



Zoonotic Stressors and Infrastructure Implosion:

One Health Approach to Sustainable Surveillance, Prevention, Response, and Control of Zoonotic Diseases

Zoonoses: Understanding the Animal
Agriculture and Human Health Connection

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Globalization

- Increase in human population and movement into animal habitat
- Extensive and rapid travel by passengers, animals
- Extensive movement by displaced populations
- Increased trade, globalization of businesses, food and food systems
- Food safety
- Climate change
- Sufficient, available , safe water to drink
- Rapid spread of infectious disease agents
- Interconnected health, economies, livelihoods
- Production, dissemination, reporting of information

The Public Awakens to Links Between Animal and Human Health



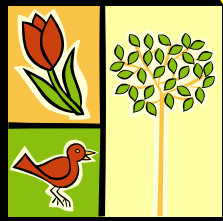
- Wild pigs suspected as cause of E. coli outbreak



One Health



- Encroachment
- Introduction
- “Spill over” &
- “Spill back”



- Agricultural
- Extensive Production



- Translocation

Wildlife

Domestic
Animal

Human

- Food processing/distribution
- Technology and
- Industry

- Human encroachment
- Ex situ contact
- Ecological manipulation
- Human behaviors



- Global travel
- Urbanization
- Biomedical
- manipulation

After Daszak P. et.al.
Science 2000 287:443

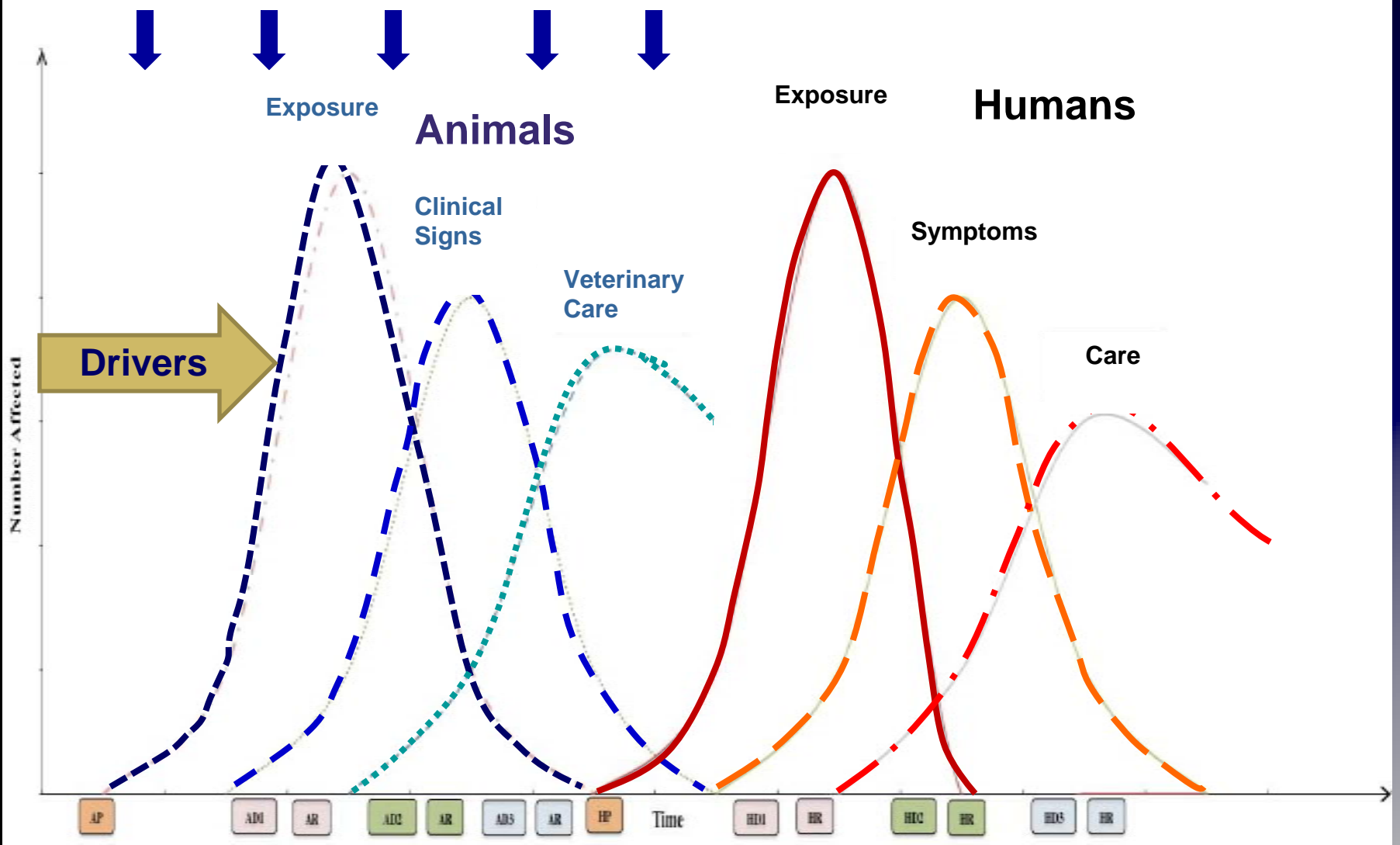
Common Course of Events with Zoonotic Disease Outbreaks

- ↓ Unusual course of disease detected in humans
- ↓ The cause of the disease is identified and confirmed (can take some time)
- ↓ Major disease control efforts instituted in human populations
- ↓ The animal source of the pathogen causing the disease is identified
- ↓ Animal populations are depopulated
 - Loss of biodiversity in the case of wildlife
 - Loss of livelihoods, business with domesticated animals

Outcomes

- Human illness and loss of life, fear, anxiety
- Loss of animal life playing a pivotal role in biodiversity (wildlife), food supply, animal products, household incomes, livelihoods, businesses (domesticated animals)
- Loss of international trade/national economies
- Loss of tourism

Integrated Zoonotic Disease Early Detection and Response System



Adapted from graph in "Sustaining global surveillance and response to emerging zoonotic diseases," IOM/NRC 2009

One Health

Is the Collaborative Effort of Multiple Disciplines

– working locally, nationally, and globally–

to attain optimal health for people, animals, and
our environment.

