Antimicrobial Resistance and Intensive Food Production

Pandemics and Industrial Food Animal Farming
CSE Webinar
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Amit Khurana
Director, Food Safety and Toxins Programme, CSE
Antimicrobial Resistance (AMR):

- Antimicrobial resistance happens when microorganisms (such as bacteria, fungi, viruses, and parasites) change when they are exposed to antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials, and anthelmintics) (WHO)

- Antibiotic resistance happens when germs like bacteria develop the ability to defeat the drugs designed to kill them. That means the germs are not killed and continue to grow. (CDC)

Pandemic:

- A pandemic is the worldwide spread of a new disease (WHO)

- Viral pandemics – such as of influenza virus and corona virus

AMR - a chronic pandemic of huge cumulative damage
Impact of AMR is huge and goes beyond health

- Existing **antibiotics are becoming ineffective** leading to:
  - Increased **morbidity** and **mortality** in humans and animals
  - **Longer hospital stays** and expensive treatments - higher healthcare expenditures
- Can also cause productivity loss, food security and livelihood issues
- Make attainment of **sustainable development goals** difficult. Such as:
  - No poverty (SDG 1)
  - Zero hunger (SDG 2)
  - Good health and well being (SDG 3)
  - Clean water and sanitation (SDG 6)
  - Responsible consumption and production (SDG 12)
- **USD 100 trillion** – cumulative cost to global economic output by **2050**
High annual deaths due to AMR leading to huge cumulative damage vis-à-vis viral pandemics of the 21st century (which are acute crisis of a limited duration)

- **700,000** deaths globally every year estimated due to resistant infections (Review on AMR, 2016)
- **2,30,000** deaths globally in 2017 due to MDR/RR-TB; most cases and deaths in India and China (WHO, 2018)
- **> 35,000** deaths each year in the U.S. (CDC, 2019)
- **~33,000** deaths estimated each year in the EU (Lancet 2019)
- **>56000 neonatal deaths** estimated due to sepsis by drug-resistance to first-line antibiotics each year in India (Lancet 2016)

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<thead>
<tr>
<th>Pandemic</th>
<th>Causative organism</th>
<th>Worldwide deaths</th>
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</thead>
<tbody>
<tr>
<td>Spanish Flu (1918-19)</td>
<td>Influenza A (H1N1) virus</td>
<td>20-50 million</td>
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<td>Asian Flu (1957-58)</td>
<td>Influenza A (H2N2) virus</td>
<td>1.1 million</td>
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<td>Hong Kong Flu (1968)</td>
<td>Influenza A (H3N2) virus</td>
<td>1 million</td>
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**After 2000**

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<thead>
<tr>
<th>Pandemic</th>
<th>Causative organism</th>
<th>Worldwide deaths</th>
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<tbody>
<tr>
<td>Swine Flu (2009)</td>
<td>Influenza A (H1N1) virus</td>
<td>0.15-0.57 million (during first year)</td>
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<td>MERS (2012)</td>
<td>MERS-CoV virus</td>
<td>858 (since Sept 2012)</td>
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<td>Covid19 (2019-20 ongoing)</td>
<td>SARS-CoV2 virus</td>
<td>&gt;0.4 million (as on June 10, 2020)</td>
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Data sourced from the WHO and the Centers for Disease Control and Prevention
Estimated 10 million lives in a year at risk by 2050, if no action taken; About 90 per cent to be in Asia and Africa

Deaths attributable to AMR every year by 2050

Source: AMR: Tackling a crisis for the health and wealth of nations
AMR has strong linkages with food and environment

**Animals**
- Poultry for eggs and meat, fisheries, dairy, swine
- **Intensive production systems** leading to antibiotic overuse and misuse

**Plants**
- Routine use of antibiotics as **fungicides** in crops to prevent diseases;
- Use of streptomycin, a CIA used in certain Tuberculosis cases

**Human health**
- Self medication
- Over-the-counter sale
- Access vs excess issue

**Waste and Environment**
- Point and non-point sources
- **Hotspots** include waste from **farms**, factories, healthcare settings and sewage/water treatment plants
- Non-point sources include rivers etc.

