

Addressing Antibiotic Resistance Through the Lens of One Health

PACCARB Meeting

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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



Convergence Model

**Genetic and
Biological
Factors**

**Physical and
Environmental
Factors**

Animals

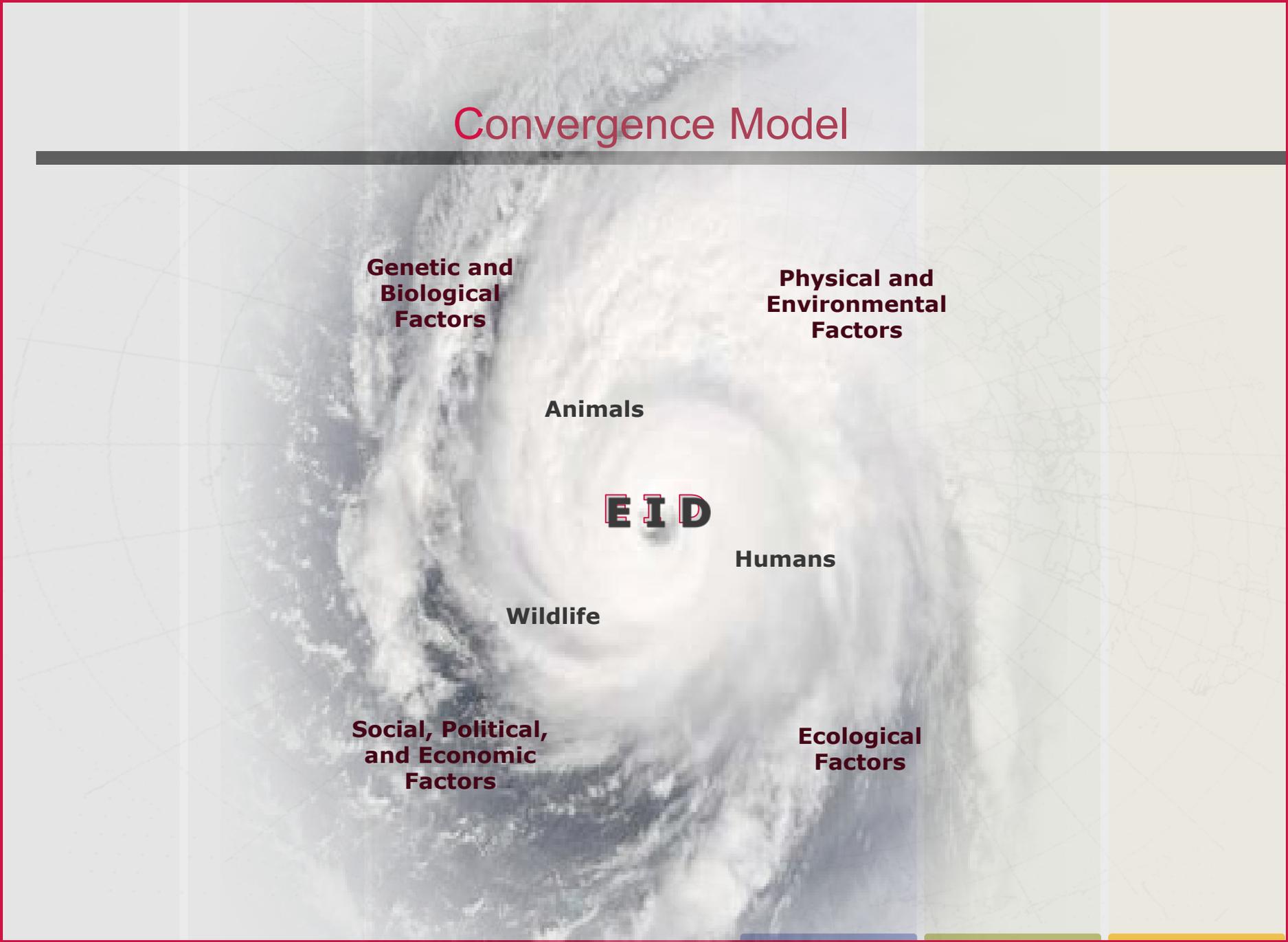
EID

Humans

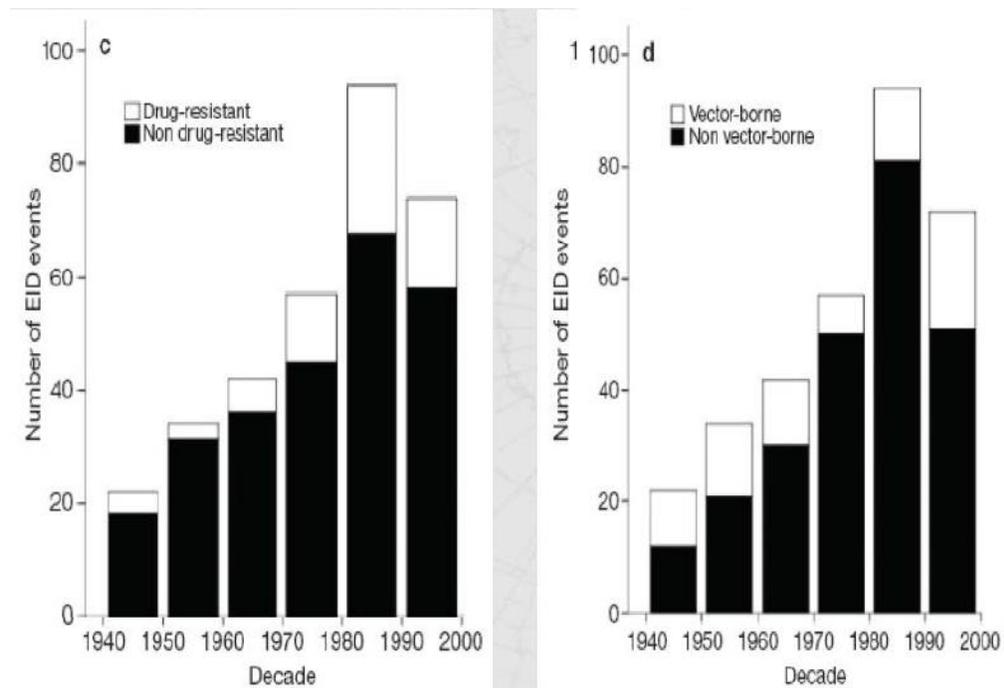
Wildlife

**Social, Political,
and Economic
Factors**

**Ecological
Factors**



Global Trends in Emerging Infection Diseases (EID)



Number of EID Events

C- Drug Resistant

