The One Health Opportunity – A Powerful Mechanism to Improve Global Health Outcomes
February 18, 2020

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The One Health Opportunity – Greatest Threats

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Director, Institute for Conservation Medicine
Anthropocene

- Significant, irreversible impacts
- Humans are the greatest threat to planetary health
- All major threats directly or indirectly related to human actions
The Anthropocene: Human Impact on the Environment

An epoch is one of the smaller divisions of geologic time. Our current epoch, the Holocene, began about 11,500 years ago. But there is growing evidence that we are entering a new epoch that could be named the Anthropocene because it is marked by extensive human impacts on the environment. This poster explores evidence that future geologists might use to define the Anthropocene.

Atmosphere
Air pollution has many components, like the emission of greenhouse gases that lead to climate change. Carbon dioxide from burning fossil fuels and changes in land use, nitrous oxide from the increased use of fertilizers, and methane from irrigated rice agriculture, cattle, and landfills are changing climate at a rate faster than most changes seen in the geologic record.

Invasive Species
One unintended consequence of extensive global trade and travel is the rapid spread of invasive species across many geographies. Invasive species change the species makeup of the environment, which will be detectable as fossils in the future.

Ocean
Overfishing decimates fish populations. Many traditional fisheries, such as the pelagic cod, have collapsed, causing immediate economic hardship and also reverberating throughout the marine ecosystem harming numerous other species.

Deforestation
Humans have drastically altered rivers and watersheds all over the world. More than half of all available fresh water is being used for agricultural, industrial, and municipal uses, drastically changing seasonal runoff patterns and downstream ecosystems.

Agricultural Land Use
Clearing native forests for agriculture or other human development reduces biodiversity and fragment habitats, impairing the ability of species to change their geographic ranges to adapt to global warming.

Defining the Anthropocene
Each geologic epoch is defined by a unique marker in the rock strata: the sharper and more global the marker, the better. Markers can be fossils of new forms of life, or a chemical signal—like the high concentration of the element iridium produced when an asteroid hit Earth 66 million years ago, leading to a mass extinction.

Scientists are considering what the most useful markers for the beginning of the Anthropocene will be. Candidates include roads, microplastics, mercury from air pollution, and radionuclides from nuclear weapons testing. Various markers would put the start of the Anthropocene as early as the beginning of the industrial revolution or as recently as the beginning of widespread globalization in the 1990s.

What will characterize the fossil record of the Anthropocene? Our actions could determine whether the epoch is marked by diminishing biodiversity or even a mass extinction.
Anthropocene in the news
Greatest Threats

- Climate change
- Emerging, re-emerging infectious diseases
- Biodiversity and natural resource loss
  - The sixth mass extinction event
- Land degradation and human expansion
- Food security
- Pollutants
- Wealth inequality
- Science denialism
- And many more!
Greatest Threats

Plastics
Climate Change
One Health
Species Loss
Pollution
Inequality
Invasive Species
Food Security
Habitat Fragmentation
Human Poverty
7.6 Billion People
Re-emerging
Infectious Disease
Zika Virus
Climate warming directly impacts health

* By 2100, 74% of world population will be experiencing deadly heat waves (Mora et al. 2017)
Global health impacts of climate change

- Loss of communities, habitable land
- Loss of arable land $\rightarrow$ food security
- Climate-related violence and climate refugees
- Extreme weather events
- Loss of natural resources and biodiversity
- Movement of species, spread of infectious diseases
Australian Wildfires

Emerging Infectious Diseases

75% human EID are from animals
70% human EID from wild animals
Wildlife Trade

- Wet Markets
- Extinction and Disease
- Crime

Coronavirus link?

https://globalstory.pangolinreports.com/#malaysia-thai-border
Animals across the globe

2000-2006 in USA

120,000,000 LIVE wildlife individuals

25 million kilograms of non-live wildlife products

Smith et al. (2012) PLoSOne
Biodiversity Loss

- Climate change
- Habitat loss
- Pollution
- Invasive species
- Infectious Diseases