**Three AMR determinants that travel across the systems, sectors**
- Antibiotic resistant bacteria
- Antibiotic resistance genes
- Antibiotic residues
Intensive animal farming systems – confined settings and high density
More food is now grown in intensive settings; the very nature of such industrial production can create crisis

Food that we eat is increasingly being produced in intensive/industrial systems

- In **high income countries**, most of food from animals is grown in intensive settings
- In **low and middle income countries** intensification is growing due to animal protein demand (from 2000 to 2030 poultry meat demand in India estimated to grow >8 times)

But the very nature of such production systems can create crisis

- **Large-scale units** with high stocking density of animals/birds/fish
- **Genetically selected breeds** for productivity (not disease resilience)
- Confined conditions; **limited focus on animal husbandry**
- 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; do not get required **regulatory attention**

- High use of **chemicals and drugs** (easy/economical substitute):
  - **Routine** antibiotic use to promote faster growth and prevent diseases despite no clinical sign
  - Use of medically important antibiotics including **critically important** and last-resort
Intensive food production is strongly linked to several pandemics

**Antimicrobial Resistance**

- Antibiotic use favors resistance; **misuse accelerates it**
- **Low/sub-therapeutic doses** creates **selection pressure** in the gut bacteria of the animal/bird
- **Resistant** bacteria survives and spreads through food, contact and waste; **Unmetabolised antibiotics in feces, antibiotic residues** in food add to problem

**Intensive food animal production**

- About **60 per cent** of all infectious diseases in humans are **zoonotic diseases**; many originate in wildlife, livestock often serve as an **epidemiological bridge**
- Intensive conditions reflect ‘**monoculture effect**’, a vulnerability due to more **contact opportunities** among those who lack genetic diversity; can help viruses **amplify** and **attain higher virulence**; Avian Influenza linked to intensive poultry and Swine flu linked to pig farming
- **Agriculture expansion** for **animal feed crops** (e.g. soy) and intensification entering into **forests** and **natural habitats** diffuses boundaries; Ebola outbreak in West Africa was a result of forest losses; pathogens of Ebola, MERS, SARS and SARS CoV2 are believed to have wild-life reservoirs as long-term hosts
Poultry litter is rich in antibiotic resistant bacteria and un-metabolized antibiotics.

The common practice of using untreated poultry litter as manure in agricultural land is transferring bacteria that are resistant to multiple antibiotics.
CSE’s work to help contain antibiotic misuse and AMR: examples of studies and reports

- 2010 (Honey)
- 2014 (Poultry)
- 2016 (Fish)
- 2017 (Poultry farms)
- 2017 (Fast food)
- 2019 (Crops)
- 2020 (Feed)
- 2020 (Fast food)
- 2020 (Zambia-AMR surveillance)
- 2020 (Zambia-Roadmap to eliminate antibiotic misuse)
Time to change the way we grow our food; re-think our relationship – how it is produced and its overall impact

- **Urgent steps:**
  - Ban antibiotic use for **growth promotion**; regulate feed well – antibiotics not to be allowed
  - Restrict **mass disease prevention** (i.e. group preventative use); regulate over-the-counter antibiotics sold without prescription
  - Limit use of **critically important antibiotics**; preserve those with **highest priority** for human use (quinolones, macrolides, 3rd, 4th, 5th gen cephalosporins, polymyxins, glycopeptides)
  - In parallel - reduce need for **chemicals** by focusing on animal husbandry, bio-security, alternatives, diagnostics, and veterinary extension systems

- **For mid and long-term:**
  - Limit the **environmental spread** of AMR determinants:
    - Adopt AMR-centric approach to manage waste from farms; make standards, monitor and manage waste/effluents, litter, manure
  - **Reduce dependence** on intensive systems; grow more food in other settings
Thank you

Amit Khurana
Director
Food Safety and Toxins Programme
CSE
k_amit@cseindia.org