ANIL AGARWAL DIALOGUE 2022

Zoonoses and Intensive Food Systems

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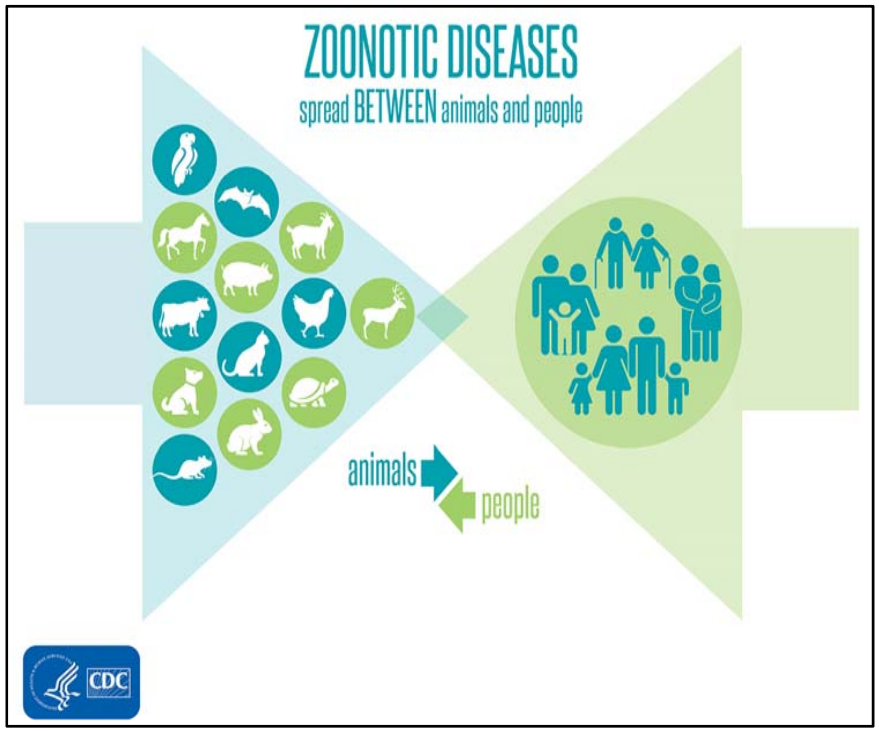
Zoonoses

Zoonoses are diseases that can spread between animals and people, moving from wild and domesticated animals to humans and from humans to animals (UNEP-ILRI report, 2020)

Caused by germs that spread between animals and people (CDC); Harmful germs like bacterial, viruses, parasites and fungi



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Classification

1. Emerging zoonotic diseases: appear newly in human populations or have existed previously but are now rapidly increasing in incidence or geographical range

   E.g., Ebola, Zika, HIV/AIDS, Highly pathogenic avian influenza (bird flu) and COVID-19

2. Epidemic zoonotic diseases: also known as outbreak zoonoses; triggered by events like climate variability, flooding, extreme weather and famines

   E.g., Anthrax, Leishmaniasis, Rift Valley fever

3. Neglected zoonotic diseases: also known as endemic zoonotic diseases; continuously present to a greater or lesser degree in certain populations; Poor detection and surveillance diminish their recognition

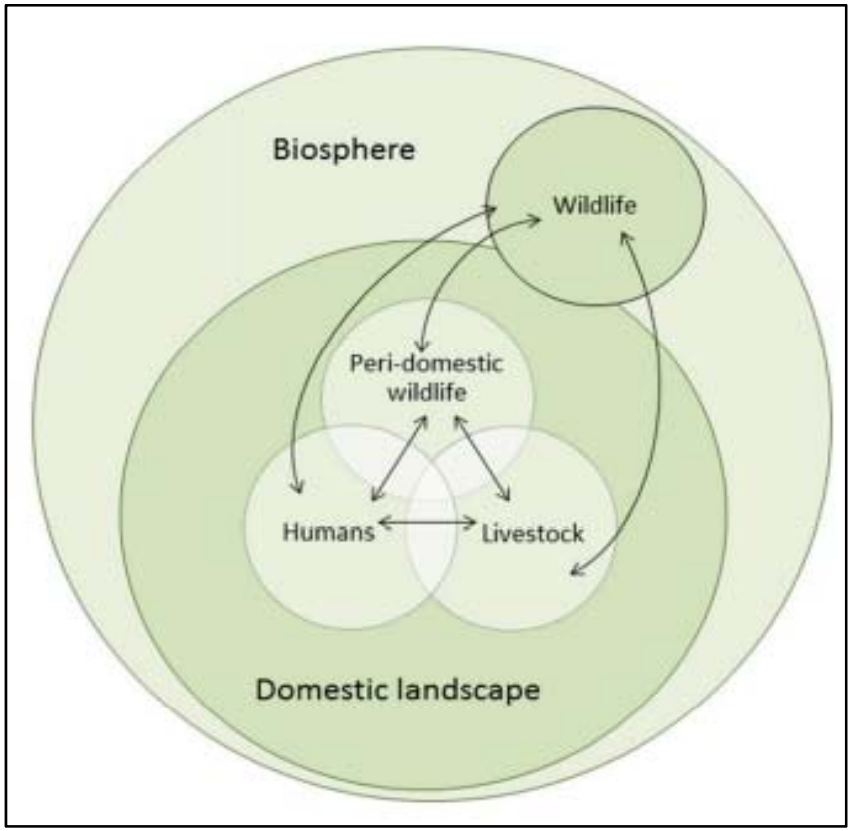
   E.g., Bovine TB, Brucellosis, Rabies, Cysticercosis (pig tapeworm), Japanese Encephalitis, Leptospirosis + some food-borne zoonoses

