World Zoonosis Day

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Organized by

Indian Federation of Animal Health Companies (INFAH)

One health & emerging zoonoses

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BETWEEN ANIMAL AND HUMAN MEDICINE, THERE IS NO DIVIDING LINE–NOR SHOULD THERE BE.

- RUDOLF VIRCHOW -

IMPORTANCE OF ONE MEDICINE – ONE HEALTH CONCEPT -

- Shared zoonoses from livestock and pets
- Food safety
- Wild life reservoirs of human pathogens
- Global Environment & Climate change
- Antimicrobial resistance
- Food Security
- Comparative medicine & Biomedical research

„There is no difference of paradigm between human and veterinary medicine. Both sciences share a common body of knowledge in anatomy, physiology, pathology, on the origines of diseases in all species."

Schwabe C. (1964, 1984 3rd Edition): Veterinary Medicine and Human Health. Williams and Wilkins, Baltimore

DISEASES OF PUBLIC HEALTH IMPORTANCE (WHO, 2008)

- 25% of all globally deaths are caused by microbes.
- 1,415 species of infectious organisms known to be pathogenic to humans.
- 217 viruses and prions,
- 538 bacteria and rickettsia,
- 307 fungi,
- 66 protozoa and
- 287 helminths.

- 868 (61%) of all known are zoonoses.

- humans as primary reservoir for only 3% of them.

- 175 diseases considered to be emerging,

- 132 (75%) are zoonotic.

