THE ONE HEALTH APPROACH TO MANAGING INFECTIOUS DISEASES

STAN FENWICK
REGIONAL TECHNICAL ADVISOR
USAID-ONE HEALTH WORKFORCE
TUFTS UNIVERSITY-UNIVERSITY OF MINNESOTA

Emerging Pandemic Threats Program
PREDICT • RESPOND • PREVENT • IDENTIFY
What is health?

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity

WHO 1946
Different perspectives for “well being”

Individual health
Public health
Societal health
Economic health
Ecosystem health

All of these are inter-related
What Is Veterinary Public Health?

According to WHO “veterinary public health is a component of public health activities devoted to the application of professional veterinary skills, knowledge and resources to the protection and improvement of human health.”

Integration of human and animal health
A one world reality........

◊ No country is isolated
  – Wildlife, livestock, people and diseases do not respect boundaries

◊ Countries of the world are inter-dependent
  – Knowledge, goods, services

◊ What happens in one country has impacts far beyond its borders
  – ‘Butterfly effect’
One Health Vision..........

........a multidisciplinary collaborative approach to improving the health of humans, animals and the environment, endorsed by FAO, OIE and WHO....... 

One Health approach........

........encourages the collaborative efforts of multiple disciplines working locally, nationally, and globally, to attain optimal health for people, animals, and our environment
The benefits of One Health

- Improving animal and human health globally through collaboration among all the health sciences, especially between the veterinary and human medical professions to address critical needs.

- Meeting new global challenges head-on through collaboration among multiple professions—veterinary medicine, human medicine, environmental, wildlife and public health.

- Developing centres of excellence for education and training in specific areas through enhanced collaboration among colleges and schools of veterinary medicine, human medicine, and public health.

- Increasing professional opportunities for veterinarians.

- Adding to scientific knowledge to create innovative programs to improve human health.
Sectors contributing to OH

- Human health sector
  - physicians
  - public health professionals
  - government and nongovernmental organizations focused on health education

- Health related disciplines in the environmental sector
  - environmental science
  - biology, ecology, zoology
  - medical entomology, wildlife biology

- Agricultural, Animal production, Veterinary medicine sector
  - private- and public-sector veterinarians
  - village, and community animal health and PH workers
  - animal producers, food systems
A brief history of One Health and the One Health Approach

www.illinois.edu

Emerging Pandemic Threats Program
PREDICT • RESPOND • PREVENT • IDENTIFY
Rudolph Virchow, founder of comparative medicine and veterinary pathology was an advocate of ‘One Medicine.’ His early research laboratory was provided by the School Of Veterinary Medicine where he taught veterinary students.

“The Between animal and human medicine there are no dividing lines – nor should there be”

The German physician and statesman Rudolf Virchow, coined the term ‘zoonosis’ to indicate the infectious disease links between animal and human health. He discovered *Trichinella* and linked it to trichinosis.
In the 18th century, Pope Clement XI instructed a physician, Dr. Giovanni Maria Lancisi, to devise disease control measures to combat *rinderpest*, a highly lethal viral disease of cattle that was devastating the human food supply. Lancisi recommended that ill and suspect animals be destroyed. In order to put Lancisi’s principles into effect, the first veterinary school in the world was established in Lyon, France on the orders of King Louis XV Bourgelat.

On August 4th, 1761, an order of the King’s Council authorised Bourgelat to ‘open a school in which the principles and methods whereby livestock diseases may be cured will be taught in public’. Its first students were admitted in February 1762.
250 years of the veterinary profession!
Sir William Osler, Canadian physician, the founder of modern medicine and veterinary pathology, is credited with coining the term ‘One Medicine.’ Osler studied with Virchow, and founded the McGill School of Veterinary Medicine.

William Osler 1849-1919

Osler reduced the role of didactic lectures and said, “I desire no other epitaph than the statement that I taught medical students in the wards, as I regard this as by far the most useful and important work I have been called upon to do.”

(Is he the father of EIS-FETP???)