AVMA-AMA One Health Task Force

The Future of Veterinary Medicine

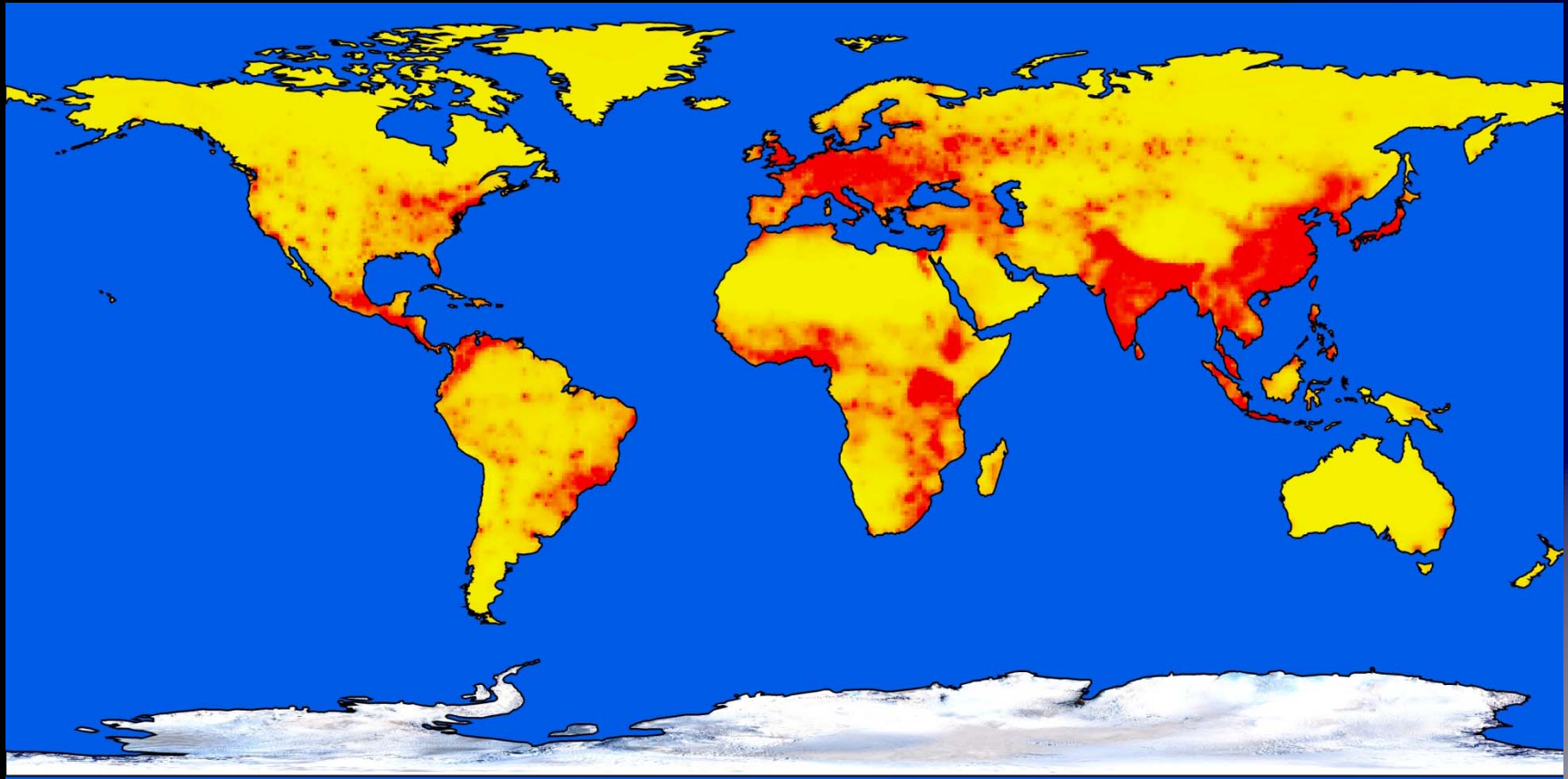
One Health Workforce

- Nurses
- Physicians
- Veterinarians
- Dentists
- PhDs
- Epidemiologists
- Public health advisors
- MPHs
- Sanitary Engineers
- Industrial Hygienists
- Environmental Specialists
- Laboratory Scientists
- Social Workers
- Health Educators
- Wildlife Biologists
- Agricultural Animal Scientists
- Statisticians
- Information Technology Specialists
- Entomologists
- Mammalogists/Ornithologists
- Lawyers
- Other

Sectors with a Role to Play

- Ministries of agriculture, Departments of veterinary services (livestock, poultry)
- Ministries of natural resources, forestry, interior (wildlife, ecosystem health)
- Ministries of health, public health (human health)
- Ministries of tourism, commerce (trade, commerce)
- Ministries of finance
- Ministry of state

Zoonotic Disease Hotspots



Sectors with a Role to Play

- International
 - WHO (Human) / HQs and Regions
 - OIE
 - FAO
 - World Trade Organization
 - Multilateral development/assistance organizations, banks (World Bank, IADB)
 - Bilateral development/ assistance organizations
 - NGO's
 - Others

Global Collaborations

- **Countries**-- Ministries of Health, Agriculture, Environment, Finance, Education, Transportation, more
- **Donor organizations**-- USAID, CIDA, DFID, GTZ, DANIDA, JICO, etc.
- **Private sector**-- food systems, human health, animal health, environment
- **Academia** -- colleges of veterinary medicine, agriculture, public health, nursing, other
- **Non-Governmental Organizations** -- community leadership, participation
- **International Governance Organizations** (WHO, OIE, FAO)

No Single Organization, Agency
Can Do it Alone!!!

Challenges

- Lack of political will at top and other levels, lack of a vision for an effective system
- Lack of buy-in from all professions/sectors
- Poor understanding by the public and scientific/ health community of the effectiveness, benefit from investments in strengthening veterinary services , wildlife health, environmental health– prevention, minimize human exposures
- Poor mutual understanding of the different missions of the different sectors, ministries; authorities
- Lack of understanding on benefits of multi-disciplinary approach to problems, solutions, impacts of solutions

Challenges

- Differences in numbers, culture, level of education, communication, incomes of professionals
- Disparate Resources-- /Jurisdictional approaches
- Few venues for interaction, true multidisciplinary, multisectoral exchange
- Absence of efficient/effective communication platforms
- Role of the media– demonization, vilification of animals
- Systems for naming zoonotic disease events in humans that vilify animals –mixed public health messages, damages to animal industry



SUSTAINING GLOBAL
SURVEILLANCE AND
RESPONSE TO EMERGING
ZOO NOTIC DISEASES

INSTITUTE OF MEDICINE AND
NATIONAL RESEARCH COUNCIL
OF THE PHILIPPINE ACADEMY

All countries, in partnership with private and public stakeholders, should develop, maintain, and globally coordinate *integrated* surveillance and response capabilities to prevent, detect, and respond to the emergence of zoonotic diseases in order to limit loss of life and livelihoods.

