AVIAN INFLUENZA AT THE HUMAN-ANIMAL INTERFACE

THE IMPORTANCE OF THE H-A INTERFACE IN THE BROADER SENSE

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Convergence Model
Why Diseases Emerge

Genetic and biological factors
- Microbial adaptation and change
- Human susceptibility to infection

Physical environmental factors
- Climate and weather
- Economic development and land use

Ecological factors
- Changing ecosystems
- Human demographics and behavior

Social, political, and economic factors
- International Travel and commerce
- Poverty and Social inequity
- War and Famine
- Lack of political will
- Intent to harm

Global Trends in Emerging Infection Diseases (EID)

335 EID events: 1940-2004
Steady increase with peak decade in 1980
20.9% drug-resistant microbes
22.8% vector-borne (28.8% in the last decade)

Foresight Analysis

EID are the “New normal”
Expect 3-4 new EID annually; 8-34 by 2015
87 new EID since 1980
- 58 viruses... 49 RNA
- mostly zoonotic
Found worldwide but proximity to animal populations or products is the key risk factor
Change in the host-pathogen ecology will be the most important single driver

The Convergence: A New Public Health Kaleidoscope Emphasizing One Health
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World Population Growth, 1950-2100

Source: Deichner, 1995
International Tourist Arrivals, 1950-2020

Source: World Tourism Organization (WTO)

There is no where in the world from which we are remote and no one from whom we are disconnected
**Human Demographics**

Migration and Translocation is unparalleled
Peri-Urban centers
Immuno-compromised population
Aging population- “baby boomers”
Rapid growth in developing world
Exposures to wildlife and vectors

Recreational practices
Shift to foods from animal-proteins
Under-nutrition vs. Over-nutrition
Healthcare vs. health promotion and prevention
Health disparities and exposure bias

**The Convergence: A New Public Health Kaleidoscope Emphasizing One Health**

Through the Lens of Animal Health

Human Health
Animal Health
Environmental Health

6
Livestock 2020 -
The Next Food Revolution

Global increase and demand for protein and food of animal origin

Shift from poverty of 1-2 billion people to middle class

“Westernization” of Asia and Latin America

Concerns with sustainability

Increases in emerging zoonoses through the concentration of people and animals

Projected Species Production, 1961 - 2025

Source: Newcomb, J., One World – One Health: An Economic Perspective, 2004
World Meat Consumption, 1983 - 2020

Global Meat Trade is Highly Concentrated

Source: Newcomb, J., One World – One Health: An Economic Perspective, 2004
Source: Center for Global Food Issues
Worldwide Ship Traffic
Multihost Pathogens

60% of all human pathogens are zoonotic
80% of animal pathogens
Ecological generalists

Microbial View
**Virus Carriers**

Fruit bats

**Nipah Virus**
Annual Global Trade in Exotic Animals

4 million birds
640,000 reptiles
40,000 primates
Illegal trade unknown – estimate $4-6 billion

Wildlife Conservation Society
Annual Burden of Foodborne Illness in the United States (estimates)

76 million illnesses
325,000 hospitalizations
5,000 deaths

Mead et al. EID 1999
CRITICAL CONTINUUM

Animal and human health are a continuum of causality and events and need to be viewed as a continuum and integration of strategies.
The Convergence: A New Public Health Kaleidoscope Emphasizing One Health

Ecosystem
1.1 Billion people lack access to clean water.
2.6 Billion lack access to adequate sanitation.

**Water Issues**

**Water-borne pathogens**
- Cholera
- Noroviruses
- Typhoid fever
- Cryptosporidiosis
- Giardia
- Legionella
- Hepatitis A & E

**Inadequate Water**
- Shigella
- Acute respiratory diseases
- Trachoma
- Scabies

**Waterborne Intermediate Hosts**
- Guinea Worms: dracunculiasis
- Schistosomiasis (160 million infections)
World’s Most Dangerous Animals

Global Distribution of Dengue Virus Serotypes, 2007
National Ecological Observatory Network (NEON)

A continental-scale research platform for discovering and understanding the impacts of climate change, land-use change, and invasive species on ecology.

Gathers long-term data on ecological responses of the biosphere to changes in land use and climate, and on feedbacks with the geosphere, hydrosphere, and atmosphere.

Nature watch: a network of stations will measure the impact of human activity and invasive species on ecosystems on a huge scale.
One Health is the collaborative effort of multiple disciplines – working locally, nationally and globally - to attain optimal health of humans, animals and our environment.

Driving Forces

- Global trade and the global food system; not always driven by health considerations
- Shift from independence to interdependence
- Complementarity – productive interdependence
- “Connexity”
- Convergence and challenges of the 3 health domains – human, animal and environment
- Collapsed space
LESSONS LEARNED

- Rapid response
- Global collaboration
- Multi-disciplinary team
- Economic devastation from global epidemics
- Convergence of human and animal health – more to come
- Understanding the “Continuum”
- Risk communication and messaging
- Social and cultural determinants of disease
- Success of international organizations
- Need for improved AH and PH infrastructures
- Key factor includes workforce competency and development

Non-Technical Issues and Concerns

- Comprehending “Wicked Problems” and shift from solving problems to managing dilemmas
- Health disparities – the ethics of addressing zoonoses
- Over-coming “pandemic fatigue”; ensuring political will (Supreme Committee plus Ministry of Finance)
- Prioritizing research to support better policies and evidence-based decisions
- Adding value from H5N1 to other zoonoses
- Possibilities of “big science” - technology and bioinformatics
- Innovations – creating “what is not” vis-a-vis improving “what is”
Strategy is a “Wicked Problem”

“Wicked problems can’t be solved, but can be tamed. Increasingly these are the problems that strategists face and for which they are ill-prepared.”

“Strategy as a Wicked Problem”, John Camillus, HBR May 2008

Wickedness is not about difficulty but rather represents issues that traditional processes cannot resolve.
Wicked issues often crop up as organizations face constant change and unparalleled challenges; they often occur in a social context with diverse opinions from numerous stakeholders.

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
- Threatening
- Often a symptom of another issue/problem
Organizations must go beyond obtaining more facts and opinions from stakeholders; they must engage them to help manage the dilemma.

**Optimizing the H-A Interface: A Way Forward**

- Recognizing the “Continuum” - planning and implementing collective strategies
- Integrating reporting and surveillance systems
- Shift from data gathering to sharing to open systems
- Creating “communities of practice” through demonstration projects that are culturally relevant
- Meta-Leadership training and skill development
- Understanding the difference between incentives and disincentives of animal and public health and create win-win scenarios
- Adopting a “One Health” mindset and operationalizing
  - Shift from capacity building to capacity effectiveness
  - Building trust and respect between AH-PH
- Optimizing roles and responsibilities of P-P-P and NGOs
CONSIDERATIONS: “BEYOND” AI

1. Create a series of R & D Centers to work holistically and ecologically for emerging zoonoses beginning with H5N1
2. Design, create and implement an integrated surveillance and disease reporting system
3. Recruit business communities to become effective and equitable players in controlling, responding and preventing EID
4. Develop a series of “communities of practice” to address EID and encourage new models involving those affected
5. Adopt a “One Health” mindset and action plan to better understand infectious disease ecology and ensure applicability for other zoonotic diseases; critical need for a shared vision and global agenda for action