Decade	Drug Resistant	Non Drug Resistant
1940-1950	4	18
1950 -1960	2	30
1960 -1970	8	35
1970 – 1980	20	50
1980-1990	30	64
1990-2000	25	58

D Drug Resistant

Decade	Drug Resistant	Non Drug Resistant
1940-1950	12	11
1950 -1960	14	21
1960 -1970	12	30
1970 – 1980	5	50
1980-1990	10	80
1990-2000	30	50

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)

Jones, K.E. et al Global trends in emerging infectious disease Nature 451:21 2/2008

Wicked Issues/Dilemmas

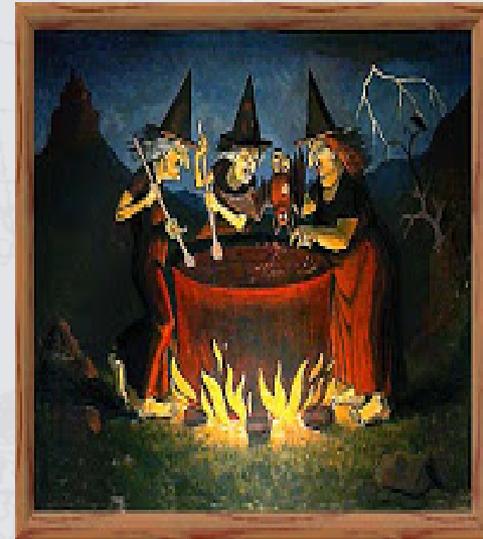
Characteristics of a Wicked Problem or Dilemma:

- 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

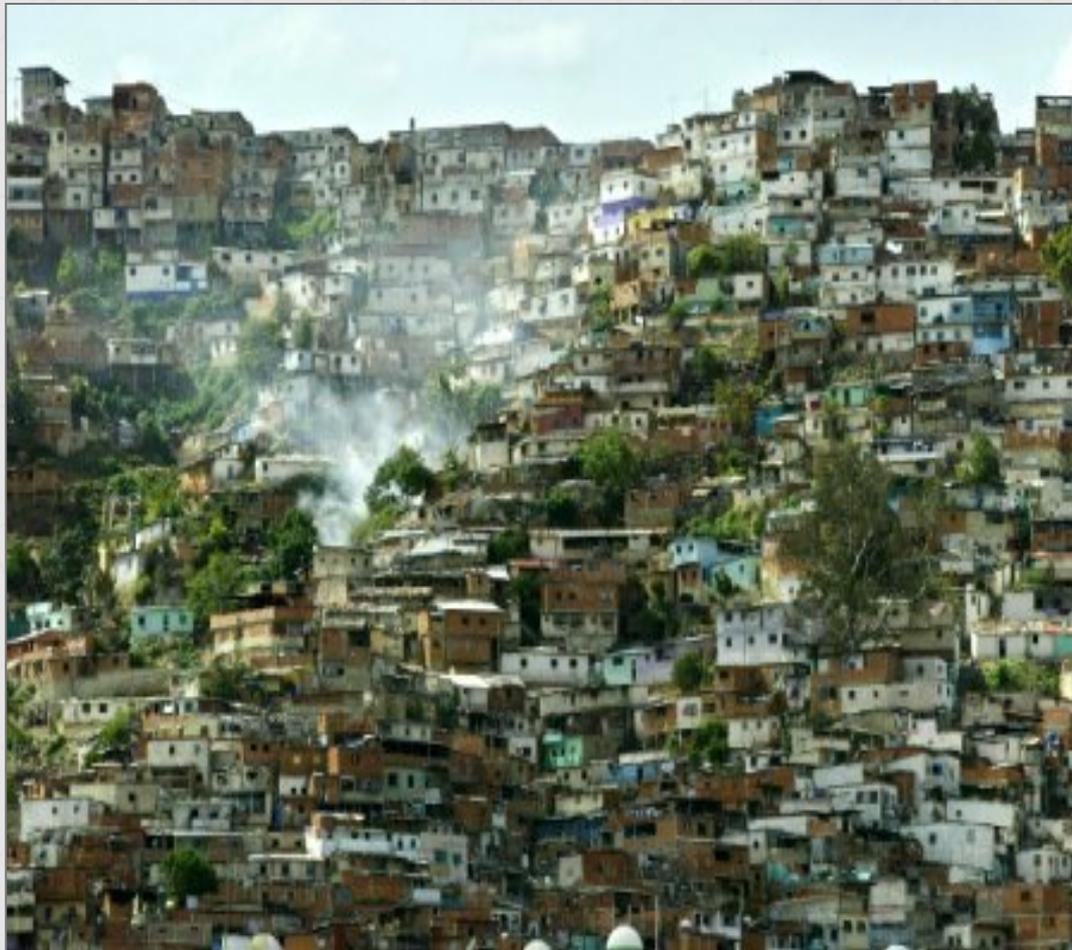
Disease burden – 20-40% but difficult to measure

