One World–One Health: An Economic Perspective

Beyond Zoonoses: The Threat of Emerging Diseases to Human Security and Conservation, and the Implications for Public Policy

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Economic Impact of Selected Infectious Diseases

- SARS: China, Hong Kong, Singapore, Canada, $30-50bn
- Foot & Mouth UK, $25–30bn
- Avian Flu Asia, $5–10bn
- BSE U.S., $3.5bn
- BSE Canada, $1.5bn
- BSE Japan, $1.5bn
- BSE UK, $10bn
- Foot & Mouth Taiwan, $5-8bn
- Classical Swine Fever, Netherlands, $2.3bn
- HPAI, Italy, $400m
- Nipah, Malaysia, $350-400m
- Avian Flu NL, $500m

Figures are estimates and are presented as relative size.
### Livestock Disease Economics

<table>
<thead>
<tr>
<th>Market supply effects</th>
<th>Market demand effects</th>
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<tbody>
<tr>
<td><strong>Increased prices</strong></td>
<td><strong>Drop in domestic prices</strong></td>
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<td><strong>Reduced volume of domestic supply</strong></td>
<td><strong>Reduced exports</strong></td>
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<td><strong>Reduced production/increased production costs</strong></td>
<td><strong>Ban or tightened controls by importing countries</strong></td>
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<td><strong>Increased financial costs</strong></td>
<td><strong>Food insecurity</strong></td>
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<td><strong>Health concerns</strong></td>
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<td><strong>Environmental degradation</strong></td>
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**Social costs**

**Externalities**
Livestock Disease Risks: Widening Concerns

- Recent animal disease outbreaks have affected one-third of global meat exports (UN/FAO)
- Economic impacts of major livestock disease outbreaks in the past 10 years exceed $80 billion
- Concerns about human health risks of emerging infectious diseases are increasing (SARS, avian flu, Nipah virus)
- Rapid growth of Asia’s livestock industries poses new challenges
- Global trade and travel increase the interconnectedness of livestock producers worldwide
- Pathogen exchanges with wildlife populations could be significant
- Bioterrorism aimed at agricultural targets is possible
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1. Inevitable Collisions: Projected Increases in Livestock Populations Will Create New Ecosystem Stresses

2. Network Dynamics: Highly Interconnected Systems Are Vulnerable to Epidemics

3. Policy Responses Must Take the Long View
UN Population Projections (Bn)

Meat Consumption and Income Trends

Log of per capita Consumption of Meat (1971-1995 avg.)

Log of per capita GNP (1971-95 avg.)

Philippines  China  India

Trend
World Meat Consumption: 1983-2020

Million Metric Tons

Source: IFPRI, “Livestock to 2020: The Next Food Revolution”

FAO Annual Data. Total meat consumption for 1983 and 1993 are three-year moving averages. 2020 projections come from IFPRI’s global model, IMPACT
Projected Species Production

Source: Center for Global Food Issues
Brazil Chicken Meat Production and Exports: 1964-2004

Source: FAOSTAT
China Chicken Meat Production and Imports: 1987-2004

Source: FAOSTAT
Thailand Chicken Meat Production and Exports: 1964-2004

Source: FAOSTAT
The Global Meat Trade is Highly Concentrated

Source: Center for Global Food Issues
Percent of Global Meat Production Exported

Source: Center for Global Food Issues
Network Theory Offers Important New Tools for Analyzing and Managing Disease Risks

• Network models (scale-free, small world, urban, etc.) give fundamental new insights into epidemiology

• Scale-free networks are especially vulnerable, but can be made more robust by focusing control measures at hubs

• Network theory has significant practical applications in understanding and managing livestock diseases through application of “contact tracking” to identify hubs
Poisson distribution

Power-law distribution

Exponential Network

Scale-free Network
Emerging Infectious Diseases: What Are the Linkages Among Wildlife, Domestic Animals and Humans?

- Fundamental forces are driving new infection disease threats for livestock
- Avian influenza poses especially large potential risks
- Emerging diseases are causing significant economic disruptions

PIG DENSITY AND AVIAN INFLUENZA OUTBREAKS IN ASIA
(as of 18/02/2004)
Control and Mitigation Methods Are Evolving Quickly

- Mass culling has been effective, but at very high cost
- Trade embargoes are crude tools to control disease
- New monitoring and detection systems are being put in place
- Vaccination is now being used, but evolutionary implications are unknown
- Rapid testing technologies have been developed
- Changes in livestock practices are being explored
Institutional Responses to Avian Flu: Recommendations of OIE/CDC/WHO

- Surveillance and separation systems to limit contact between wild birds and poultry
- Strategies to ensure the purity of drinking water supplies for poultry
- Tight control measures over livestock movement in affected areas
- Bird-proofing of poultry sheds to prevent contact between wild birds, especially migrating waterfowl, and poultry
- Protection for workers during culling operations including protective clothing and vaccinations
- Financial support for losses incurred by farmers culling their flocks
- Endorsement of vaccination strategies as complement to culling
Sustainable Long-Term Solutions May Require Innovative Science and Policy

- Breed livestock for disease resistance
- Produce animal vaccines in feed grains
- Implement advanced monitoring and detection systems for livestock
- Develop global wildlife health surveillance network
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