Painting by Thomas Corner
Pasteur is regarded as one of the three main founders of microbiology, together with Ferdinand Cohn and Robert Koch

- he created the first vaccines for rabies and anthrax -

Pasteur was fearless, he used a glass tube held between his lips to draw a few drops of saliva from the mouth of a rabid bulldog, held on the table by two assistants, their hands protected by gloves.

By Albert Edelfelt
Robert Koch, German physician, 1843-1910

Koch became famous for isolating *Bacillus anthracis* (1877), the tuberculosis bacillus (1882) and *Vibrio cholerae* (1883) and for his development of Koch’s postulates.

Koch’s pupils found the organisms responsible for diphtheria, typhoid, pneumonia, gonorrhoea, cerebrospinal meningitis, leprosy, bubonic plague, tetanus, and syphilis, among others, by using his methods.

**Koch’s Postulates:**
To establish that an organism is the cause of a disease, it must be:
- found in all cases of the disease examined
- prepared and maintained in a pure culture
- capable of producing the original infection, even after several generations in culture
- retrievable from an inoculated animal and cultured again
• Daniel Salmon and Theobald Smith, both veterinarians, developed inactivated vaccines to control hog cholera, leading to the development of vaccines against typhoid and polio; Salmon’s research led to the name Salmonella!

• Smith pioneered research on anaphylaxis, which used to be called ‘Theobald Smith’s phenomenon’

• Smith and Kilbourne (DVM and MD) discovered that arthropods (ticks) could transmit pathogens (Babesia) – this led to the discovery by Walter Reed that mosquitoes were vectors of yellow fever
In 1933, Smith was awarded the Royal Society’s prestigious Copley Medal “For his original research and observations on diseases of animals and man”.

- Observed differences between human and bovine tuberculosis (1895)
- Discussed the possibility of mosquitoes as malaria vectors (1899)
- Conducted research on Brucella infections (1900)
- Used toxin/antitoxin as a vaccine for diphtheria (1909)
- In the process of investigating an epidemic of infectious abortions of cattle in 1919, Smith described the bacteria Campylobacter fetus

Smith was an MD and epidemiologist who was Inspector of the Veterinary Department in the newly created US Bureau of Animal Industries (founded to control important animal diseases).
Calvin Schwabe, veterinary epidemiologist and parasitologist, described and promoted One Medicine and proposed a unified human and veterinary approach to zoonoses in his 1964 book ‘Veterinary Medicine and Human Health’.

(Courtesy of the School of Veterinary Medicine, University of California, Davis, vetmed.ucdavis.edu).
1970s  Frederick Murphy DVM and Karl Johnson MD, unravelled the mystery of Ebola virus and its life cycle; Murphy photographed the virus. Thomas Monath MD and Graham Kemp DVM formed a team who isolated Lassa Fever virus from rodents Kemp went on to work on many zoonotic viruses including dengue, rabies, yellow fever, Rift Valley fever and many others
1990s  Rolf Zinkernagel and Peter C. Doherty, physician and veterinarian, discovered how the immune system distinguishes normal cells from virus-infected cells.

They received the 1996 Nobel Prize in physiology or medicine.
In 1898 veterinarians were employed by the U.S. military to oversee a safe food supply for troops during Spanish-American War.

In 1939 Dr. Otto Stader developed the Stader splint which was extensively utilized for injured soldiers in WWII.

In 1956 a U.S. military veterinarian adapted the canine hip prosthesis for use in humans.

In 1989 military veterinarians and physicians played a vital role in diagnosing and managing the Ebola outbreak in Reston, Virginia.
One Health Veterinary Issues

- Zoonotic disease response and control; pathogen surveillance and monitoring
- Food safety farm to fork
- Public health – animal human interface, pollution, farming, cross-species interactions, animal products trade
- Wildlife health – human encroachment and interaction, bush meat, ecosystem understanding and approach
- Antimicrobial resistance – overuse in animals, incorrect usage, spread of resistant bacteria from animals to humans
- Disaster preparedness – rescue and emergency services, disease risks, interactions between animals and people
Overview of Emerging Diseases