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

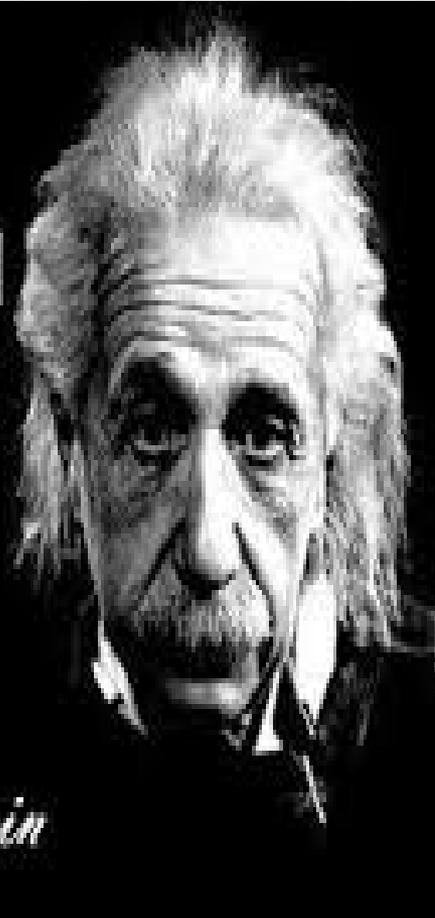


New Thinking is Critical

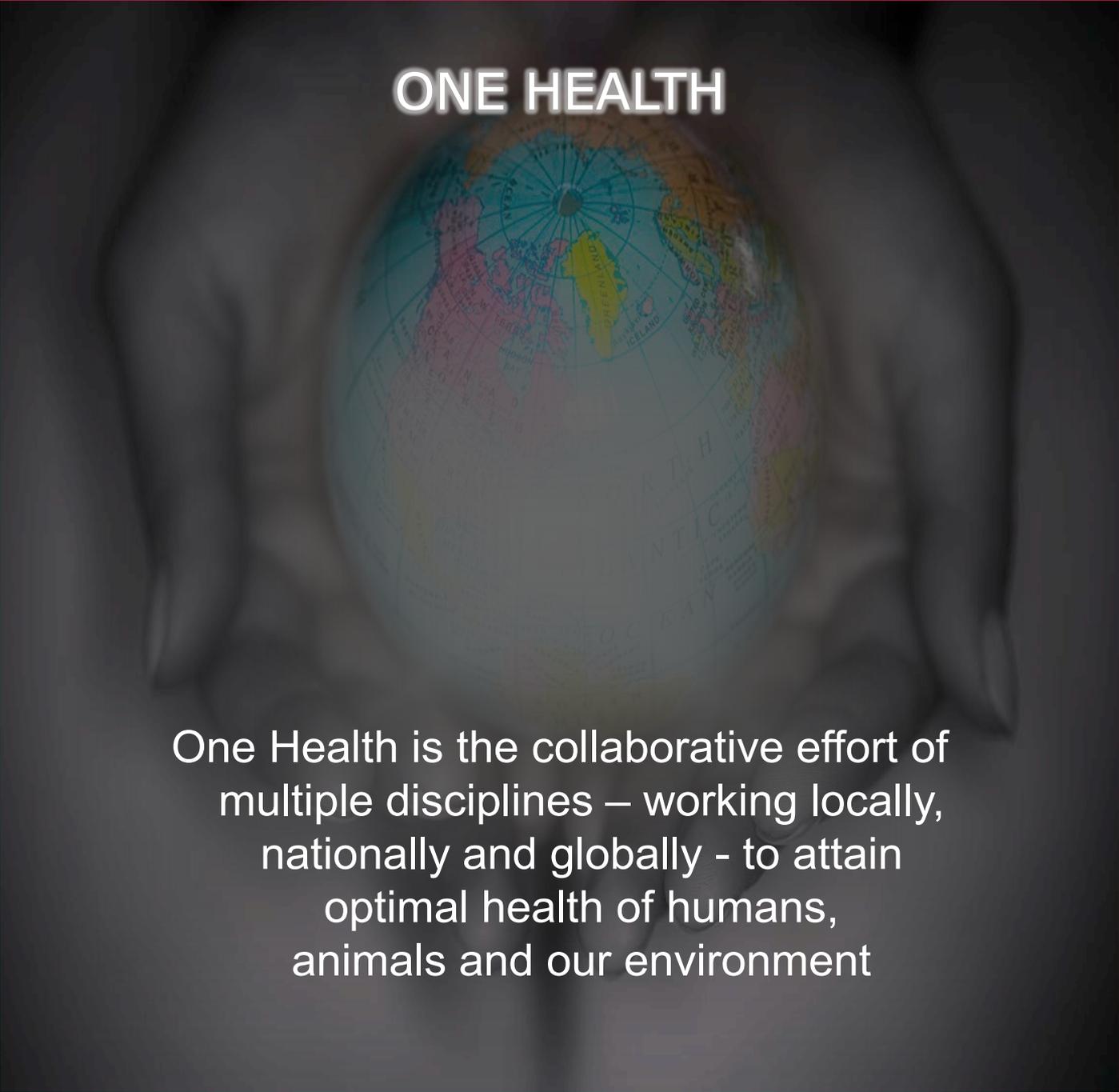
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WE CANNOT SOLVE
OUR PROBLEMS WITH
THE SAME THINKING
WE USED WHEN
WE CREATED THEM

