	Medical Officer
4	Dr. Pabitra Kumar Saha	DLS	Principal Scientific Officer
5	Dr. Rezaul Huq Khan	DLS	Scientific Officer
6	Dr. Md. HuzzatUllah	DLS	Upazila Livestock Officer
7	Dr. SK Shaheenur Islam	DLS	Upazila Livestock Officer
8	Dr. Umme Ruman Siddiqi	CDC, DGHS	Evaluator Disease Control
9	Dr. Tahmina Akter	CDC, DGHS	Assistant Director
10	Haque Mahbub Morshed	BFD	Assistant Conservator of Forest
11	Dr. Mohammad Mostafizur Rahman	BFD	Veterinary Surgeon, Bangabandhu Sheikh Mujib Safari Park, Dulhazra, Cox's Bazar
12	Md. Anisur Rahman	BFD	Wildlife Supervisor, Bangabandhu Sheikh Mujib Safari Park, Gazipur
13	Dr. Md. Giasuddin	BLRI	Director, National Reference Laboratory for Avian Influenza (NRL-AI)

Observers

#	Name	Organization	Title/Position
14	Prof. Dr. Sanya Tahmina	CDC, DGHS	Director
15	Dr. Fahmida Khanam	NIPSOM	Assistant Professor (Virology)
16	Prof. Dr. Shohael Mahmud Arafat	BSMMU	Professor
17	Prof. Dr. Paritosh Kumar Biswas	CVASU	Professor
18	Dr. KBM Saiful Islam	SBAU	Chairman and Associate Professor, Department of Medicine and Public Health
19	Prof. Dr. S.M Lutful Kabir	BAU	Professor
20	Dr. ASMA Hannan	OHS	Upazila Livestock Officer Seconded to One Health Secretariat of Bangladesh
21	Prof. Dr. Nitish Debnath	FAO	Senior Technical Advisor
22	Dr. Kazi Hassan Ameen	WHO	Consultant
23	Dr. Kelly O'Neill	USAID	GHSA Advisor
24	Dr. Erin Kennedy	CDC	One Health Technical Coordinator
25	Dr. Ariful Islam	Predict-2	Country Team Leader

#	Name	Organization	Title/Position
26	Dr. Farhana Haque	ICDDR,B	Associate Scientist
27	Dr. Solomon Benigno	P&R	Regional One Health Technical Advisor
28	Dr. Md. Abul Kalam	P&R	One Health Technical Advisor, Bangladesh
29	Prof. Mahmudur Rahman	P&R	Independent Consultant
30	Dr. Sukanta Chowdhury	ICDDR,B	Assistant Scientist at Programme for Emerging Infections
31	Dr. Eric Brum	FAO	Emergency Centre for Transboundary Animal Diseases (ECTAD) Country Team Leader

Facilitators

32	Dr. Karen A. Alroy	CDC	Epidemiologist
33	Dr. Sean Shadomy	CDC	CDC Liaison to FAO
34	Dr. Md. Abdul Hai	DLS	Principal Scientific Officer
35	Dr. Rabeya Sultana	IEDCR	Assistant Professor
36	Mr. Abu Naser Mohsin Hossain	BFD	Assistant Conservator of Forest

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

For an 508 accessable version of Appendix B, please click here:
https://www.cdc.gov/onehealth/what-we-do/zoonotic-disease-prioritization/fact-sheet.html

ONE HEALTH ZOONOTIC DISEASE PRIORITIZATION PROCESS OVERVIEW

Goals of the One Health Zoonotic Disease Prioritization Process

- To use a multisectoral, One Health approach to
  1. Prioritize zoonotic diseases of greatest concern
  2. Develop next steps and action plans to address the priority zoonotic diseases in collaboration with One Health partners

OHZDP Workshop Process

BEFORE THE WORKSHOP

Prepare and Plan for the Workshop

- Contact the CDC One Health Office at least 3 months before scheduling a workshop.
- Identify Core Planning Team and obtain financial resources to accommodate for workshop logistics, venue, materials, travel, and translation.
- Identify workshop participants (facilitators, voting members, advisors) from human, animal, and environmental health sectors and other related partners.
- Generate an initial list of zoonotic diseases to be considered for prioritization using reportable disease lists, literature, and input from all represented One Health sectors.
- Conduct a literature review on the initial list of zoonotic diseases by reviewing publications, reports, grey literature, etc.

DURING THE WORKSHOP

Develop Criteria

- 5 criteria will be used to prioritize the list of zoonotic diseases; criteria are locally appropriate and address the needs of each unique location.

Develop Questions

- 1 categorical question will be developed to measure each criteria.

Rank Criteria

- Each voting member will rank criteria in their preferred order, allowing each sector to address their sector's priorities and needs. Individual rankings are combined to produce a combined ranked list of criteria.

Prioritize Zoonotic Diseases

- Score each zoonotic disease by answering the categorical questions for each weighted criterion and entering this data into the OHZDP Tool.
- The ranked zoonotic disease list from the OHZDP Tool is used to facilitate discussion among the participants to finalize the priority zoonotic disease list.

