Building Resilience Against Outbreaks & Pandemics

Research to identify sustainable solutions

The 3rd Global Research and Innovation Forum
Human-animal-environment interfaces in a changing world: how to mitigate emerging risks?

Key research achievements / Progress update

24 October 2023

William B. Karesh
EcoHealth Alliance
The human-animal-environment interface

Vectors
Wildlife
Domestic Animals
Example mpx: The risk of spillover

While our understanding of human-to-human transmission grows, there remains limited knowledge on the reservoir of MPXV and major spillover pathways, hampering the development of risk mitigation strategies.
Example SARS-CoV-2: The risk of spillback

Wildlife

Humans

Domestic Animals

Reservoir formation

Ecological impact

Viral evolution
Example SARS-CoV-2: The risks

- Reservoir formation
- Ecological impact
- Viral evolution

Wildlife

Humans

Domestic Animals

Wildlife interaction
Example SARS-CoV-2: The risks

- Reservoir formation
- Ecological impact
- Viral evolution

Wildlife

Humans

Domestic Animals
Example SARS-CoV-2: The risks

Wildlife

Humans

Domestic Animals

Reservoir formation

Ecological impact

Viral evolution

From Telenti et al., 2021

From Pickering et al., Nov 2022, Nature Microbiol
Lessons learned

• There is an urgent need to increase integrated targeted surveillance for zoonotic pathogens in animals (especially farmed animals and wildlife)

• Novel animal hosts and human behavior have the potential to drive pathogen evolution – molecular surveillance can enable early detection

• Institutionalized collaboration between all sectors involved in zoonotic disease management is required for efficient outbreak response
One Health Approach
One Health Approach to Zoonotic Diseases

Assess collaboration through joint review of SPAR, JEE & PVS and other OH reports

Jointly Plan during National Bridging Workshops

Implement roadmap Following the guiding lines of the TZG

Address specific OH needs Using the TZG Operational tools
Key achievements and gaps

Integrated, targeted surveillance in animals
- Launch of Tripartite joint call for increased SARS-CoV-2 surveillance in susceptible wildlife
- Surveillance in animals remains underfunded and scattered offering a blind spot for pathogen emergence

Monitoring of Pathogen evolution
- Due to the limited surveillance monitoring remains scattered
- For SARS-CoV-2 there is a rising number of evidence that viral evolution is driven during adaptation to novel animal hosts

Increasing One Health capacities
- Tripartite have rolled out National Bridging Workshops in 46 countries.
- > 20 countries have installed a One Health catalyst
- > 50 countries have used the Tripartite Zoonosis Guide (TZG) operational tools
- Tripartite→Quadripartite
Threats in a Changing World

Research to develop new opportunities for innovative mitigation interventions
24 October 2023

Serge Morand
*CNRS, Montpellier University and OHHLEP*

Catherine Machalaba
*EcoHealth Alliance and OHHLEP*
An increasing number of outbreaks

Outbreaks of zoonotic diseases
1960-2019

Outbreaks of vector-borne diseases
1960-2019

Outbreaks of livestock - poultry diseases
2005-2019

Outbreaks of wildlife diseases
2005-2019

Data source: GIDEON

Data source: OIE-WAHIS
An increasing number of livestock and poultry
A planet dominated by livestock and poultry

Increasing epidemics

Increasing biodiversity loss

Total heads of poultry and wild birds (billion in log)

Biomass (in billions kg)
From Outbreak Response to Preventive Action

We can reduce the frequency and impact of outbreaks

**FIGURE 6.**
One Health investment framework to reduce pandemic risk

Investment framework to mobilize finance for pandemic prevention
Targeting Hotspots

Equity considerations:
- Access to diagnostics
- Access to health care
- Training and workforce
- Food security
- Livelihood options
- Land rights

Allen et al. Nature Comm. 2017
# Key Interface

**Tailor your approach based on the relevant source(s) of risk**

<table>
<thead>
<tr>
<th>Interface</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Tourism                                        | • Encroachment into caves  
• Wildlife selfies                                                          |
| Communities living in/around conserved areas   | • Agriculture (e.g., livestock rearing, crops)  
• Housing  
• Food acquisition and food preparation                                           |
| Natural resource extraction                    | • Commercial/concession-based logging, mining, and oil and gas extraction  
• Guano harvest                                                                |
| Access and resource use                        | • Informal (e.g., artisanal) mining  
• local clearing (e.g., for charcoal)  
• Subsistence and non-subsistence wildlife hunting and fishing                  |
| Research                                       | • Biological sampling and disease investigation                          |
| Biodiversity management                        | • Reintroduction/translocation  
• Introduction and establishment of invasive alien species (and biological measures to control them) |
Risk Reduction Indicators

**Prevention of Zoonotic Spillover**

**From Relying on Response to Reducing the Risk at Source**

OHHLEP whitepaper/Opinion piece

**Box 1. Prevention of Zoonotic Spillover to Humans**

- Prevention of pathogen spillover from animals to humans; shifting the infectious disease control paradigm from reactive to proactive (Primary prevention). Prevention includes addressing the drivers of disease emergence, namely ecological, meteorological and anthropogenic factors and activities that increase spillover risk, in order to reduce the risk of human infection. It is informed by, amongst other actions, biosurveillance in natural hosts, people and the environment, understanding pathogen infection dynamics and implementing intervention activities.

**Intermediate Indicators**

- Number of risk-driving practices identified
- Number of actions taken to address risk-driving practices
- Number of sectors/stakeholder groups engaged in spillover risk reduction efforts
- Amount of financial resources allocated to spillover prevention
- Spillover risk mapped and up to date
- Spillover interfaces (places and activities) identified at national or subnational levels
- Risk assessment(s) conducted and up to date for zoonotic pathogens at each specific spillover risk interface identified
- Spillover risks considered in land use and other development projects planning and impact assessment criteria
Development Project Impact Assessment

Awareness

Coordination

Safeguards

Mitigation measures

Incentives and liability

Image credits: Arcelor Mittal; The Washington Post; IDEEAL project
Community- and Industry-Driven Solutions

- Empower communities and industries to reduce risk
- Broaden the One Health workforce
- Invest in social sciences
- Many solutions are needed!

Safe viewing platform - Uganda

https://www.silverbackgorillatours.com/uganda/maramagambo-forest
Early Warning for Prevention and Response

Examples of likely effects from El Niño Southern Oscillation on health and wild populations.

Background map of correlation between sea surface temperatures and rainfall anomalies from Dr. Asaf Aryaiba et al., PLoS Neglected Pathogens, 2012.

Shades of yellow to red indicate negative correlations and blue to green positive correlations.
Remember...Context Matters!

Using a One Health Approach for pandemic risk reduction:

- Understand risks more comprehensively
- Determine baseline capacity
- Identify relevant sectors, stakeholders, and entry points
- Assess feasibility and acceptability of potential solutions: trade-offs and co-benefits
- Advance equity

Register at: https://forms.gle/9wpur8fnaMf9VCHc9

Please join the South African Agricultural Research Council and its partners!