<table>
<thead>
<tr>
<th>Stage</th>
<th>Transmission to humans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1: agent only in animals</td>
<td>None</td>
</tr>
<tr>
<td>Stage 2: primary infection</td>
<td>Only from animals</td>
</tr>
<tr>
<td>Stage 3: limited outbreak</td>
<td>From animals or (few cycles) humans</td>
</tr>
<tr>
<td>Stage 4: long outbreak</td>
<td>From animals or (many cycles) humans</td>
</tr>
<tr>
<td>Stage 5: exclusive human agent</td>
<td>Only from humans</td>
</tr>
</tbody>
</table>

Emerging Pandemic Threats Program

PREDICT • RESPOND • PREVENT • IDENTIFY
Five stages in the evolutionary transformation of an animal pathogen (some disease agents have successfully become human or zoonotic diseases others have not)

Stage 1: Pathogen only in animals
Stage 2: Pathogens from animals to humans (‘primary infection’) (HPAI, rabies)
Stages 3 & 4: ‘Secondary infections’ increasing transmission from animal to human and humans to humans
Stage 5: Pathogens exclusive to humans (Measles, HIV)
Reasons for the emergence of zoonotic diseases include: intensive agricultural practices, global trade in exotic animals, consumption of "bush meat," and human population pressures.

The pattern of newly emergent infectious diseases (e.g., SARS and West Nile Fever) is one of demography, human development and anthropogenic environmental change driving repeated pathogen spillover from wildlife and the spread of the newly evolved pathogens in dense human populations.
Important historical zoonotic diseases include

Rabies
Plague
Yellow fever
Tuberculosis
Spanish influenza
Recently Emerged Zoonoses

- Human immunodeficiency virus (HIV)
- Haemorrhagic fevers (Ebola, Marburg)
- Bat viruses (Nipah, Hendra, Lyssa)
- Highly Pathogenic Avian Influenza (HPAI)
- Bovine Spongiform Encephalopathy (BSE)
- Severe Acute Respiratory Syndrome (SARS)
- Hantaviruses
Emerging and Re-emerging Infectious Diseases
1,461 human infectious diseases recognised

Approximately 60% due to multi-host pathogens that move between species

Over 75% of new emerging human infections have been zoonotic
Dr. Gro Harlem Brundtland, former director of the World Health Organization (WHO), at the United Nations Global Leadership Awards on April 19, 2001

“in a modern world, bacteria and viruses travel almost as fast as money. With globalization, a single microbial sea washes over all humankind (he forgot animals and the environment!) and there are no health sanctions”
Global example – lessons from H5N1

- Public health and animal health officials see H5N1 from different perspectives
- Resource sharing – human health sector given priority
- Governments evaluate the importance of issues differently
- Physicians and veterinarians often don’t understand or appreciate each other!
How can H5N1 best be described?

- An animal health problem?
- A public health problem?
- A food security problem?
- An environmental health problem?
- A trade problem?
- An economic problem?
- A political problem?

Or all of the above?
Emerging Pandemic Threats Program

PREDICT • RESPOND • PREVENT • IDENTIFY

Nipah virus 1998
Malaysia; pig illnesses; 105 human deaths; now in Bangladesh, annual mortalities, no pigs – what is the connection ???????

Hendra virus 1994–2009
Multiple equine deaths; 4 human deaths;
What is the connection???
Epidemic animal diseases show links to the environment and human behaviour – also need a OH approach to control……..

......and control measures such as culling can cause huge problems for the environment and human health – farmers committed suicide after FMD herd destruction

Emerging Pandemic Threats Program
PREDICT • RESPOND • PREVENT • IDENTIFY
Less Successful Stories
One person dies every 10 minutes
55,000 deaths per year, mostly children
99% of infections caused by dogs

Priority for veterinary and PH authorities
Multidisciplinary approach essential
10% of cost of human treatment would allow eradication in dogs
Population control of stray dogs
Vaccination of owned dogs

Control of strays not by culling alone – ecological, ethical and economic reasons

Bali, Indonesia – at least 120 deaths since 2009!

www.wormsandgermsblog.com
Pandemic H1N1 ("swine flu")

Highly infectious, low mortality
Mass panic in 2009 outbreak
Rapid global spread
Declared a pandemic in 2009
Now part of seasonal influenzas

A man in Mexico City with his 'Jaws' mask, Mirror UK
OIE recommendations

Pigs infected with pandemic (H1N1) 2009 virus should be managed similarly to herds infected with any other swine influenza virus; control outbreaks with biosafety measures, avoiding dissemination to humans and animals.