The Sixth Mass Extinction

Since 1970, we’ve lost 52% of the Earth’s bird, mammal, fish, reptile and amphibian populations:

- 39% for land-based species
- 39% for marine species
- 76% for freshwater species

SOURCE: World Wildlife Fund

USA TODAY
Disease threats and biodiversity conservation

- Ebola in great apes
- Fibropapillomatosis in sea turtles
- Rabies and canine distemper in wild carnivores
- Chytridiomycosis in amphibians
- Devil Facial Tumor Disease in Tasmanian devils
- White nose syndrome in bats
- Colony Collapse Disorder in bees
Not just for “conservationists”
Feeding 7.6 billion and counting
Increased Meat Consumption and One Health

- **Animal**
  - Loss of biodiversity
  - Welfare issues
  - Disease transmission

- **Environmental**
  - Water and land resources
  - Waste and pollution
  - Climate change

- **Human**
  - Obesity
  - Heart disease
  - Diabetes
  - Colorectal cancer
  - EIDs
Impacts on marine food webs

- Fisheries
- Seabirds
- Food webs
- Chemical compounds from plastics
EDCs in wildlife

BPA Turtle Study

Modified from: Jandegian, CM, et al. 2015.
General and Comparative Endocrinology.

Effects of the environmental estrogenic contaminants bisphenol A and 17α-ethynyl estradiol on sexual development and adult behaviors in aquatic wildlife species

Ramji K. Bhandari, Sharon L. Deem, Dawn K. Holliday, Caitlin M. Jandegian, Christopher D. Kassotis, Susan C. Nagel, Donald E. Tillitt, Frederick S. vom Saal, Cheryl S. Rosenfeld.
Human impacts from EDCs

What Endocrine-Disrupting CHEMICALS ARE DOING TO YOUR BODY

- Phytoestrogens
- Polychlorinated Biphenyls (PCB)
- Polyaromatic Hydrocarbons
- Pesticides

Dr. Axe

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Global Health
Introduction to One Health
An Interdisciplinary Approach to Planetary Health

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            drsharondeem.com

Thank You
The Value of One Health for Strengthening Health Security

February 18, 2020

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Health-Benefitting Ecosystem Services

All are forms of health security!
Health of Environment, Animals, and People

![Image of polluted environment with a pie chart showing deaths attributable to the environment (12.6 million) and not attributable to the environment (43 million)].

- Deaths (millions), 2012
  - Attributable to the environment: 12.6 million (22.7%)
  - Not attributable to the environment: 43 million

![Image of a cyclist in a polluted urban environment with text about the most known human infectious diseases shared with animals].

- Most known human infectious diseases are shared with animals:

- Shared with animals (61%)
- Not known to be shared (39%)

Resulting in over 1,000,000,000 human cases every year.
Economic Cost of Disease Outbreaks

High cost of epidemics: *Impacts often extend far beyond the health sector*

Figures are estimates and are presented as relative size. Based upon BioEra, World Bank, and UNDP data. Chart updated by EcoHealth Alliance.
Moving from Disease Response to Prevention

Key role for One Health approaches to help achieve health security gains

Source: Karesh et al. 2012. The Lancet & WHO
Shared Drivers: Biodiversity Loss and Recent EIDs from wildlife

- Land use changes
- Food industry changes
- Human susceptibility to infection
- Agricultural industry changes
- International travel & commerce
- War & famine
- Unspecified
- Climate & weather
- Breakdown of public health measures
- Bushmeat
- Human demographics & behavior
- Medical industry changes
- Antimicrobial agent use
- Other industries

EcoHealth Alliance/Loh et al. VBZD, Jones et al. 2008 Nature
Country-Level Drivers of Disease Emergence

- Land use changes: 26%
- Agricultural intensification: 18%
- Human susceptibility to infection: 13%
- Food industry changes: 13%
- Antimicrobial agent use: 7%
- War and famine: 4%
- Bushmeat: 2%
- Other: 17%