~ Albert Einstein

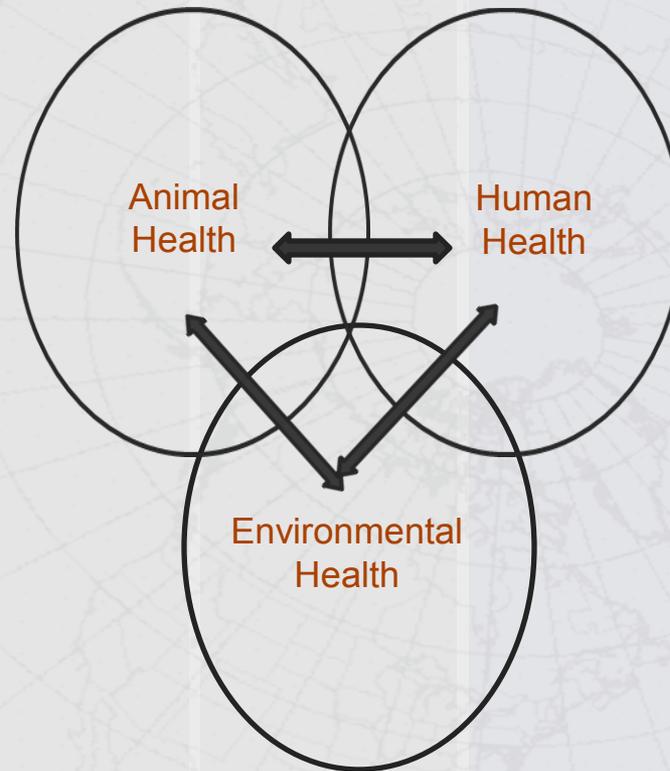


ONE HEALTH

A conceptual image for a 'One Health' presentation. It features a central globe held gently in two hands, set against a dark background. The globe is semi-transparent, showing continents and oceans. The hands are rendered in a soft, ethereal style. The entire scene is framed by a red border. On the left and right sides, there are vertical panels with a light beige background and a faint grid pattern. The text 'ONE HEALTH' is at the top, and a descriptive paragraph is at the bottom.

One Health is the collaborative effort of multiple disciplines – working locally, nationally and globally - to attain optimal health of humans, animals and our environment