Many pigs slaughtered at the start of the 2009 H1N1 pandemic in an attempt to stop the spread of disease.

Bovine Spongiform Encephalopathy (BSE)

First recognized in Britain in cattle in 1984
“Mad cow disease”
Spongy degeneration of the brain and spinal cord caused by a prion
Variant Creutzfeldt–Jakob disease (vCJD) infected humans who consumed infected beef products
Major economic losses
Political cover-up worsened situation

Graph showing drop in beef prices after BSE

whyfiles.org/193prion/4.html
Public health officials assumed the cause of the outbreak was St. Louis encephalitis (SLE) until a veterinary pathologist at the Bronx Zoo linked the animal and human outbreaks. She realized that crows and other birds ordinarily resistant to SLE were dying, so the agent was not likely SLE. Her work helped set the stage for the discovery of WNV in the Western Hemisphere.

After it was recognized that the outbreaks were caused by West Nile virus, the CDC established the National Center for Emerging and Zoonotic Infectious Diseases.

Emerging Pandemic Threats Program

PREDICT • RESPOND • PREVENT • IDENTIFY
Building a One Health Framework
....Transforming how Public Health is put into action

Healthy animals, healthy people, healthy communities
So what? Why change now?

- Traditional disciplinary approach NOT working well enough...
- Increasing public impatience with lack of progress
- Working across disciplines, sectors, cultures catalyzes creativity and innovation
New ways of One Health thinking

- Systems based thinking
  - A framework of thought where an issue is best understood in the context of its relationships within the larger reality (as part of a process)
- Holistic approach
- Recognition that complex problems cannot be solved with a single discipline-based approach
A One Health approach to outbreak response

- **Engagement** of all stakeholders
  - all voices, participatory, grass roots

- **Strengthen collaborations** and build strategic alliances around shared interests
  - cross-disciplinary, trans-boundary, multi-sectoral

- **Build infrastructure and capacity**
  - local and global logistics, equipment, tools, sustainable economies
  - AND the people, skills, mindsets to be effective
Optimizing the One Health Approach

- Each One Health professional should be well-trained for their roles and appropriately equipped
- Professions should have the skills and competencies to work collaboratively with each other and with government, the private sector and the community
- Health systems need to be restructured to benefit from One Health efficiencies
One Health Opportunities

- New ways of thinking about issues through multi-disciplinary lenses
- Better management of complex problems
- Capture creative ideas and innovations to increase disease outbreak response capacity
One Health Challenges

- Training increasingly specialized
  - narrow and deep
- Disciplinary ‘silos’
  - thinking constrained by education and discipline
- Little reward for thinking differently
  - conservatism in medical professions
- Discomfort
  - lack of skills to follow a One Health approach
Obstacles

Overpopulation
Poverty
Deforestation
Environmental change
Drug resistance
World trade and travel
Poor education
Political will
The One Health Initiative Task Force has a vision of One Health that will enhance the integration of animal, human, and environmental health for the mutual benefit of all. Potential outcomes that may be possible include:

1. Enhanced collaboration among colleges of veterinary medicine in developing centres of excellence for education and training

2. Collaboration among multiple professions—veterinary medicine, public health, human medicine, ecology, and wildlife—to meet new global challenges head-on

3. Enhanced collaboration among veterinary clinicians and researchers to embrace the concept of translational medicine

www.onehealthinitiative.com

Emerging Pandemic Threats Program

PREDICT • RESPOND • PREVENT • IDENTIFY
The focus needs to be on the capacity of all areas not only public and animal health capacity, but also wildlife and ecosystem health.

Global threats begin at the local level.
The goal of the One Health Workforce Project is to improve the capacity of countries in high risk areas to respond to outbreaks of emergent zoonotic diseases that pose a serious threat to human health using a One Health approach.
The Final Word From SEAOHUN!!