Discuss Next Steps and Action Plans for Multisectoral, One Health Engagement

- Discuss next steps and action plans for identifying areas for One Health engagement for prevention and control of the prioritized zoonotic diseases.

AFTER THE WORKSHOP

- Stakeholders advocate and implement recommended next steps and action plans to implement a One Health approach for the priority zoonotic diseases.

OHZDP Workshop Outcomes

- A list of priority zoonotic diseases of greatest concern agreed upon by all represented One Health sectors
- Recommendations for next steps and action plans for multisectoral, One Health engagement to address the priority zoonotic diseases
- Understanding of the roles and responsibilities of all represented One Health sectors
- The creation or strengthening of multisectoral, One Health coordination mechanisms and networks
- A report highlighting the outcomes of the workshop to help advocate for One Health priorities

www.cdc.gov/onehealth/global-activities/prioritization.html

APPENDIX C: Ranked Zoonotic Disease List from the One Health Zoonotic Disease Prioritization Workshop for Bangladesh

The prioritized zoonotic diseases for Bangladesh are bolded in the table below.

Rank	Zoonotic Disease	Ranked Score
1	**Rabies**	**1.00**
2	**Zoonotic Influenza (including avian and swine)**	**1.00**
3	**Anthrax**	**0.85**
4	**Japanese Encephalitis**	**0.81**
5	**Nipah**	**0.76**
6	**Ebola**	**0.71**
7	**Glanders and Melioidosis**	**0.70**
8	**Bovine Spongiform Encephalopathy**	**0.67**
9	**Brucellosis**	**0.63**
10	**Plague**	**0.59**
11	**Leptospirosis**	**0.57**
12	**SARS**	**0.52**
13	**Hydatid Disease**	**0.51**
14	**Listeriosis**	**0.49**
15	**Middle East Respiratory Syndrome (MERS-CoV)**	**0.49**
16	**Salmonellosis**	**0.46**
17	**Rotavirus**	**0.44**
18	**Leishmania**	**0.44**
19	**Yellow Fever**	**0.44**
20	**Psittacosis**	**0.44**
21	**Nematodiasis**	**0.42**
22	**Kyanasur Forest Disease**	**0.41**

Rank	Zoonotic Disease	Ranked Score
23	**Rift Valley Fever**	**0.37**
24	**Q Fever**	**0.34**
25	**West Nile Virus**	**0.32**
26	**Orf (Contagious ecthyma) and Pseudocowpox**	**0.31**
27	**Cysticercosis**	**0.29**
28	**Escherichia coli (including EHEC, ETEC and O:157)**	**0.26**
29	**Balantidiosis**	**0.26**
30	**Giardiasis**	**0.26**
31	**Trematodiasis**	**0.24**
32	**Toxoplasmosis**	**0.24**
33	**Amoebiasis**	**0.22**
34	**Cryptosporidiosis**	**0.20**
35	**Zoonotic Tuberculosis**	**0.20**
36	**Crimean-Congo Hemorrhagic Fever (CCHF)**	**0.19**
37	**Campylobacteriosis**	**0.19**
38	**Schistosomiasis**	**0.16**
39	**Hepatitis E**	**0.15**
40	**Lymphatic Filariasis**	**0.15**
41	**Typhus (including Scrub Typhus, Murine Typhus, and Cat-flea Typhus)**	**0.07**

APPENDIX D: Ranked criteria, corresponding questions and answers with assigned weights

Criterion A: Intervention Ability (0.20)

Question: Is there a vaccine or treatment available for humans or animals?

Answer:	Score:
☐ None	0
☐ Only humans	1
☐ Only animals	2
☐ Both humans and animals	3

Criteria B: Severity of Disease (0.41)

Question:What is the human Case Fatality Rate of the disease?

Answer:	Score:
☐ <5%	0
☐ 5 - <10%	1
☐ 10 - <50%	2
☐ 50 – 100%	3

Criteria C: Economic Burden (0.14)

Question: What is the economic loss in livestock? The disease agent has:

Answer:	Score:
☐ <5% CFR in animals, <20% production loss	0
☐ <5% CFR in animals, ≥20% production loss	1
☐ >5% CFR in animals, <20% production loss	2
☐ >5% CFR in animals, ≥20% production loss	3

Criteria DResponse Capacity (0.11)

Is there an established surveillance system in place in Bangladesh?

Answer:	Score:
☐ None for animals, none for humans	0
☐ Yes for animals, none for humans	1
☐ None for animals, yes for humans	2
☐ Yes for animals, yes for humans	3

Criteria E: Transmissibility (0.14)

Question: What is the human-to-human disease transmission potentiality? The disease agent has:

Answer:	Score:
☐ No potential for human-to-human transmission	0
☐ PRare human-to-human transmission	1
☐ Sustained human-to-human transmission	2

Photo 13: Man at a fish market in Bangladesh.

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Photo 14. Man and a child walking through a sunflower field in Noakhali, Bangladesh.

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