Table. Newly discovered microbes of public health importance

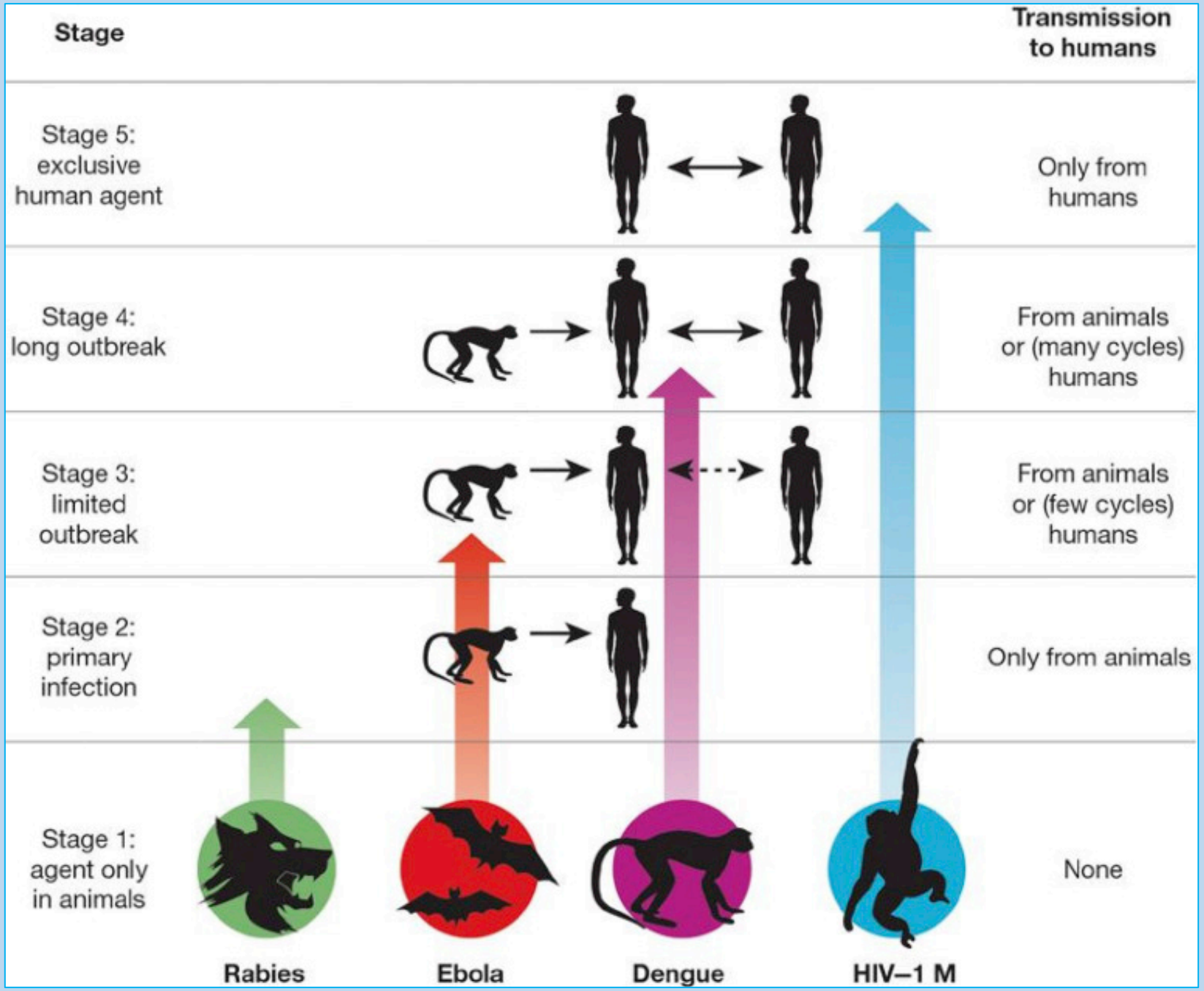
Year	Microbes	Disease
1975	Parvovirus B-19	Fifth disease
1976	*Cryptosporidium parvum*	Cryptosporidiosis
1977	Ebola virus	Ebola haemorrhagic fever
1977	*Legionella pneumophila*	*Legionnaire's disease*
1977	Hantaan virus	Korean haemorrhagic fever
1977	*Campylobacter jejuni*	Gastroenteritis (food poisoning)
1980	Human T-lymphotropic virus I (HTLV-I)	T-cell leukemia/lymohoma
1981	Toxin producing strains of *Staphylococcus aureus(golden staph)*	Various infections
1982	*Escherichia coli* O157:H7	Food poisoning
1982	HTLV-II	Lymphoma
1982	*Borrelia burgdorferi*	Lyme disease
1983	Human immunodeficiency virus	AIDS
1983	*Helicobacter pylori*	Duodenal and gastric ulcer and stomach cancer
1985	*Enterocytozoon bieneusi*	Microsporidiosis diarrhoea
1986	*Cyclospora cayatanensis*	Diarrhoea
1988	Hepatitis E virus	Hepatitis
1989	*Ehrilichia chafeensis*	Human monocytic *Ehrilichiosis*
1989	Hepatitis C virus	Liver cancer (hepatocellular carcinoma)
1991	Guanarito virus	Venezuelan haemorrhagic fever
1991	*Encephalitozoon hellem*	…
1991	New species of *Babesia*	Babesiosis haemolytic disease
1992	*Vibrio cholerae* O139	Cholera
1992	*Bartonella henselae*	Bacteremia, endocarditis, bacillary angiomatosis and peliosis hepatis
1993	Sin nombre virus	Hantavirus cardiopulmonary syndrome (HCPS), aka Four corners virus or Navajo flu
1993	Encephalitozoon cunculi	…
1994	Sabia virus	…
1995	Human herpes virus 8(HHV-8)	Kaposi's sarcoma
1999	Nipah virus[a]	…
2002	SARS coronavirus[a]	Severe acute respiratory syndrome
2003	Influenza A (H5N1)[a]	Avian Influenza
2009	Influenza A(H1N1)	Swine Flu
2012	Novel coronavirus	Severe respiratory infection

Adapted from WHO, 2005[4]
[a]First identified in Asia.

Prominent outbreaks, epidemics, and pandemics of the century

Year(s)	Pathogen	Geographic location	Cases/mortality	Other notes
1918–1920	Influenza (Spanish flu)	Worldwide	500 million cases and 30 to 100 million deaths	The Spanish flu claimed the lives of 2–5% of world's population, far exceeding the death toll of WWI.
1957–1958	Influenza (Asian flu)	Worldwide	1 to 2 million deaths	Accelerated development of a vaccine limited the spread of the responsible influenza strain.
1968–1969	Influenza (Hong Kong flu)	Worldwide	500,000 to 2 million deaths	The Hong Kong flu was the first virus to spread extensively due to air travel.
1960-present	HIV/AIDS	Worldwide, primarily Africa	70 million cases and 35 million deaths	HIV was first identified in 1983. The earliest known case came from a blood sample collected in 1959.
1961-present	Cholera	Worldwide	1.4 to 4 million annual cases and 21,000 to 143,000 annual deaths	The seventh cholera pandemic began in South Asia in 1961. Recent notable outbreaks include those in Zimbabwe from 2008 to 2009, Haiti from 2010-present, and Yemen from 2016-present.
1974	Smallpox	India	130,000 cases and 26,000 deaths	One of the worst smallpox epidemics of the twentieth century occurred just 3 years before the disease was eradicated.
1994	Plague	India	693 suspected cases and 56 deaths	The outbreak originated in Surat, India. Within days, hundreds of thousands of the city's 1.6 million residents fled, spreading the disease across five states.
2002–2003	SARS	Originated in China, spread to 37 countries	8,098 cases and 774 deaths	International business travel allowed the SARS virus to spread quickly across continents.
2009	Influenza (Swine flu)	Worldwide	284,000 deaths	Many public and private facilities in Mexico closed; The pork industry also suffered losses, even though eating pork products posed no risk.