Recommendations by Priority & Category

	TECHNICAL	ECONOMIC	POLITICAL
	Strengthen Surveillance and Response Capacity	Financing and Incentives for Surveillance	Governance of Global Efforts to Improve Surveillance and Response Capabilities
High priority	Establish surveillance and response strategies (<i>Recommendation 1-1</i>)	Design sustainable funding strategies (<i>Recommendation 2-1</i>)	Create a coordinating body for global zoonotic disease surveillance and response (<i>Recommendation 3-1</i>)
Priority	Improve use of information technology to support surveillance and response activities (<i>Recommendation 1-2</i>)	Create an audit and rating framework for surveillance and response systems (<i>Recommendation 2-2</i>)	Deepen the engagement of stakeholders (<i>Recommendation 3-2</i>)
	Strengthen laboratory network to support surveillance and response activities (<i>Recommendation 1-3</i>)	Strengthen incentives for country and local reporting (<i>Recommendation 2-3</i>)	Revise OIE governance strategies (<i>Recommendation 3-3</i>)
	Build human resources capacity to support surveillance and response efforts (<i>Recommendation 1-4</i>)		Mitigate disease threats from wildlife and trade (<i>Recommendation 3-4</i>)
	Establish a zoonotic disease drivers panel (<i>Recommendation 1-5</i>)		

High Priority Recommendations

- **Technical** : Establish Surveillance and Response Strategies
- **Economic** : Establish Sustainable Funding Strategies
- **Political** : Create a Coordinating Body for Global Zoonotic Disease Surveillance and Response

Priority Technical Recommendations to Support Surveillance and Response Activities

- Purpose, design, tools for and use of surveillance data across sectors
- Improve use of IT
- Strengthen the laboratory network
- Build human resources capacity
 - Human- Animal
 - Clinical, epidemiology, laboratory, social sciences, other
- Establish a zoonotic disease drivers panel

Priority Economic Recommendations to Support Surveillance and Response Activities

- **Create an Audit and Rating Framework for Surveillance and Response Systems**
- **Strengthen Incentives for Country and Local Reporting**

Priority Political Recommendations to Improve Surveillance and Response Capabilities

- Deepen the engagement of stakeholders
- Revise OIE governance strategies
- Mitigate disease threats from wildlife and trade

Recommendation 1-1: Strategic approaches to surveillance

1. Work with researchers to develop science-based criteria to determine the magnitude and distribution of disease drivers.
2. Immediately strengthen surveillance in human populations at high-risk for zoonotic diseases (for example, livestock and poultry workers) especially in countries where disease surveillance in animal populations is weak.
3. Develop and strengthen surveillance systems to detect outbreaks early in animal populations rather than discovered later through secondary human outbreaks.
4. Synchronize and share surveillance information from both human and animal populations in an integrated system, in as close to real time as is possible.
5. Engage science-based nongovernmental organizations as valuable partners that provide the wide geographic reach and field-expertise needed for more comprehensive surveillance and response activities.

Build Human Resources Capacity

- U.S. government agencies should take the lead in developing new interdisciplinary educational and training programs that integrate human and animal health and allied fields.
- Existing national and regional training programs in field epidemiology, clinical, and laboratory diagnosis supported by HHS, USDA, and DOI should be improved to
 - include a better balance of human and animal health concerns
 - incorporate contributions from laboratory and social science professionals
 - connect with one another where appropriate.

Recommendation 1-4: Build Human Resources Capacity Building to Support Surveillance and Response Efforts

- NIH Fogarty International Center, CDC, USDA ARS, USDA APHIS, NIFA (CSREES), USGS, should be funded to
 - provide leadership, partner with educational institutions, ministries of health, agriculture, natural resources
 - New curricula and training programs need to include human and animal health professionals, paraprofessionals, community and public health professionals for maximal opportunities to improve interdisciplinary communication

One Health Capacity Building Field Epidemiology and Laboratory Training Program (FETP/FE(L)TP)

- Modeled after CDC Epidemic Intelligence Service (EIS)
- Goal to strengthen linkage between epidemiology and laboratory systems in surveillance & outbreak response
- 2 year full-time training and gov't in-service program in applied epidemiology and public health
- MD's, DVM's, laboratory scientists
- 25% coursework and 75% field work
- 12 active programs representing 22 countries
- 18 self-sustaining programs representing 24 countries

Nigeria FELTP

- First cohort began October 2008
- 1st FELTP to include a veterinary track
- Goal: To strengthen the country's public and animal health systems and infrastructure by developing a cadre of physicians, laboratorians, and veterinarians with advanced skills in epidemiology to serve in leadership positions at the federal and state level
- 3 tracks/13 trainees
 - 6 Physicians
 - 4 Veterinarians
 - 3 Laboratorians



Other Relevant Training Programs

- **USDA/APHIS laboratory sciences training**
- **OIE Reference laboratory supported laboratory training**
- **Envirovet (Academia- Colleges of Veterinary Medicine, NGOs)**
 - Veterinarians, veterinary students , wildlife biologists
 - 7 weeks intensive lecture, laboratory and field experiences
 - terrestrial and aquatic ecosystem health in developed and developing country contexts.
 - Highlights the transdisciplinary cooperative nature of work required for effective wildlife and ecosystem research, management, and long-term problem-solving.

International Veterinary Education Discussions

- OIE, FAO, USAID, World Bank
- Many countries do not have accrediting bodies for colleges of veterinary medicine
- OIE Addressing education of veterinarians worldwide to assure competent workforce to oversee animal health to ensure healthy animals for international trade
- All graduating veterinarians should have knowledge of public health, zoonoses prevention and control, disease surveillance, food safety, understanding of human, animal, environmental health intersection
- OIE considering tool, like PVS tool to assess veterinary education in countries, identify and close gaps
- One Health Curricula shared by professional schools, faculty exchange, student exchange, “twinning”

Establish Sustainable Funding Strategies

- USAID—in partnership with international finance institutions & other bilateral assistance agencies—should lead efforts to generate sustainable financial resources to adequately support the development, implementation, and operation of integrated zoonotic disease surveillance and response systems.
- Commission agencies to conduct an in-depth study of the nature and scope of a funding mechanism;
- Consider a tax on traded meat and meat products as a potential source of revenue.



Create a Coordinating Body for Global Zoonotic Diseases Surveillance/Response

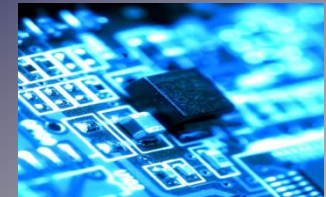
USAID, in cooperation with the UN and other stakeholders from human and animal health sectors—

should promote the establishment of a coordinating body to ensure progress towards development and implementation of evidence-based harmonized, long-term strategies for integrated surveillance and response for zoonotic diseases.