Dynamics of One Health Domains



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

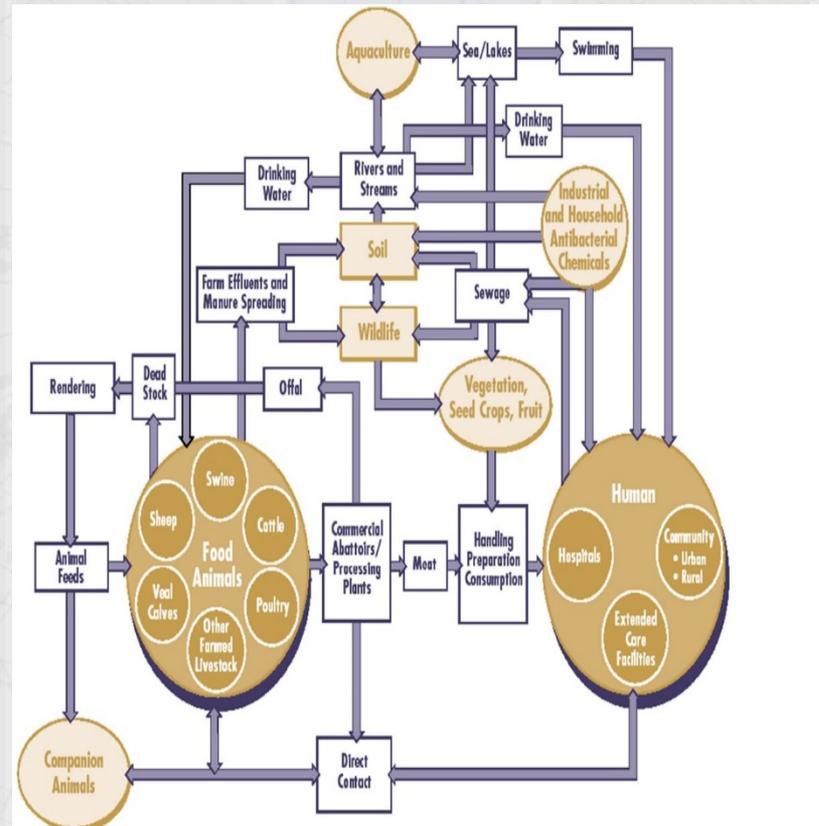
Environmental

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

Department of Health Logo

Department of Environment & Food & Rural Affairs Logo

UK Five Year Antimicrobial Resistance Strategy 2013 to 2018

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

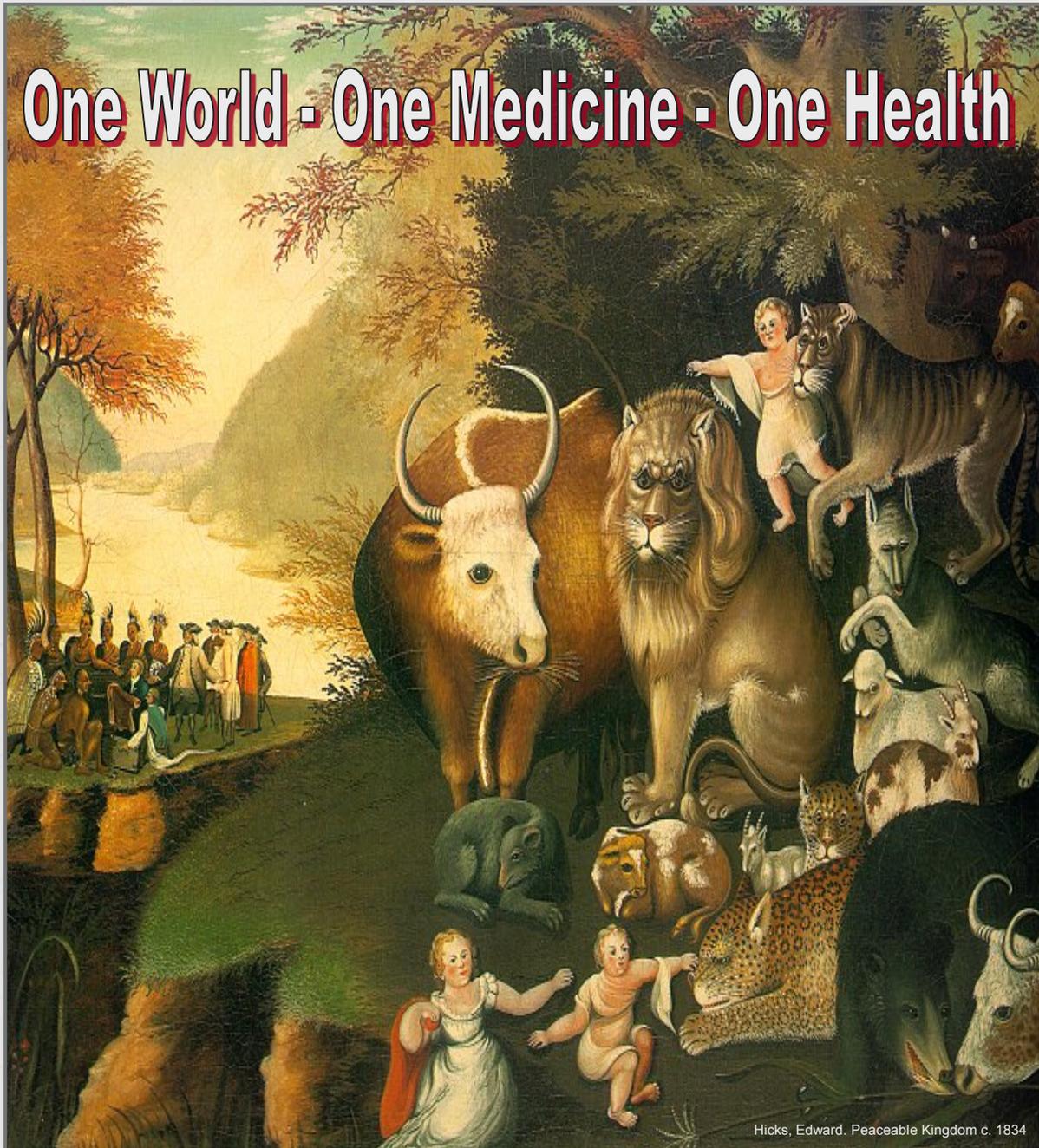
Nigel Gibbens
Chief Veterinary Officer
Department of Environment Food and Rural Affairs

On behalf of the Chief Medical Officers and Chief Veterinary Offices in Northern Ireland, Scotland and Wales.

Northern Ireland Executive Logo
Welsh Government Logo
The Scottish Government Logo



One World - One Medicine - One Health



Hicks, Edward. Peaceable Kingdom c. 1834