[Map showing distribution across countries]
Global Health Security Agenda

A partnership against global health threats

Action Packages

- Antimicrobial Resistance
- Biosafety & Biosecurity
- Immunization
- Sustainable Financing
- Surveillance
- Workforce Development
- Zoonotic Disease

(multi-sectoral) National Action Plans for Health Security (NAPHS)

Countries working together on commitments to the Global Health Security Agenda

Prevent  | Detect  | Respond
## Supporting Functions for Health Security

### Cross-cutting Functions
- Governance: leadership, policy, statute, regulation, enforcement
- Resource allocation and coordination
- Community engagement and resilience
- Risk communication and education
- Workforce development and sustainment
- Research and development
- Data and information management

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Carlin et al. 2019 *Building Resilience to Biothreats*
• Not everyone working together all the time....

• But strong human, animal and environmental health systems are needed to determine relevant sectors for a given objective, disease, or situation
Context Matters! Rift Valley Fever

Value-added information sharing between sectors to understand the ecology, epidemiological, and economics of Rift Valley Fever

Graphic: M. Rostal
National One Health Coordination

Priority issues for multi-sectoral coordination: individual sectors may have different roles, but generate synergies from a shared vision.

‘All hands on deck’ sentiment for more routine coordination in emergencies and in peacetime.

Example:
One Health Governance structure, Uganda
Early Warnings from Wildlife and Effective Collaboration to Prevent Human Outbreaks

Yellow Fever is a mosquito-borne virus that infects humans as well as non-human primates, potentially resulting in hemorrhagic fever leading to death. Yellow Fever transmission can occur if infected monkeys and any of the mosquito vector species are present. In 2012, after One Health training by partners from the PREDICT program, staff at a wildlife sanctuary in Santa Cruz, Bolivia, reported six dead Howler Monkeys near the park. Early investigation during specimen collection and analysis at University of San Andres’ Institute of Molecular Biology suggested that the infection was associated with a Flavivirus (a family of viruses transmitted from mosquitoes or ticks). PREDICT partners alerted the Bolivian Ministry of Health while conducting further analysis for the specific pathogen — ultimately identified as Yellow Fever virus. A transdisciplinary, collaborative and coordinated response was undertaken in the region, including preventive human vaccination campaigns, mosquito control, and public outreach. Although infected monkeys had never been previously reported in Bolivia, the response to this outbreak was rapidly mobilized — within eight days from the detection to resolution of the outbreak. No human cases were reported, suggesting the benefit of awareness of risks, early warning systems in animals (including local laboratory capacity to screen for pathogens), and effective collaboration channels with a wide range of partners.
Risk Communication

Coordinated Messaging to Reduce Disease Risk and Promote Biodiversity
Projected Impacts of Climate Change

- 5% increase in people at risk of malaria exposure
- 10% increase in diarrheal disease burden
- 7.5 million more stunted children
- Direct health damages of US$2-4 billion
- Up to equivalent of 20% in labor productivity losses in some regions from excess heat
- 100 million into extreme poverty

Undermines Sustainable Development

World Bank 2018

Background map of average rainfall anomalies from Dr. Assaf Anyamba, et al., PLOS Neglected Pathogens, 2012.

Shades of yellow to red indicate below normal rainfall and blue to green indicate above normal.
Local Health Security: Call to Action

Cancer Town

'Almost every household has someone that has died from cancer'
A small town, a chemical plant and the residents' desperate fight for clear air

Louisiana has the most toxic air in America
Mainstreaming One Health Across Sectors

A multisectoral, One Health approach can help optimize sustainable development for a healthy, safe, and equitable future.
Getting Involved in the GHSA

- Alliance for Health Security Cooperation
- GHSA Consortium
- GHS Next Generation Network
Additional Tools and Information
One Health, Here, There and Everywhere: Why it is ‘so’ urgent!