Improve Use of Information Technology

- With support of USAID, WHO, FAO, OIE, and the World Bank, and public / private sector partners should aid nations to develop, adapt for local conditions, and implement information and communication technologies for integrated zoonotic disease surveillance.
- Effective use of technologies facilitates acquisition, integration, management, analysis, and visualization of data sources across human and animal health sectors and empowers information sharing across local, national, and international levels.
- To establish, sustain, and maintain this technologically-sophisticated system, both leadership and investment are critically needed.



Strengthen the Laboratory Network

- USAID should promote and initially fund the establishment of an international laboratory working group charged with designing a global laboratory network plan for zoonotic disease surveillance.
- Design a laboratory network for efficient, effective, reliable, and timely diagnosis, reporting, information sharing, disease response capacity, and integration of human and animal health components.
- A long-term coordinating body for zoonotic diseases, perhaps modeled after the United Nations System Influenza Coordinator's (UNSIC) office, should implement the global laboratory network plan, manage it, and assess its performance in consultation with the international laboratory working group.



Establish a Zoonotic Disease Drivers Panel

The U.S. Department of State, in collaboration with WHO, FAO, OIE, and other international partners, should impanel a multidisciplinary group of technical experts –

-- to review regularly state-of-the-science information on the underlying drivers of zoonotic disease emergence and propose policy and governance strategies to modify and curb practices that contribute to zoonotic disease emergence and spread.

Recommendation 2-2: Economic - Priority

Create an Audit and Rating Framework for Surveillance and Response Systems

USAID should convene a technical working group to –
--design and implement, by the end of 2012, an independent mechanism to audit and rate national surveillance system capacities for detecting and responding to emerging zoonotic disease outbreaks in humans and animals.

[WHO/ IHRs

OIE/ Performance of Veterinary Services tools]

Strengthen Incentives for Country and Local Reporting

To reduce incentives to conceal outbreaks and to mitigate the negative social and economic repercussions of early disease reporting (stigma of disease, food safety concerns, culling, and trade and travel disruptions)

- Financial incentives at country and local levels are needed through partnerships among bilateral aid agencies, the international community, and national governments
 - Country level: USAID—in partnership with international finance institutions and other bilateral assistance agencies—should implement economic incentives to encourage middle- and low-income countries to report human, animal, and zoonotic disease outbreaks.
- Local level: National governments, with added support from the international community, should identify and provide the resources needed for financial incentives to promote early disease reporting and to engage in effective responses at the local level.

Deepen the Engagement of Stakeholders

In its work on zoonotic disease surveillance and response, USAID—in collaboration with WHO, FAO, and OIE—should

convene representatives from industry, the public sector, academia, NGOs, as well as smallholder farmers, and community representatives to determine

how best to build trust and communication pathways among these communities to achieve the efficient bi-directional flow of both formal and informal information needed to support effective, evidence-based decision making and coordinated actions.

Revise OIE Governance Strategies

To protect animal health and international trade, and to contribute significantly to the reduction of human and animal health impacts from zoonotic diseases, OIE member states should take the necessary steps to:

- Adhere to Resolution 17 (adopted on May 28, 2009), which reminds OIE member states of their obligation to make available to OIE all information on relevant animal diseases, which includes those that are of zoonotic potential.
- Create legally binding obligations for OIE members to develop and maintain minimum core surveillance and response capabilities for animal health risks, including zoonotic diseases.

OIE Continued....

- Authorize OIE to publicly disseminate information received from nongovernmental sources, in the event OIE member states fail to confirm or deny such information in a timely manner, or when denials of such information run counter to persuasive evidence OIE has obtained from other sources.
- Empower the OIE Director-General to declare animal health emergencies of international concern with respect to emerging or re-emerging zoonotic diseases that constitute a serious animal health or public health risk to other countries and issue recommendations about how countries should address such emergencies.

Conclusions

- Shared vision, increased political will and buy-in by all sectors needed to achieve a truly one health approach to zoonosis surveillance, disease prevention, and control
- Environmental, agricultural, human health policies and practices needed to address zoonoses effectively
- Joint funding streams supporting cross sectoral approaches to prevention, surveillance, control, education, research needed
- Technical, education, economic, communication, governance strategies needed to achieve an integrated, effective system spanning environment, animal, human health

Thank you

- Acknowledgements
 - IOM/NRC Committee and Staff on Sustainable Global Surveillance and Response to Emerging Zoonotic Diseases
 - USAID for funding study
 - Dr. Carol Rubin, CDC



Vision for an Effective System

- Prevention programs in animal populations underway– bio-security, animal husbandry, vaccination programs
- Surveillance systems in animal populations, animal health workers, primary health care clinics in place
- Report of unusual disease event in animal reported to veterinary services
- Veterinary investigation team launched, epidemiologic and clinical information, and samples for lab analysis collected
- If zoonoses likely, info shared with human health authorities, consultation on prevention of spread to humans, limit animal to animal spread
- Laboratory confirmation of cause in timely fashion

Vision for an Effective System

- One health policies in place addressing drivers leading to outbreaks
- Joint human/animal/environment working group established for analysis, planning, implementation, evaluation, communication (Local, National)
- Joint human-animal-environmental investigation teams formed, launched; risk factors identified
- Animal disease control efforts launched
- Steps taken to stop / limit human exposures
- Infection control interventions implemented in clinics, hospitals, health care workers
- Risk communication underway with the media

Achieving a Global One Health Work Force

- Political will and leadership by a multidisciplinary team of leaders having the vision
- Increasing number /balance of health professionals to partner with other disciplines
- Shared, sustainable resources, protocols
 - Sufficient resources
 - Breakdown of jurisdictional lines, silos, barriers
- Evaluation