2014–2016	Ebola	West Africa, primarily Guinea, Liberia, and Sierra Leone	28,600 cases and 11,325 deaths reported (likely underestimates)	300,000 doses of an experimental Ebola vaccine were subsequently stockpiled.
2015-present	Zika	The Americas, primarily Brazil	Unknown number of cases and 0 deaths reported	The Zika epidemic has resulted in few, if any, deaths. However, birth defects resulting from infection in pregnant women occurred frequently, which prompted some governments to encourage delaying pregnancy for as long as 2 years.
2016	Dengue	Worldwide	100 million cases and 38,000 deaths	Dengue outbreaks occur periodically in affected regions. 2016 was notable for the unusual scale of outbreaks across the globe.
2017	Plague	Madagascar	2,417 cases and 209 deaths	Plague is endemic in Madagascar, but an increase in pneumonic plague, which can be transmitted from human to human, was associated with the recent spike in cases.
2019	COVID-19	Global spread	18,23,19, 261 cases and 39,54,324 deaths	New variants are evolving, role of animals in the epidemiology is unknown?



The 5 stages through which pathogens of animals evolve to cause diseases confined to humans. (Wolfe *et al.,* 2007)

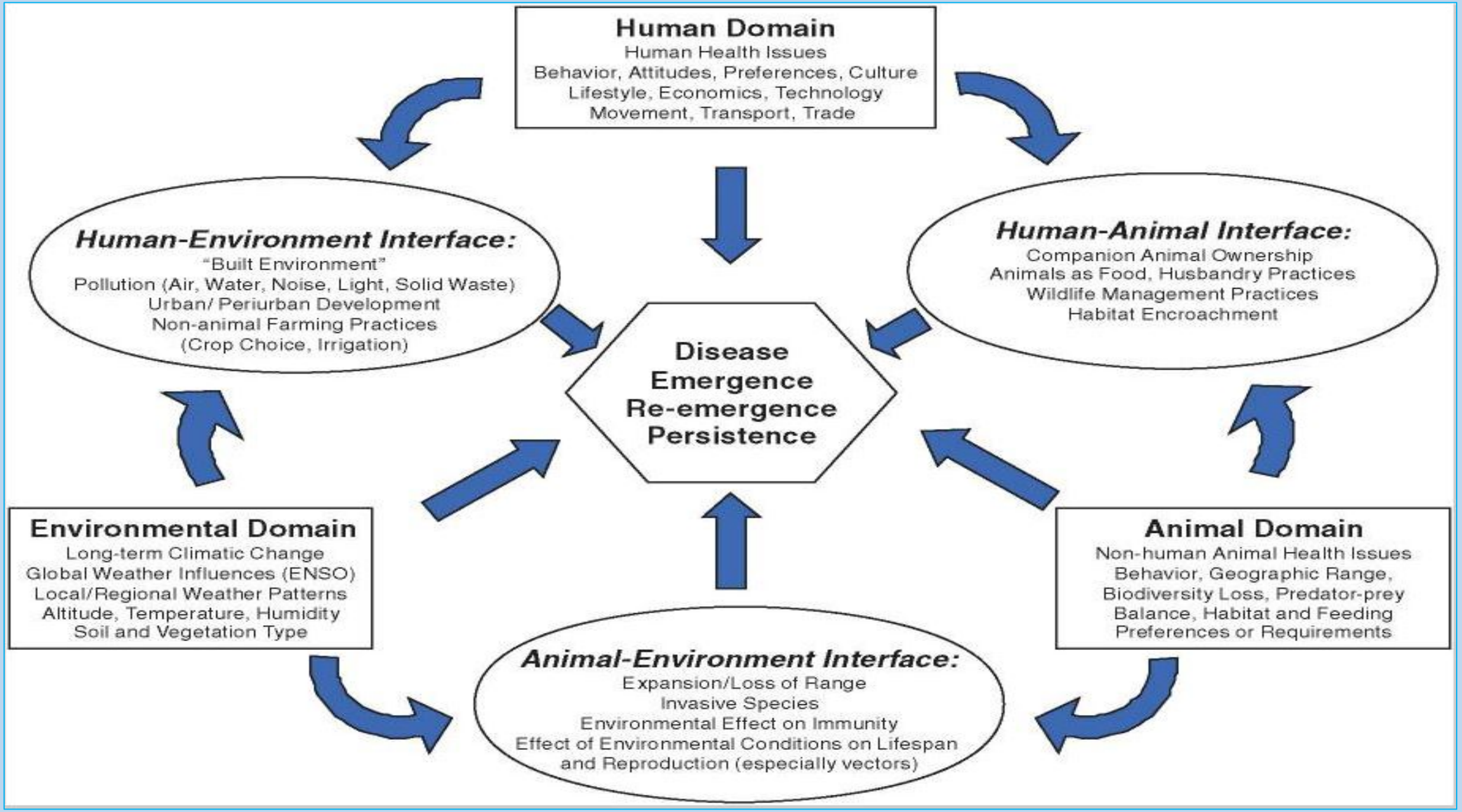
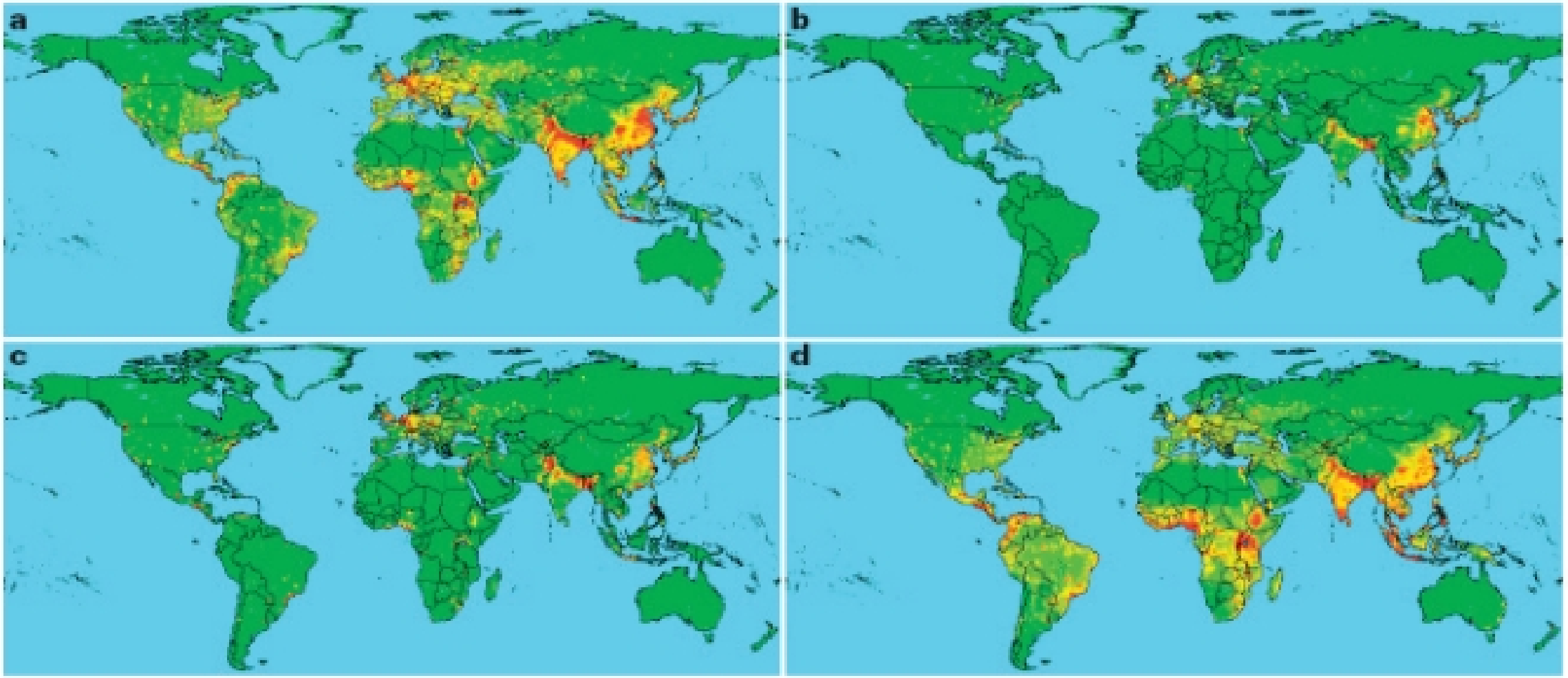