February 18, 2020
Collaborations start with Relationships!!
Which start when we come together in direct conversations.
One Health Truths

Need for Reframing of human attitudes
Many faces (arenas in need) of One Health

- Animals as Sentinels
- Antimicrobial Resistance
- Bio-Diversity/Conservation Medicine
- Bio-Surveillance
- Climate Change
- Civil Society
- Comparative Biology
- Disaster Preparedness/Relief
- Economics/Complex Systems
- Food & Water Safety/Security
- Human – Animal Bond
- Non-Communicable Diseases
- Plant & Soil Health
- Vector-borne Diseases/Climate Change
- Welfare/Well-being of animals, humans, planet
- Zoonotic Diseases
Many faces (arenas in need) of One Health

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Zoonotic Diseases

Why Support Global Health?
## Economic Benefits of One Health

<table>
<thead>
<tr>
<th>Examples of outbreaks</th>
<th>Type of impact</th>
<th>Magnitude of impact (US$ billion)</th>
<th>Number of cases</th>
<th>Cost/ case, US$ 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small public-health impact</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SARS in 37 countries (2003)</td>
<td>Economic cost</td>
<td>40-54 a/</td>
<td>8,096</td>
<td>4,941</td>
</tr>
<tr>
<td>Ebola in West Africa (2013-16)</td>
<td>Comprehensive cost</td>
<td>53 c/</td>
<td></td>
<td>1,850</td>
</tr>
<tr>
<td>Large public-health and economic impact</td>
<td>Response cost only</td>
<td>563 e/</td>
<td>76 m</td>
<td>7,395</td>
</tr>
<tr>
<td>AIDS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catastrophic public-health and economic impacts (pandemics)</td>
<td>Economic cost (ongoing, annual expected value)</td>
<td>80 f/</td>
<td>~30% of population</td>
<td>~37</td>
</tr>
<tr>
<td>Flu pandemic (or similar disease)</td>
<td>Comprehensive cost (annual)</td>
<td>570 f/</td>
<td></td>
<td>~265</td>
</tr>
</tbody>
</table>

Notes and sources:
- f/ Severe and moderately severe pandemics, with annual probabilities of 1.5% & 2.0%, respectively. Pan, V., Jameison, D., & Summers, L. (2016). The Inclusive Cost of Pandemic Influenza Risk. NBER Working Paper No. 22137. Based on average-case scenario of the World Bank, with economic impact of 4.5% of GDP. A novel flu strain is considered most likely, but other pathogens cannot be excluded. They will most likely originate in animals (like novel flu strains). Thus, “similar disease” refers e.g. to a coronavirus with similar transmissibility and severity as a severe flu. See also (28) and (37).

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**Funding for One Health Capacities in Low- and Middle -Income Countries** Jonas, O, Published online Jan 15, 2020, Narratives of One Health in Action, One Health Commission website https://tinyurl.com/wzwc7jm
Economics of One Health: Costs and benefits of integrated West Nile virus surveillance in Emilia-Romagna


doi:10.1093/trstmh/trx039

One Health Economics to confront disease threats

Catherine Machalaba, Kristine M. Smith, Lina Awada, Kevin Berry, Franck Berthe, Timothy A. Bouley, Mieghan Bruce, Jose Cortinhas Abrahantes, Anas El Turabi, Yasha Feferholtz, Louise Flynn, Guillaume Fournier.

One Health 7 (2019) 100000

Prevent, Prepare and Respond: Economics of One Health to Confront Disease Threats

30 January – 2 February 2017

Workshop Report

Economic Benefits of One Health

This compilation of publications focuses on the Economic Benefits of using a One Health approach.