Transmission

- Two key routes
  - **Direct:** Animals to human via contact, aerosols, body fluids (e.g. rabies)
  - **Indirect:** Through vectors (e.g. yellow fever); Food-borne (e.g. salmonellosis)

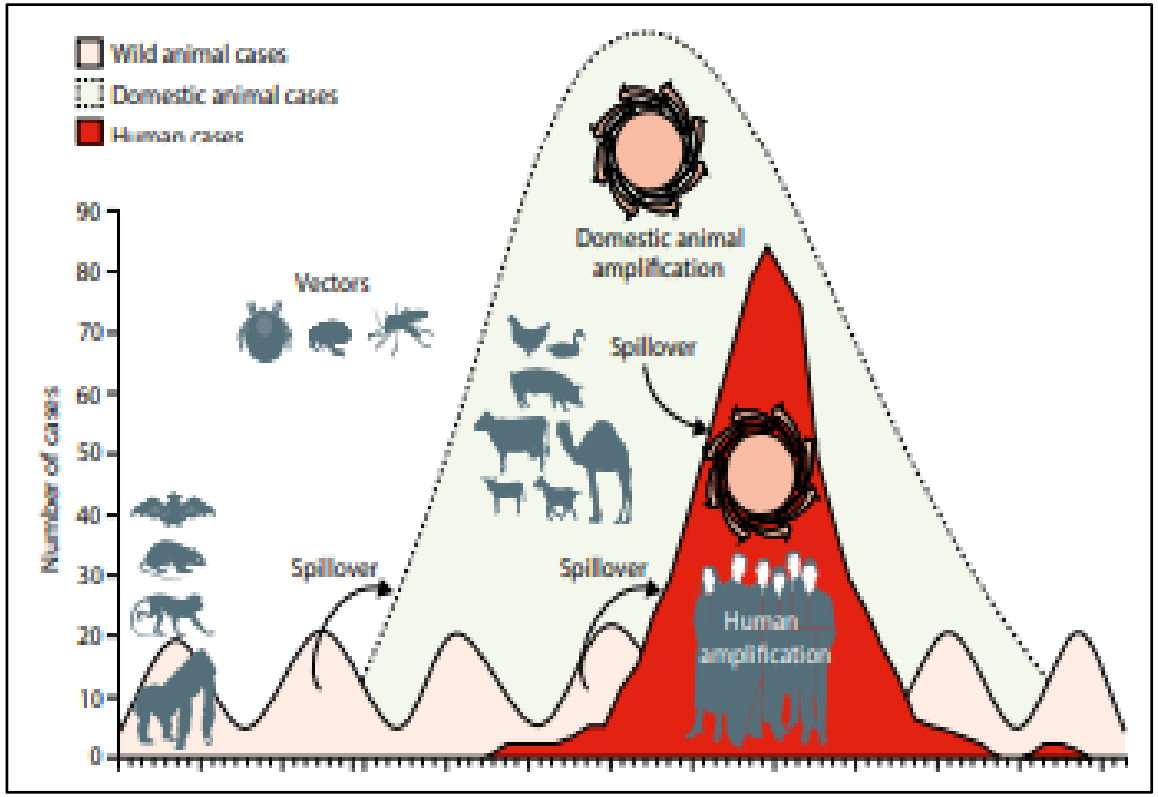
- Domestic animals and peri-domestic wildlife can act as bridges for the emergence of human diseases; natural reservoirs may be wildlife
  - Contact rates are high
  - **Share more viruses** with people than wild animals (av:19 vs 0.5)
  - Viruses generated in bio-insecure industrial and intensive agricultural systems can result in zoonotic forms:
    - E.g. **Highly pathogenic avian influenza** (HPAI), an important economic disease of domestic poultry that **evolves from low-pathogenic viruses** that circulate commensally in the environment in wild bird populations