Human Domain
Human Health Issues
Behavior, Attitudes, Preferences, Culture
Lifestyle, Economics, Technology
Movement, Transport, Trade
Human-Environment Interface:
"Built Environment"
Pollution (Air, Water, Noise, Light, Solid Waste)
Urban/ Periurban Development
Non-animal Farming Practices
(Crop Choice, Irrigation)
Human-Animal Interface:
Companion Animal Ownership
Animals as Food, Husbandry Practices
Wildlife Management Practices
Habitat Encroachment
Disease
Emergence
Re-emergence
Persistence
Environmental Domain
Long-term Climatic Change
Global Weather Influences (ENSO)
Local/Regional Weather Patterns
Altitude, Temperature, Humidity
Soil and Vegetation Type
Animal Domain
Non-human Animal Health Issues
Behavior, Geographic Range,
Biodiversity Loss, Predator-prey
Balance, Habitat and Feeding
Preferences or Requirements
Animal-Environment Interface:
Expansion/Loss of Range
Invasive Species
Environmental Effect on Immunity
Effect of Environmental Conditions on Lifespan
and Reproduction (especially vectors)

Table 1. Factors affecting infectious disease emergence

Factor	Specific factor	Disease emergence
Ecological changes	• Climate change • Changes in water ecosystems • Deforestation/reforestation • Flood/drought • Famine	• Rift Valley fever • Argentine haemorrhagic fever, Hantaan or Korean haemorrhagic fever • Hantavirus pulmonary syndrome in the southwestern United States of America
Human behavior international travel and commerce	• War • Population migration (movement from rural areas to cities) • Economic impoverishment • Urban decay • Factors in human behaviour (such as the commercial sex trade, outdoor recreation and activities…) • Worldwide movement of goods and people • Air travel	• HIV and other sexually transmitted diseases • Dengue • Rat-borne hantaviruses • Introduction of cholera into South America, dissemination of O139 (non-O1) cholera bacteria (via ships)
Technology and industry Developments (food)	• Globalization of food supplies • Changes in food processing and packaging	• Food production processes: haemolytic uraemic syndrome certain *Escherichia coli* strains from cattle contaminating meat and other food products), bovine spongiform encephalopathy, Nipah virus (pigs), avian influenza, severe acute respiratory syndrome (probably)
Technology and industry Developments (health care)	• New medical devices • Organ or tissue transplantation • Drugs causing immunosuppression • Widespread use of antibiotics	• Ebola • HIV • Creutzfeldt-Jakob
Microbial adaptation and change	• Microbial evolution as a response to selection in the environment	• 'Antigenic drift' in influenza virus • Possibly genetic changes in severe acute respiratory syndrome, coronavirus in humans • Development of antimicrobial resistance (HIV, antibiotic resistance in numerous bacterial species, multi-drug-resistant tuberculosis, chloroquine-resistant malaria)
Breakdown of the host's defenses	• Immunodepression • Imunnodeficiency resulting from HIV infection	• *Mycobacterium bovis* • *Listeria monocytogenes* in humans
Breakdown in public health or control measures	• Lack ofor inadequate sanitation and vector control measures	• Tuberculosis (mainly in the United States of America) • Cholera in refugee camps in Africa, resurgence of diphtheria in the former Soviet republic and Eastern Europe in the 1990s



Global distribution of the relative risk of an EID event

Maps are derived for EID events caused by (a) zoonotic pathogens from wildlife; (b) zoonotic pathogens from non-wildlife; (c) drug-resistant pathogens; and (d) vector-borne pathogens. Green corresponds to lower values; red to higher values.

WHO's Blueprint list of priority diseases requiring urgent R&D attention, 2018

Disease	Description	Availability of biomedical countermeasures
Crimean-Congo Hemorrhagic fever (CCHF)	Hemorrhagic fever caused by virus transmitted primarily through ticks and livestock, with case-fatality rate of up to 40%. Human-to-human transmission possible.	No vaccine available; Ribavirin (antiviral) provides some treatment benefit
Ebola virus disease	Hemorrhagic fever caused by virus transmitted from wild animals, with case-fatality rate of up to 90% (50% is average). Human-to-human transmission is possible.	Experimental vaccine and treatments available
Marburg virus disease	Hemorrhagic fever caused by virus transmitted by fruit bats, with case-fatality rate of up to 88% (50% is average). Human-to-human transmission is possible.	No vaccine available
Lassa fever	Hemorrhagic fever caused by virus transmitted from items that have contacted rodent urine or feces, with case-fatality rate of 15% in severe cases (1% overall). Human-to-human transmission is possible.	No vaccine available; Vaccine development funded by The Coalition for Epidemic Preparedness InnovationsCEPI
Middle East respiratory syndrome coronavirus (MERS-CoV)	Respiratory disease caused by a coronavirus transmitted by camels and humans, with case-fatality rate of 35%.	No vaccine available; Vaccine development funded by CEPI