If you are aware of additional publications on the Economics of One Health that need to be included here please notify cstroud@onehealthcommission.org

2019

Infectious disease and economics: The case for considering multi-sectoral impacts,
https://doi.org/10.1016/j.onehlt.2018.10.008

2018

Societal cost of zoonoses: One Health economics
Article from free online course ‘One Health: Connecting Humans, Animals and the Environment’
Accessed 2-4-19, https://www.futurelearn.com/courses/one-health/10/steps/54580

2018

Economics of bovine tuberculosis: a one health issue.
Azami HY, Zinsstag J, Chapter 3 (Page no: 31) in Bovine Tuberculosis
https://www.cabi.org/vetmedresource/ebook/20183117957

2017

One Health education for future physicians in the pan-epidemic “Age of Humans”,

Incorporating One Health into Medical Education,
Rabinowitz PM, Natterson-Horowitz BJ, Kahn LT, Kock R, Pappasian A, BMC Medical Education. 2017 Feb 23; 17: 45
https:// commons.bmc.edu/bmcmedcentral/articles/10.1186/s12917-017-0883-6

2016

One Health Core Competency Domains,
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5020065/

Core competencies and One Health: From theory to action,
Fenwick S, 2016, FPT Presentation at the USAID One Health Workforce Meeting, Hanoi, Vietnam.
Antibiotic resistance is the quintessential One Health issue

In May this year, the long-awaited final report from the Review on Antimicrobial Resistance was published. The report estimates that the 700,000 annual deaths currently attributable to infections by drug-resistant pathogens will increase, if unchecked, to 10 million by 2050, running up a bill of US$100 trillion in terms of lost global production between now and then. The reported numbers are somewhat
The microbial community in the ground is as important as the one in our guts.

The Atlantic, Jun 11, 2013
https://theatln.tc/2rWtDX8
Food and Water Safety and Security

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

INVITATION

The Smart Women, Smart Power Initiative cordially invites you to

Food Insecurity as a Security Challenge
Disaster Preparedness / Relief

Lessons from Katrina, a game changer in disaster preparedness and response –
Don’t Show Up without pet carriers!!!
Disaster Preparedness / Relief

2009 Hurricane Floyd
Governors and Mayors!

CDC will never be in charge!

U.S. Constitution would have to be rewritten or amended to make public health a federal responsibility!

10th Amendment in Bill of Rights

By default, public health is a state and local responsibility.

Each state has developed its own public health laws.

Slide content courtesy of Laura Kahn
Animals as Sentinels

Elevated PBDE Levels in Pet Cats: Sentinels for Humans?


U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Experimental Toxicology Division.


Serum PBDEs in a North Carolina Toddler Cohort: Associations with Handwipes, House Dust, and Socioeconomic Variables

Heather M. Stapleton, Sarah Eagle, Andreas Sjödin, and Thomas F. Webster

1Nicholas School of the Environment, Duke University, Durham, North Carolina, USA; 2Centers for Disease Control and Prevention, Atlanta, Georgia, USA; 3North Carolina State University, Raleigh, North Carolina, USA; 4University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA; 5Centers for Disease Control and Prevention, Atlanta, Georgia, USA; 6North Carolina State University, Raleigh, North Carolina, USA.


U.S. domestic cats as sentinels for perfluoroalkyl substances: Possible linkages with housing, obesity, and disease.

Bost PC, Strynar MJ, Reiner JL, Zweigenbaum JA, Secoura PL, Lindstrom AB, Dye JA.
Humans ??? as Sentinels

The 1999 West Nile Story in the US

Tracy McNamara: (Human) Canaries in the Coal Mine

Our current funding structures are the opposite of One Health. They virtually guarantee that we will not find an emerging zoonotic threat until we have people in emergency rooms or bodies in the morgue.

June 21, 2018  https://www.youtube.com/watch?v=qm8NnL582uc&t=61s
Humans ??? as Sentinels

Does it matter that in cities around the US, all the animals (shelters, wildlife, pets) do not fall under Jurisdiction of ‘Any’ federal agencies and therefore are not under any form of surveillance?

Yes!!!!!!........Why?
Humans ??? as Sentinels

“The threats we face today have changed and evolved... but our systems have not. We are left with a species gap. CDC focuses on human diseases; it does not do animal diseases.”

“What if?”

What if that flu in cats in a shelter in New York in 2017 had turned out to be like the 1918 flu pandemic?

What if the zoonotic coronavirus we are facing today turns into a similar pandemic?