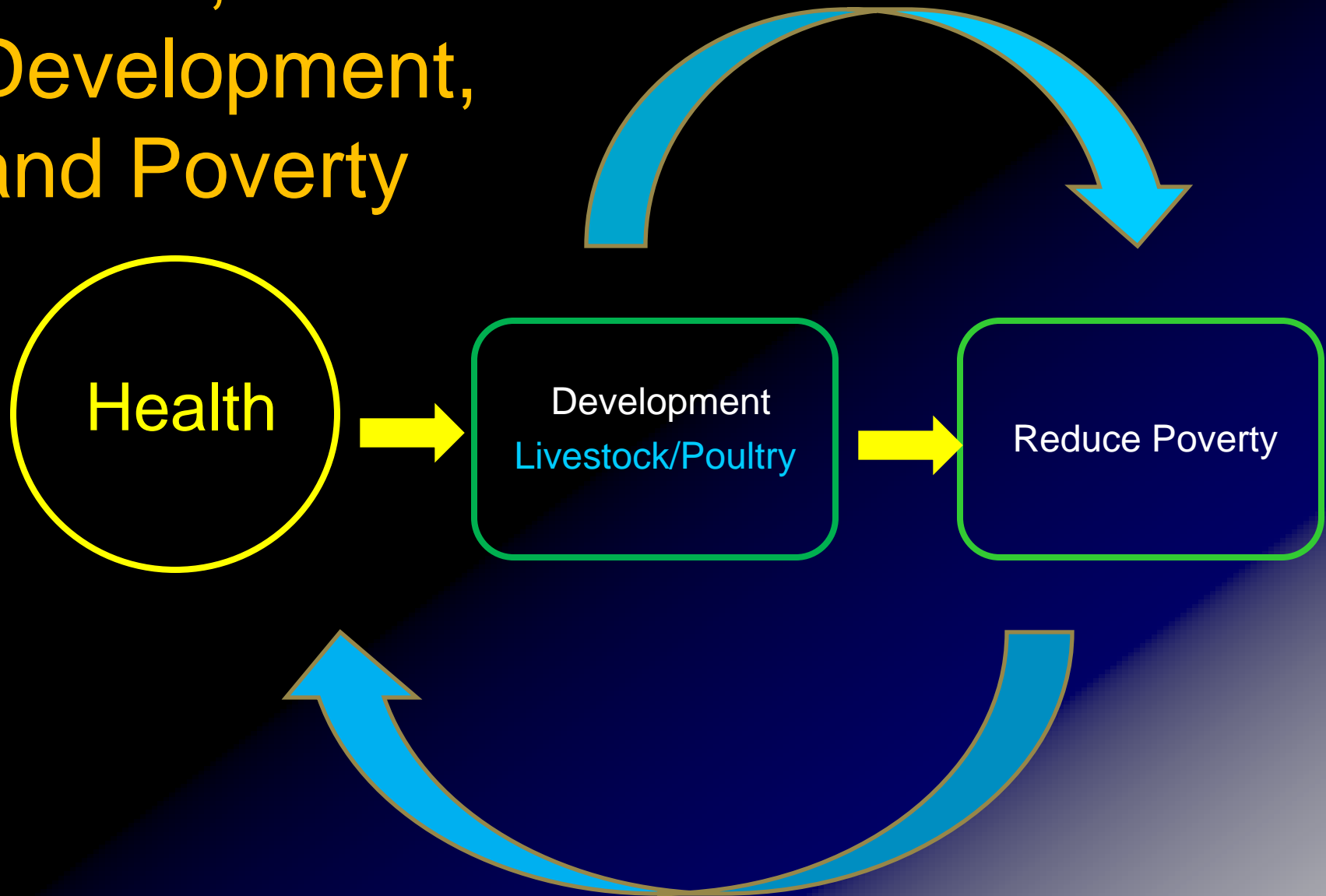
To Achieve One Health, Global Health

- Education -- Multiple disciplines understanding why and how they can/must work effectively together to achieve better prevention and response outcomes
- Incentives (funding, promotions, rewards) that promote collaboration
- Mechanisms in place to facilitate working across silos, bureaucratic barriers; Coordinating unit(s) in ministries
- Communication between offices, departments, ministries, colleges, schools, (all levels)







Urbanization

- Today–
 - Rapidly increasing human population– approaching 9 Billion by 2050
 - 50% of world population living in urban settings, proportion is growing
 - 80% of world's poorest populations living in rural areas

Health, Development, and Poverty



Millenium Development Goals

MDGs	Main Themes	Cross Cutting Issues			
<i>Goal 1: Eradicate Extreme Poverty and Hunger</i> 	Agriculture, Rural Development and Poverty reduction	Gender equality	Human Rights	Civil Society Participation	Refugees
<i>Goal 2: Achieve Universal Primary Education</i> 	Education				
<i>Goal 3: Promote Gender Equality and Empower Women</i> 					
<i>Goal 4: Reduce Child Mortality, Goal 5: Improve Maternal Health. Goal 6: Combat HIV/AIDS, Malaria and other diseases</i> 	Health and Population				
<i>Goal 7: Ensure environmental Sustainability</i> 	Environment				
<i>County Specific</i> 	Disaster Risk Management				
Goal 8: Develop a Global Partnership for Development					

Source:
UNDP

Human illness and deaths

- SARS (2002-2003) : 8,096 ill; 774 deaths (\$60 Billion)
- HP H5N1 (2003-2010): 498 reported/confirmed ill; 294 deaths (\$10 Billion in Asia)
- BSE/nv CJD (1986-1996):
 - UK (1986-1996): 168 cases; 164 deaths (\$850-935 M/ yr)
 - US (2003-2007): 3 cases; 3 deaths (\$11 Billion)
- Pandemic H1N1 (2009-2010): > 18,000 deaths globally (\$Billions US; disease surveillance and response in humans, costs to pork industry)

Economic Impact of Emerging Zoonotic Diseases

- Global losses from response to emerging zoonotic diseases > \$200 Billion last 20 years
- Destruction/culling of poultry (HP H5N1 avian influenza) in the billions
- Increase in poverty in developing countries
 - Poorest households derive higher % income from food animal production
 - Vietnam– income from poultry sector important for 99% of poor households; Ban on poultry result in losses up to 30% of income for poorest households