Severe acute respiratory syndrome (SARS)	Respiratory disease caused by a coronavirus transmitted from human to human and from an unknown animal reservoir (possibly bats), with a case-fatality rate of 10%.	No vaccine available; experimental vaccines are under development
Nipah and henipaviral diseases	Disease caused by a virus transmitted by fruit bats, pigs, and humans; can manifest as an acute respiratory syndrome or encephalitis. The case-fatality rate is estimated at 40 to 75% and depends on local capabilities.	Vaccine development funded by CEPI
Rift Valley fever	Disease caused by a virus transmitted by contact with the blood or organs of infected animals, or by mosquitos. In severe cases, can manifest in an ocular infection, as meningoencephalitis, or as a hemorrhagic fever. Up to 50% case-fatality rate in patients with hemorrhagic fever. No human-to-human transmission reported.	An experimental, unlicensed vaccine exists but is not commercially available; CEPI has an open call for proposals for development of a new vaccine
Zika	Disease caused by a flavivirus transmitted by *Aedes aegypti* mosquitoes. Can result in microcephaly in infants born by infected mothers and in Guillain-Barré syndrome. Human-to-human transmission is possible.	No vaccine available
Disease X (representing pathogens currently unknown to cause human disease and requiring cross-cutting preparedness)	N/A	CEPI is funding the development of institutional and technical platforms that allow for rapid R&D in response to outbreaks of any number of pathogens for which vaccines do not yet exist.

What is One Health?

It is a collaborative, multisectoral, and transdisciplinary approach - working at the local, regional, national, and global levels - with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment.

The Foundation of One Health

- ✓ Communication
- ✓ Coordination
- ✓ Collaboration

Among human, animal, environmental health, and other relevant partners.

One Health initiatives

Time	Event
Approximately 400 BCE	Hippocrates urged physicians that all aspects of their patient's lives need to be considered including their environment
1855	**Rudolph Virchow first used the term 'zoonosis' for infections acquired from animals**
1971	An international group, Wildlife Trust, formed by naturalist Gerald Durrell. The Wildlife Trust is now known as EcoHealth Alliance
1984	**Calvin Schwabe, veterinary epidemiologist coined the term 'One Medicine'**
2004	Human Animal Infections and Risk Surveillance (HAIRS) begins operation in the UK
2004	**Manhattan Principles are defined in a meeting on 'One World One Health' convened by the Wildlife Conservation Society**
2006	First International Ministerial Conference on Avian Influenza and Pandemic Influenza (IMCAPI) Beijng, PR China
2006	The Global Early Warning System for major Animal Diseases (GLEWS) developed and implemented by FAO, OIE and WHO
2008	American Veterinary Medicine Association (AVMA) was instrumental in forming the One Health Initiative Taskforce (OHITF)
2008	The South Africa Centre for Infectious Disease Surveillance (SACIDS) established as a One Health Virtual Centre linking research institutions in Tanzania, DRC, Mozambique, Zambia and South Africa
2008	The One Health Initiative (OHI) www.onehealthinitiative.com, a major internet based communications resource launched
2008	FAO, OIE, WHO, UNICEF, World Bank and UNSIC produce collaborative document 'Contributing to One World, One Health. A Strategic Framework for Reducing Risks of Infectious Disease at the Animal– Human-Ecosystem Interface
2010	Tripartite Concept Strategy—An FAO-OIE-WHO collaboration
2010	World Bank publishes 'People, Pathogens and Our Planet: Vol 1. Toward a One Health Approach for Controlling Zoonotic Disease.
2011	First International One Health Congress Melbourne, Australia
2011	One Health Central and Eastern Africa (OHCEA) formed as a network of 14 public health and veterinary institutions in Ethiopia, Uganda, Kenya, Tanzania, DRCongo and Rwanda
2013	**The Gates Foundation calls for One Health research through the Grand Challenge program**
2014	One Health Summer Schools available in Denmark, England and Australia. Masters in One Health offered in USA and UK, and a doctorate in the USA
2019	**One Health India Conference and Delhi Declaration**