Pathogen flow at the wildlife–livestock–human interface



Source: Jones et al., 2013, PNAS, 110: 8399-8404

Spillover and amplification; high domestic animal cases



Source: Karesh et al. (2012) Lancet, 380: 1936–45

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Impact

- More than 60 per cent of the infectious diseases in humans are zoonotic
- More than 75 per cent of emerging infectious diseases are zoonotic
- About 2.6 billion people suffer and almost 3 million people die from zoonotic diseases annually
- High disease burden due to food-borne illnesses (e.g. salmonellosis) - comparable to HIV/AIDS, Malaria, TB together

Deaths due to viral pandemics

Pandemic	Causative virus	Worldwide deaths
Spanish Flu (1918-19)	Influenza A (H1N1) virus	20-50 million
Asian Flu (1957-58)	Influenza A (H2N2) virus	1.1 million
Hong Kong Flu (1968)	Influenza A (H3N2) virus	1 million
After 2000		
SARS (2003)	SARS CoV	916 (Nov 2002- Aug 2003)
Swine Flu (2009)	Influenza A (H1N1) virus	0.15-0.57 million (during first year)
MERS (2012)	MERS-CoV	858 (since Sept 2012)
Ebola (2014-16)	Ebola virus	11,310
Covid-19 (2019-present)	SARS-CoV2	5.95 million (as on Feb 28, 2022)

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Intensive food-animal production systems – drivers and zoonoses connect

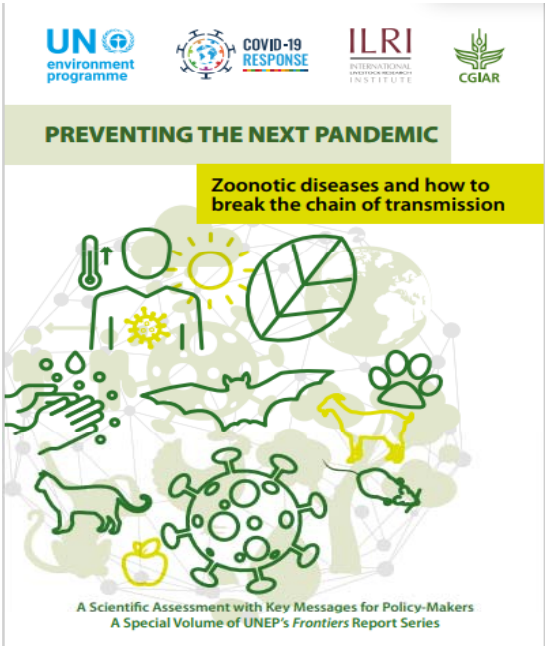
- **Growing food demand (protein, animal protein**)
- Growing population
- Growing incomes / purchasing power
- Urbanization
- Changing food habits, evolving taste
- Less people, less land to grow food
- **Political mandate - for exports, livelihood opportunities**
- **Availability of inputs - machines, feed, drugs and chemicals**

- Large-scale units with **high stocking density** of animals/birds/ fish
- **Genetically selected similar breeds** for productivity (not disease resilience)
- Kept under **confined conditions** and in **close proximity**; **limited focus on animal husbandry; high stress**
- **Dependence on commercial feed**, inputs (also known as animal feeding operations, factory farms)
- Often **geographically concentrated**; vertically integrated by large players; involves contract farming
- **Industrial systems** but considered agriculture; can bypass required regulatory attention

- **Amplification** of pathogens/virulence due to '**monoculture effect**' as there are more contact opportunities among those lacking genetic diversity
- **Agriculture expansion** for animal feed crops (e.g. soy) and intensification entering into forests and natural habitats **diffuses boundaries b/w human-animal-wild-life**
- High use of **chemicals** including antibiotics (easy/economical substitute) can lead to resistant bugs **(Antimicrobial resistance)**
- **Waste** from such farms which is rich in bacteria, antibiotics, resistant conferring genes can lead to greater emergence and spread of diseases (and AMR)