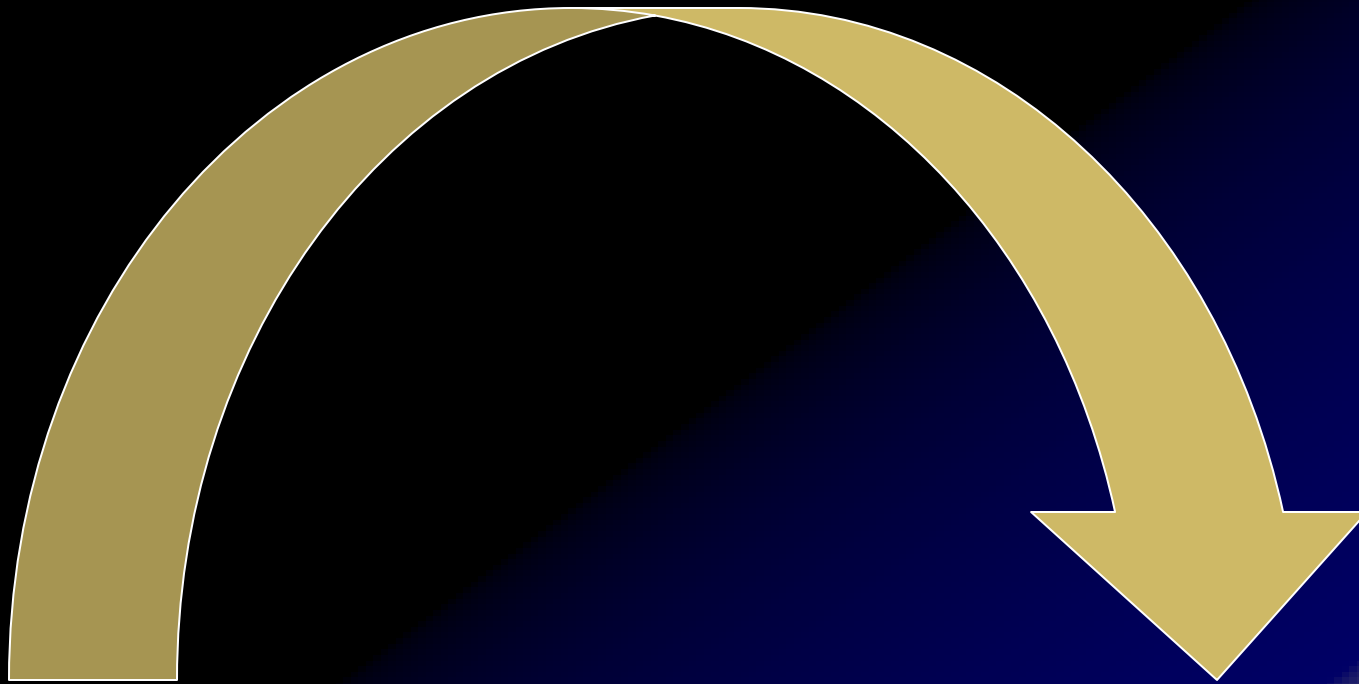
Implementing One Health

- Policies , Addressing Drivers, Resources
- Intersectoral/Interdisciplinary Research
- Multi/Inter Professional Education
- Multisectoral Health programs – providers, disease prevention, surveillance, response

Contributions of Animals to Society

- Food, nutrition, animal protein, prevent malnutrition
- Animal byproducts sold-- household income, livelihoods, money for food, education, health
- Work animals, power, energy, fuel/heat, assistance to people with disabilities
- Mental health, social relationships
- Ecosystem health, biodiversity, ecotourism, community and household livelihoods
- International trade, national revenues, national and global economies
- More