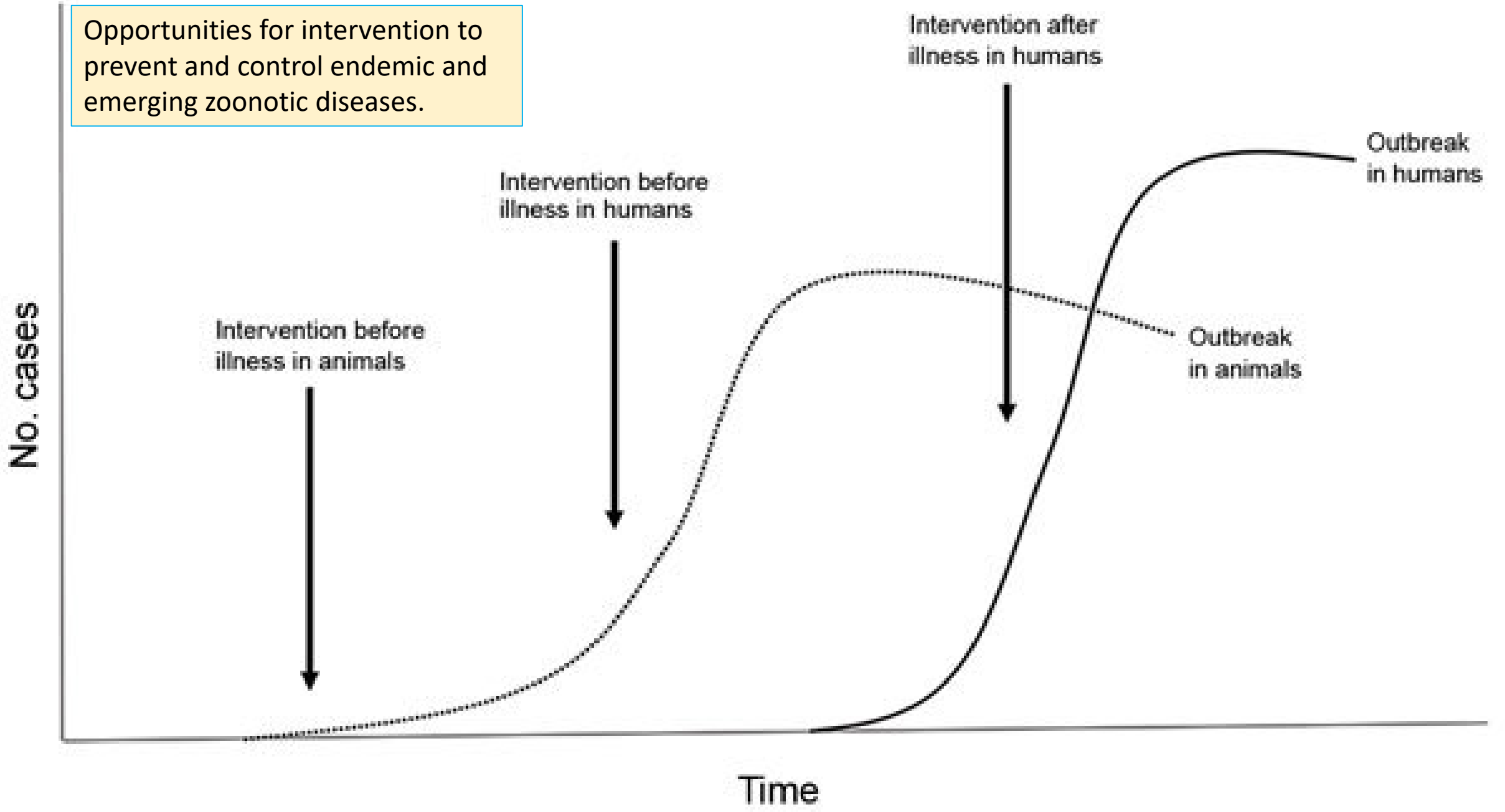
Delhi Declaration-2019 recommended sustainable 10 point OHR

