Addressing Antibiotic Resistance Through the Lens of One Health

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Historical Epidemiologic Transitions – 1st Transition

10,000 years ago

New social order due to agriculture

Zoonoses through animal domestication

Increases in infectious diseases

Epidemics in non-immune populations
Historical Epidemiologic Transitions
2nd Transition

* Recent decades
* Effective drugs
* Vaccines
* Diagnostics
* Steep decline in infectious diseases
Historical Epidemiologic Transitions – 3rd Transition

- Last 30 years
- Emerging and re-emerging infectious diseases globally
- 75 percent are zoonotic
- Over 20% resistant pathogens
- Globalization
- Ecological disruption
- Population increase
- Urbanization
- The “perfect microbial storm”
- 21st century mixing bowl
Global Trends in Emerging Infection Diseases (EID)

Number of EID Events

C- Drug Resistant

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<th>Decade</th>
<th>Drug Resistant</th>
<th>Non Drug Resistant</th>
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335 EID events: 1940-2004; steady increase with peak decade in 1980

20.9% drug-resistant microbes; 22.8% vector-borne (28.8% in last decade)

Wicked Issues/Dilemmas

Characteristics of a Wicked Problem or Dilemma:

- Complex and tangled
- Unprecedented
- Difficult to define and enigmatic
- Solution is not binary; many choices
- Often generate unexpected consequences
- Unique and past experiences not helpful
Double, Double Toil and Trouble: The Great 21st Century Mixing Bowl

* 7.5 billion people to 9-10 billion
* 35-40 billion food animals to 60 billion
* 315 million tons of meat produced
* $1.4 trillion output
* 1 billion people in slums to grow to 2 billion in 25 years
* Rapidly changing and polluted environment
* All likely using antibiotics
Global Animal Assets at Risk

Disease burden – 20-40% but difficult to measure

Trade regulations keep up to 30% total animals and animal products from being exported at any point in time – further results of disease burden

Current global use estimated to be 63,151 tons, usage will increase to approximately 105,000 tons by 2030; this is due to increase in animal numbers and shift to more intensive systems

Use of antibiotics, especially in the developing world and Asia will continue to increase disproportionately
Peri-Urban Slum
Ecosystem
New Thinking is Critical

"We cannot solve our problems with the same thinking we used when we created them."

~ Albert Einstein
One Health is the collaborative effort of multiple disciplines – working locally, nationally and globally - to attain optimal health of humans, animals and our environment.
Newton’s 3rd Law of Motion: in essence, for every action, there is an equal and opposite reaction.
Transmission of Resistance
Multiple Domains of One Health

Horizontal and vertical
Within species
Across species
Environmental
Food
Water
Multiple human settings
Attribution
One Health

- Addressing wicked problems
- When past solutions to contemporary problems work less well
- A changing mindset
- New emphasis on prevention
- Shift thinking and actions upstream and closer to the origin of the problem
- Needs to be better appreciated in economic terms; proof of concept – value proposition
Benefits of a One Health Approach

We live in an exquisitely inter-connected and horizontally integrated world but our systems, processes and organizations are still siloed and vertically-oriented.

Improving animal and/or environmental health is a public health strategy

Focusing on a single domain will address 1/3 of the problem

A thought process that brings together veterinary medicine and human medicine

Promotes and requires inter- or trans-disciplinarity
Information resources also need to be strengthened to support health professionals, their patients, animal keepers and the public so that all understand the value and importance of antibiotics to society. This will only be achieved if human and veterinary health professionals work more closely with their patients and animal keepers, before deciding if an antibiotic is really needed and in the event that it is, which one is most appropriate. This is a fine line with the aims of the global “One-Health” approach which spans people, animals, agriculture and the wider environment.

Professor Dame Sally C. Davies
Chief Medical Officer
Chief Scientific Adviser
Department of Health

Nigel Gibbens
Chief Veterinary Officer
Department of Environment Food and Rural Affairs

On behalf of the Chief Medical Officers and Chief Veterinary Offices in Northern Ireland, Scotland and Wales.
One World - One Medicine - One Health