Seven major anthropogenic drivers of zoonotic disease emergence; many of these occurring at same places and amplifying their impact; three are related to food systems

1. Increasing demand for animal protein
2. Unsustainable agricultural intensification
3. Increased use and exploitation of wildlife
4. Unsustainable utilization of natural resources accelerated by urbanization, land use change and extractive industries
5. Travel and transportation
6. Changes in food supply chains
7. Climate change



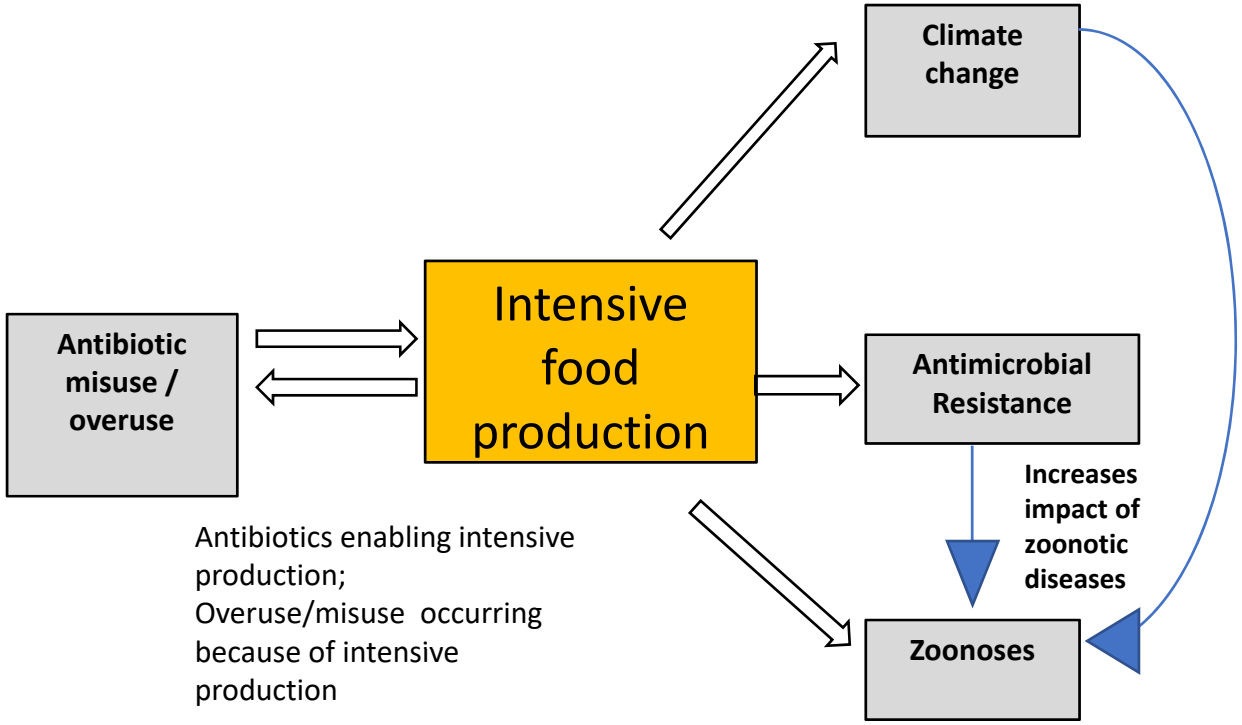
Source: Preventing the next pandemic: Zoonotic diseases and how to break the chain of transmission, 2020, UNEP-ILRI

Four out of 10 policy options suggested to reduce the risk of future zoonotic pandemics are also directly related to food systems

1. Raise awareness of health and environment risks and prevention
2. Improve health governance, including by engaging environmental stakeholders
3. Expand scientific inquiry into the environmental dimensions of zoonotic diseases
4. Ensure full cost financial accounting of the societal impacts of disease
5. Enhance monitoring and regulation of food systems using risk-based approaches
6. Phase out unsustainable agricultural practices
7. Develop and implement stronger biosecurity measures
8. Strengthen animal health (including wildlife health services)
9. Build capacity among health stakeholders to incorporate environmental dimensions of health
10. Mainstream and implement one health approaches

Source: Preventing the next pandemic: Zoonotic diseases and how to break the chain of transmission, 2020, UNEP-ILRI

Intensification dependent on chemicals (like antibiotics); it is a driver for Zoonoses, Climate Change, AMR; AMR increases the impact of Zoonoses



Antibiotics enabling intensive production;
Overuse/misuse occurring because of intensive production

Source: CSE analysis