



Emerging Threats: Re-Imaging the Boundaries and Purpose of Surveillance for Emerging Threats

Lessons from Avian Influenza

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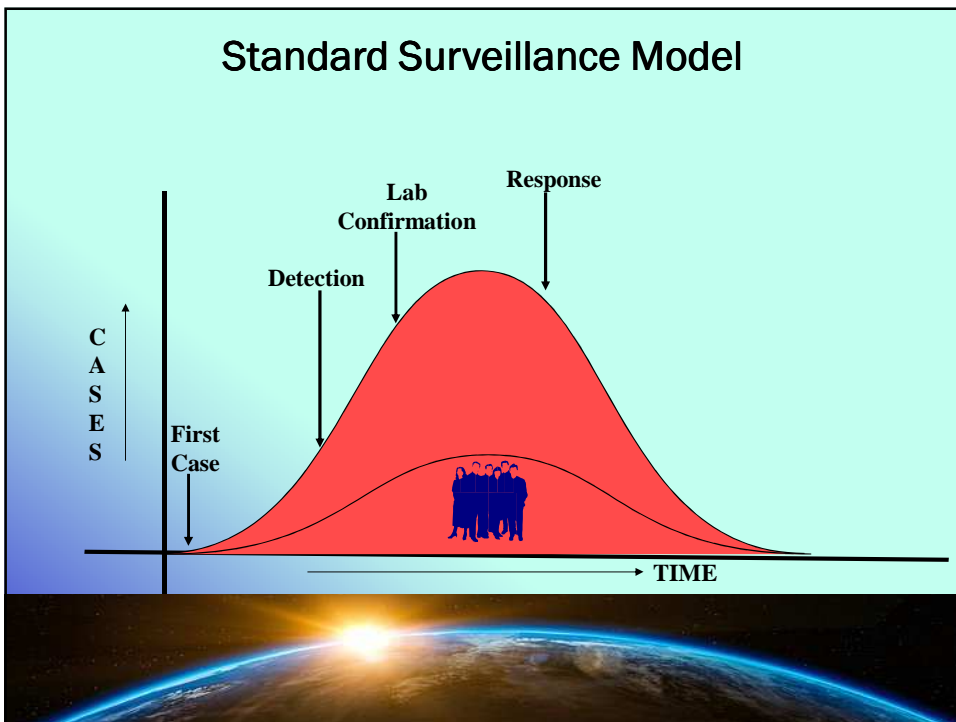


5 Core Take Home Messages

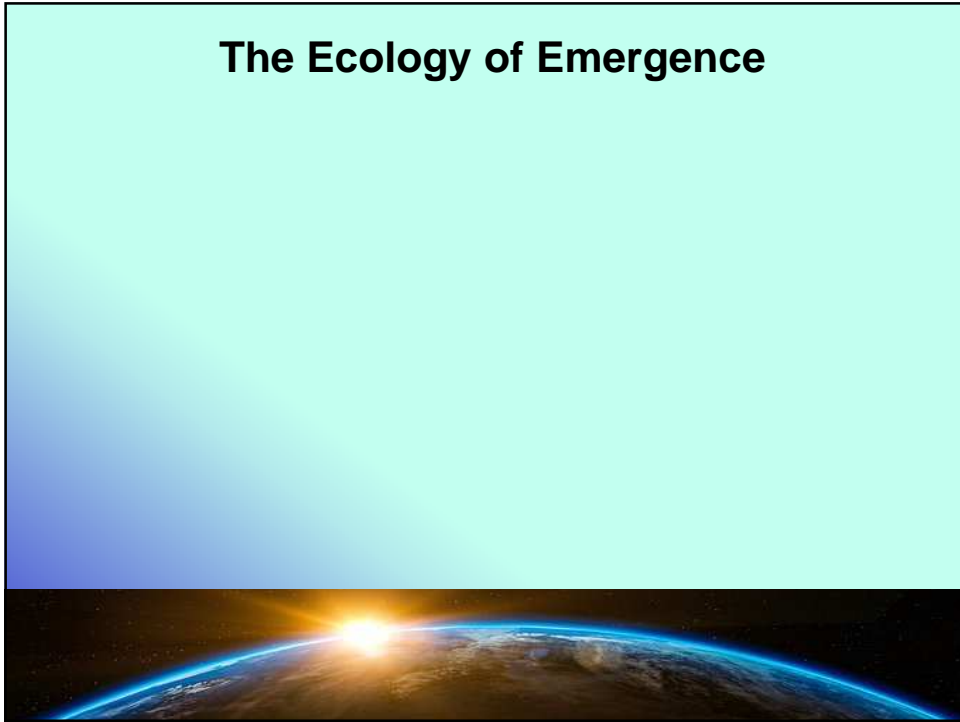
- Rapid response to AI has led to dramatic advances in understanding the “drivers” of disease emergence
- This enables “targeting” of surveillance to those “places, populations and times” where the risk of emergence is greatest
- Key is recognizing that three-quarters of all new diseases emerge from animal reservoirs
- This in turn enables surveillance efforts to focus on where and when new disease may emerge BEFORE they emerge and pose a global threat
- Importantly, this also allows for introducing interventions to “disrupt” disease emergence at its source – preventing future threats