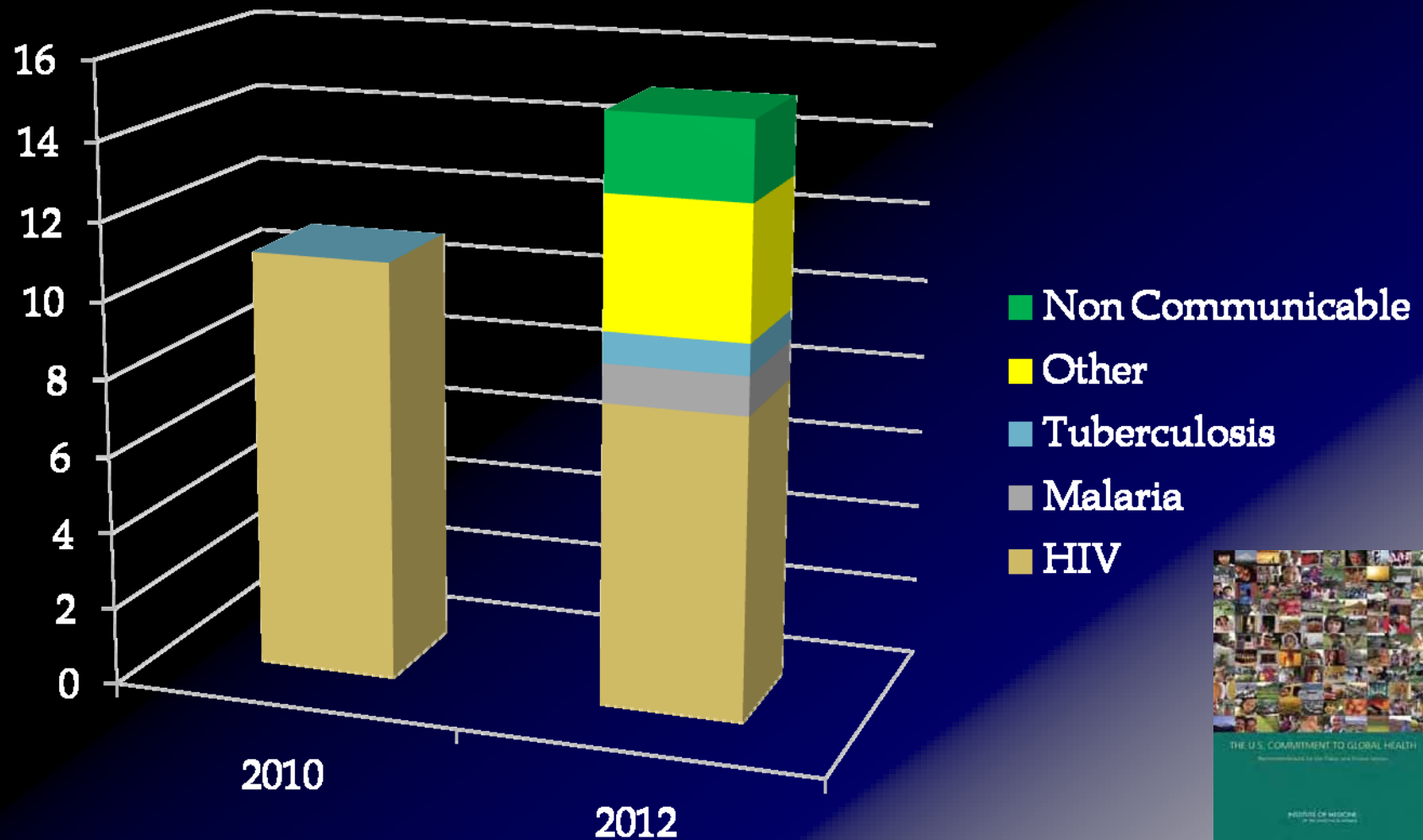
The Spectrum of Health Care



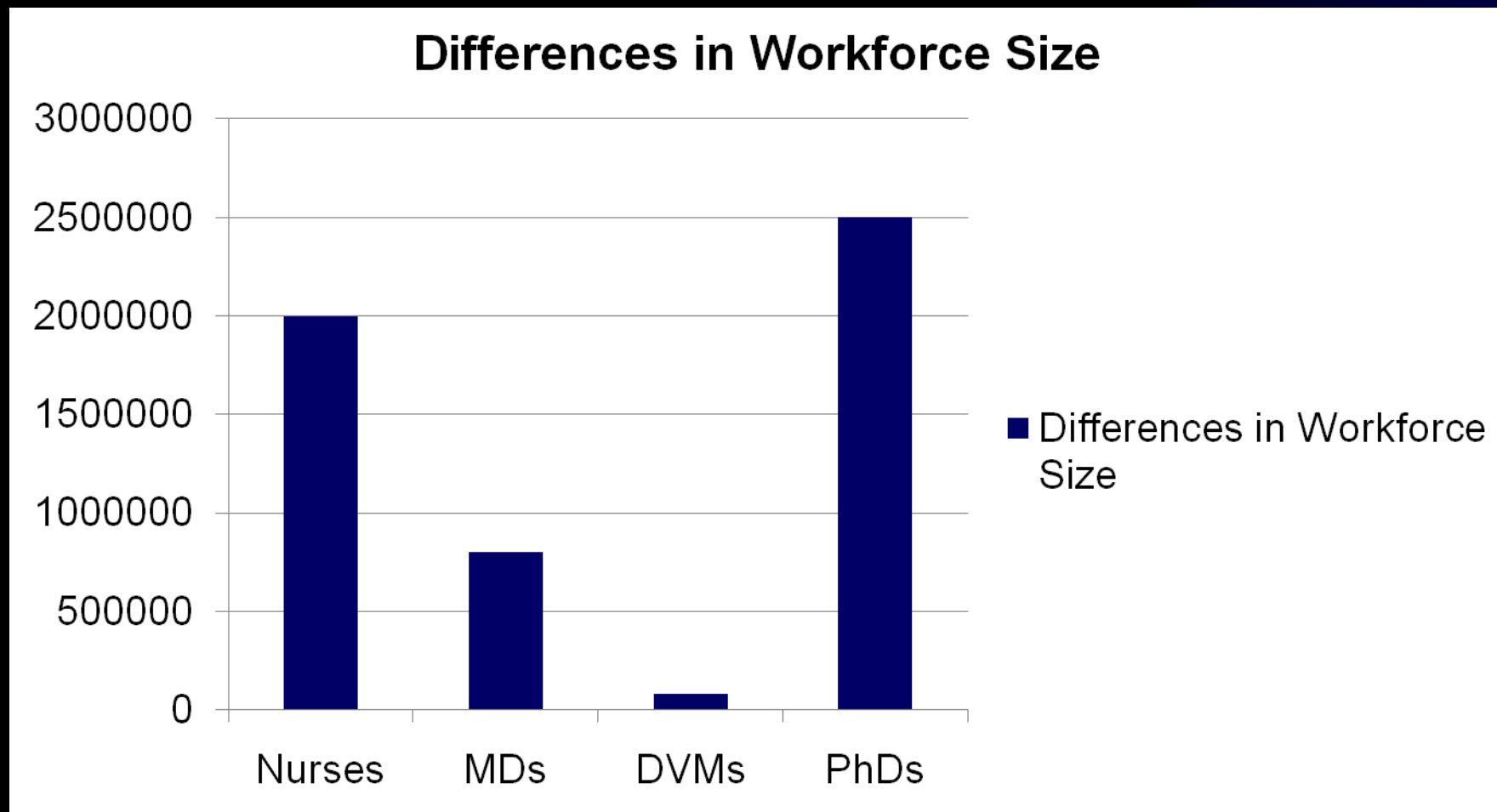
Prevention
Public Health

Treatment/Cure
Medical Care/
Service Delivery

Recommended Global Health Funding 2012 - \$Billions

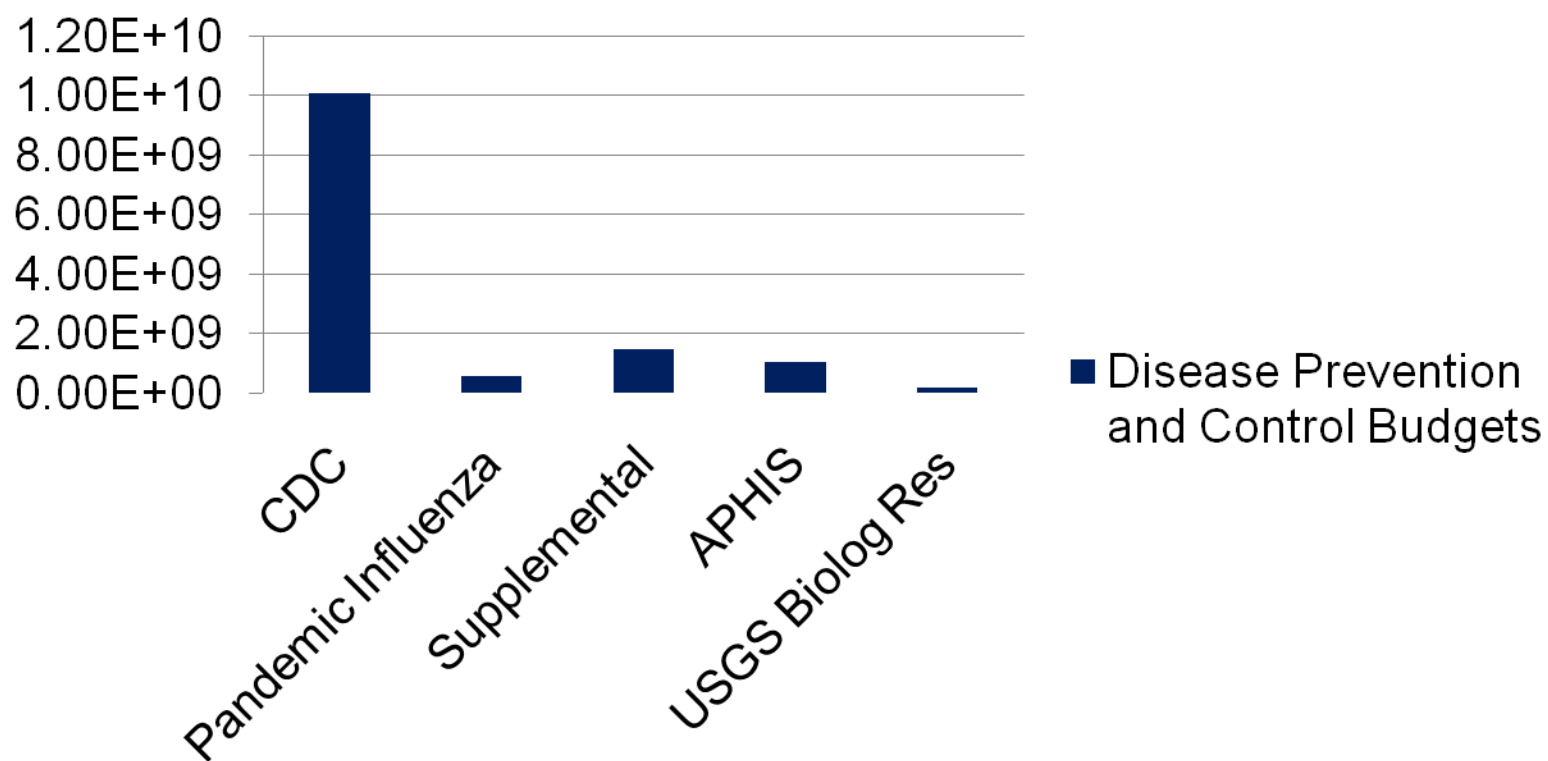


Differences in Workforce Sizes - US



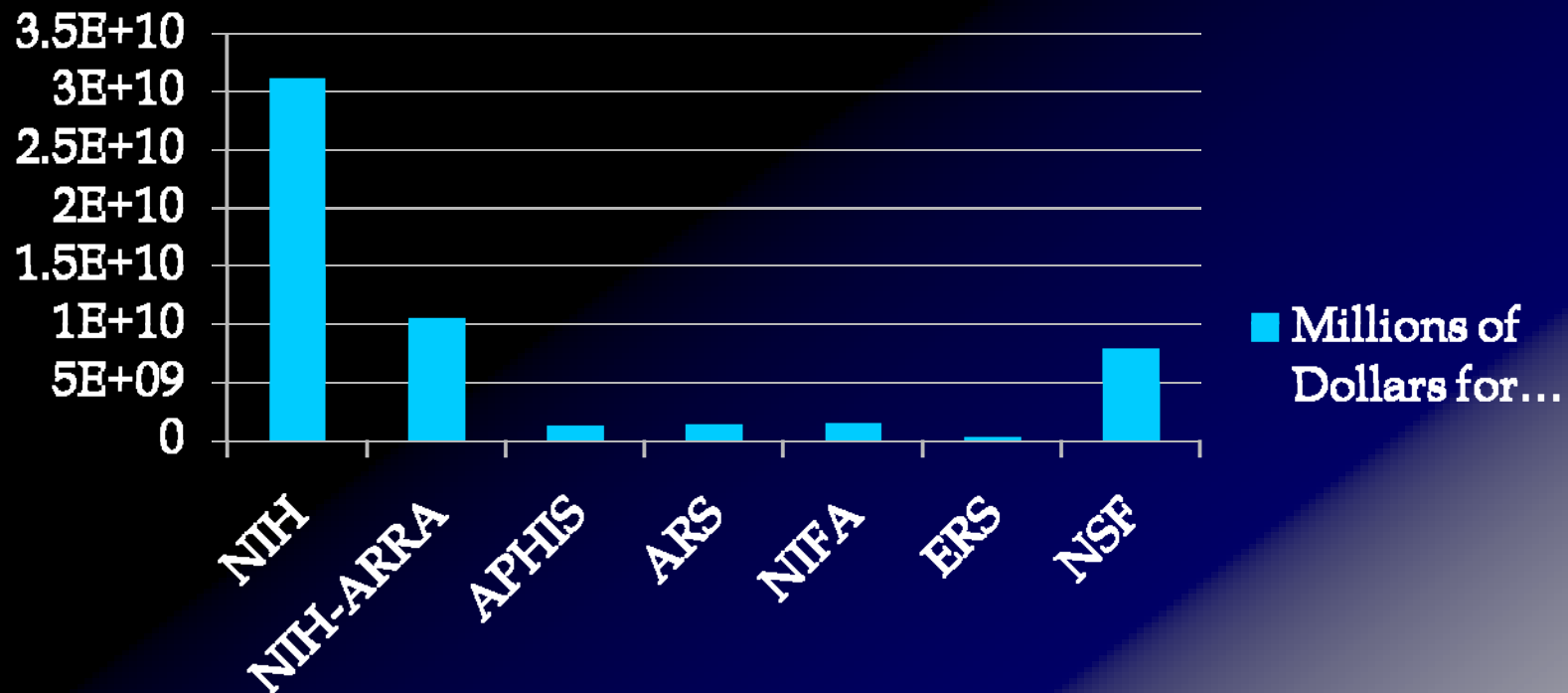
FY10 Budgets US Agencies Disease Prevention and Control

Disease Prevention and Control Budgets



FY-10 Budgets for Research, Selected Federal Agencies, US

Millions of Dollars for Research



Agents of Bioterrorism

Category	Bacteria, Rickettsia, Toxins	Viruses	Total (% Zoonotic)
A	Anthrax; Botulism; Plague; Tularemia	Smallpox Viral Hemorrhagic Fevers	6 (83%)
B	Brucellosis; Epsilon toxin of <i>C. perfringens</i> ; Glanders; <i>Staphylococcus</i> , enterotoxin B; Q Fever		5 (80%)
C	Multidrug-resistant tuberculosis	Hantaviruses; Nipah virus; Tickborne encephalitis viruses; Yellow Fever	4 (80%)

Committee Membership

GERALD T. KEUSCH (Co-Chair), Boston University, MA (MD)

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PETER DASZAK, Wildlife Trust, New York, NY (PhD, Wildlife health)

CORNELIS DE HAAN, The World Bank (retired), Washington, D.C. (economics, animal health)

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Mitigate Disease Threats from Wildlife & Trade

To mitigate and decrease the threat of zoonotic diseases emerging from wildlife, U.S. government entities and their international partners, especially OIE, should proactively take the following initiatives:

- a. Conduct a comprehensive review of federal and state laws on trade in wildlife as a prelude to optimizing the policy and regulatory options to: identify gaps and weaknesses in such laws; and enact new legislation, regulations, or administrative rule changes to strengthen the government's ability to protect human and animal health from diseases carried by traded wildlife through foreign commerce or in interstate commerce.
- b. Incorporate efforts and initiatives that support actions to prevent, prepare for, protect against, and respond to threats to human and animal health into current and new international negotiations and cooperative processes that address drivers of zoonotic diseases (e.g., exotic pet trade, food safety and security, environmental degradation, and climate change).

Recommendation 3-4 (cont'd)

- c. Pursue negotiations for a new international agreement on trade in wildlife species that improves international collaboration on reducing the threat that such trade presents to human and animal health. The objectives of the negotiations and the agreement would be to make wildlife-related zoonotic disease prevention and control a higher priority in the international management and control of legal and illicit trade in wildlife species, the production and distribution of food and animals, and environmental protection.
- d. Incorporate wildlife diseases and zoonoses into the OIE World Animal Health Information System (WAHIS), and integrate reporting on wildlife diseases and zoonoses in GLEWS. OIE should also expand the role and capability of its Working Group on Wildlife Diseases in order to meet more effectively the growing zoonotic threat wildlife diseases represent.