We are missing what is right in front of our noses....

.........All the animals in our environment.

In the US right now we are looking for aerosolized bacteria .................. and dead people.

We are using taxpayers as ‘sentinels’.
Stark Reminders - why we urgently Need to implement One Health

We are NOT Ready!!

April 3, 2015  Bill Gates: The next outbreak? We’re not ready
https://www.youtube.com/watch?v=6Af6b_wyiwI

January 2017  Bill Gates: A deadly epidemic is a real possibility and we are not prepared
https://goo.gl/uZxp86

April 27, 2018  Bill Gates: A coming disease could kill 30 million people within 6 months — and we should prepare for it as we do for war
https://read.bi/2CSpV7x

The Star, Kate Allen, Feb 2, 2020
What can we DO!!!!
Education - Global One Health Day

ANNUAL one health DAY
November 3

Promoting efforts around the world to bring together all human, animal, and environmental health disciplines.

Created and Hosted by:

check www.onehealthday.org for more information

http://bit.ly/2QYAaeD
Education — Cradle to Grave

The World We Need
PREPARING SOCIETY TO CREATE THE WORLD WE NEED THROUGH ONE HEALTH EDUCATION

INTERNATIONAL
ONE HEALTH for ONE PLANET EDUCATION INITIATIVE
(1 HOPE)

VISION
A world where people of all ages embrace a One Health & Well-Being (OHWB) approach recognising the interdependencies among humans, animals, plants and their shared environment.

AIM
Build global capacity for promoting and valuing the OHWB concept and approach as the foundation for achieving the UN-2030 Sustainable Development Goals (SDGs).

CONTRIBUTORS
Individuals/organisations from education and community groups invited from all global regions – Africa, Americas, Asia, Europe, Middle East, Oceania.

1HOPE - Community /Civil Society
1HOPE - Corporate
1HOPE - Government/Advocacy/Policy
1HOPE - Primary/Secondary
1HOPE - Tertiary
Education—(Public)—This Exhibit can Travel

OUTBREAK
Epidemics in a Connected World
Open May 18, 2018 - 2021, Second Floor

One World
One Health

"Human or livestock or wildlife...can't be discussed in isolation. There is just one health."
—William R. Raves, Infectious Disease Expert

ONE HEALTH means that animal, human, and environmental health are connected. ONE HEALTH is a way of seeing why disease outbreaks occur when and where they do, and how to stop them from spreading.
One Health Federal Inter-Agency Network

Overview:

One Health recognizes the health of people is connected to the health of animals and the environment. It is a collaborative, multisectoral, and transdisciplinary approach—working at the local, regional, national, and global levels—with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment.

A One Health approach is important because 6 out of every 10 infectious diseases in humans are spread from animals.

Learn more about One Health.

https://www.cdc.gov/onehealth/index.html
To establish in the US an Inter-Agency One Health Program
One Health Awareness Month
January 2020 (in the US and Beyond)
ISOHA has created an instructional document on how to pursue legislative or executive branch advocacy for One Health initiatives. While focused on government advocacy in the United States, this document may also be helpful for those planning One Health advocacy in any country. http://bit.ly/2B3aLek
US CDC - One Health Zoonotic Disease Prioritization
One Health reports for:

- Burkina Faso
- Cameroon
- Côte d’Ivoire
- Ethiopia
- Mozambique
- Pakistan
- Tanzania
- Uganda

Also working to Implement One Health at Government Level:

- Northern Ireland
- Nigeria
- Rwanda
- Thailand
- Viet Nam
- Others???
One Health Truths

One Health is a pathway to both Planetary Health and Global Security
Collaborations start with Relationships!!
Which start when we come together in direct conversations
One Health Truths

Heal the Past......

Live the Present....
One Health, Here, There and Everywhere:
It’s Urgent!
and
It’s Up to US!!
to make One Health the default way of doing business around the world!!
One Health, Here, There and Everywhere:
It is urgent on ‘so’ many fronts

Thank you

For listening

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Q&A

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