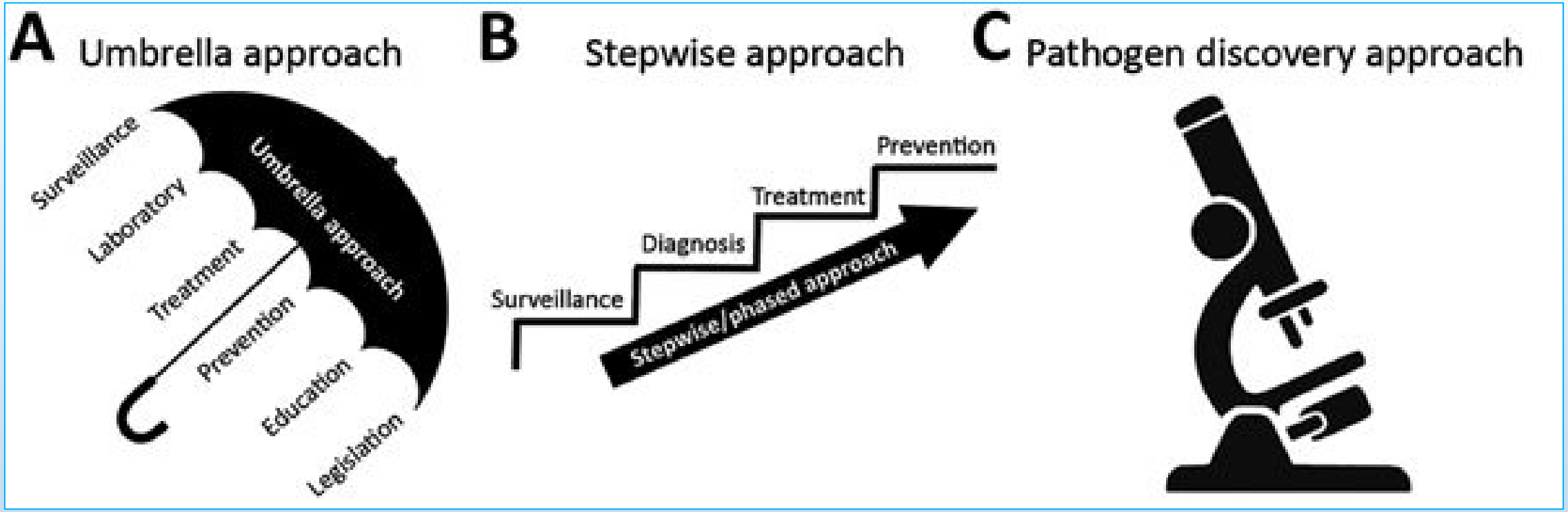
- 1. Review, update and document the current disease burden(s) resulting from zoonotic diseases and AMR.
- 2. Identify the priority area(s) of concerns with respect to diseases.
- 3. Promote basic and applied research to understand the mechanism of virulence, infections and its transmissions.
- 4. Capacity building through engagement and training of manpower including students, scientists, researchers, primary respondents, and health care professionals.
- 5. Capacity building and improvement of related infrastructure for research, diagnosis, and health care system(s) to enable
- 6. Share information on existing and evolving disease burdens, challenges, research outcome and outputs and promote exchange of resources.
- 7. Explore opportunities and promote partnership through scientific collaborations between public and private organizations.
- 8. Evolve with practical governance, policy mechanism(s) and regulation(s) to define the role of Government and other stakeholders on responsibly regulating/ dealing with One Health related activities.
- 9. Incentivize the OHR through dedicated funding, rewards mechanisms as well as due protection of intellectual rights, wherever applicable.
- 10. Create and implement a One Health communication and outreach plan for all stakeholders including the public, through print and online platforms, workshops, training, and conference like this (One Health India Conference) to provide a platform for mass awareness helping a nation to ensure its own health security.

Strategic framework for zoonoses management using One Health approach

- Prioritization of zoonotic diseases
- Assessment of zoonotic disease burden
- Zoonotic disease surveillance
- Joint Human – Animal outbreak response
- Strengthening laboratory systems in public health and veterinary sectors
- Real time implementation of prevention and control strategies

Opportunities for intervention to prevent and control endemic and emerging zoonotic diseases.





Three program approaches for implementing integrated zoonotic disease detection, prevention, and control programs.

A- Comprehensive (umbrella) approach, designed to accelerate collaboration and impact.

B- Phased (stepwise) approach in which each step building on prior developed program areas and capacities.

C- Pathogen discovery approach, based on the necessity of early intersectoral collaboration to generate knowledge in the context of discovering an emerging zoonotic pathogen.

Challenges in implementation of OH

- commercial interest,
- lack of inter-sectoral communication,
- lack of inter-sectoral trust,
- silos in education and
- siloed funding.

Let’s communicate, coordinate and collaborate for a common goal

Wishing you all a
very happy

World Zoonosis Day
2021

Thanks .....