Standard Surveillance Model



The Ecology of Emergence



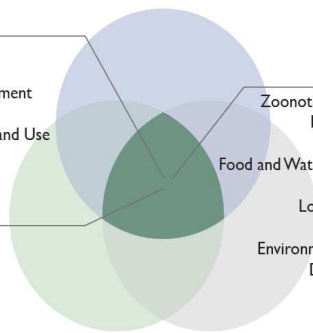
Ecological Drivers Underlying Disease Emergence

Drivers

Land Use
Climate Change
Economic Development
Globalization
Energy Extraction and Use
Migration

Influences

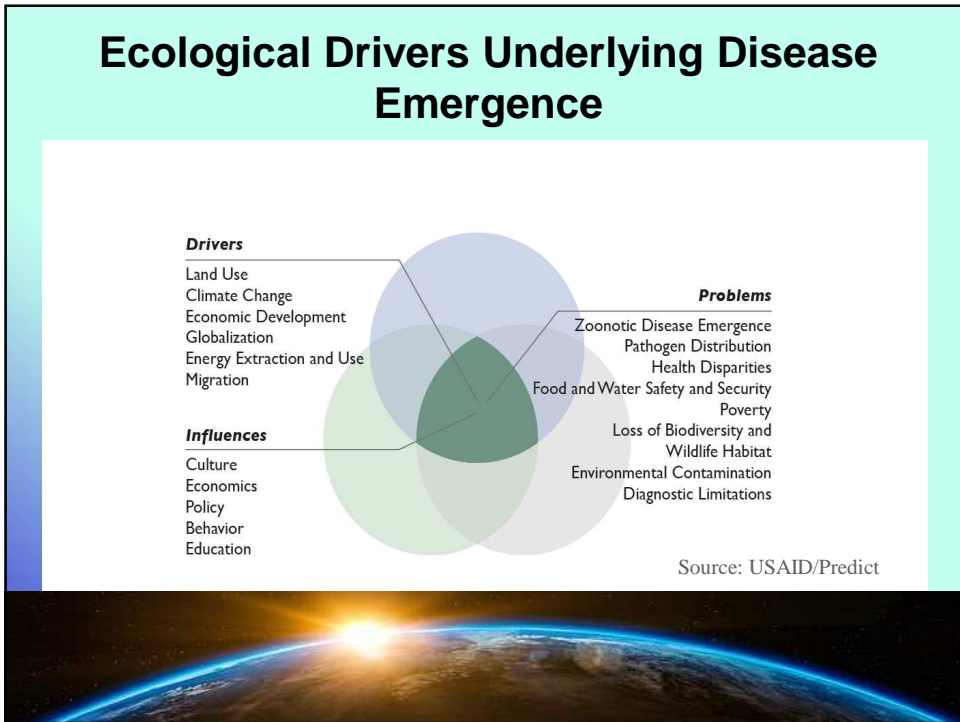
Culture
Economics
Policy
Behavior
Education



Problems

Zoonotic Disease Emergence
Pathogen Distribution
Health Disparities
Food and Water Safety and Security
Poverty
Loss of Biodiversity and
Wildlife Habitat
Environmental Contamination
Diagnostic Limitations

Source: USAID/Predict



Geographic “Hot Spots” – For Disease Emergence

Predicted Relative Risk of Zoonotic EID Events

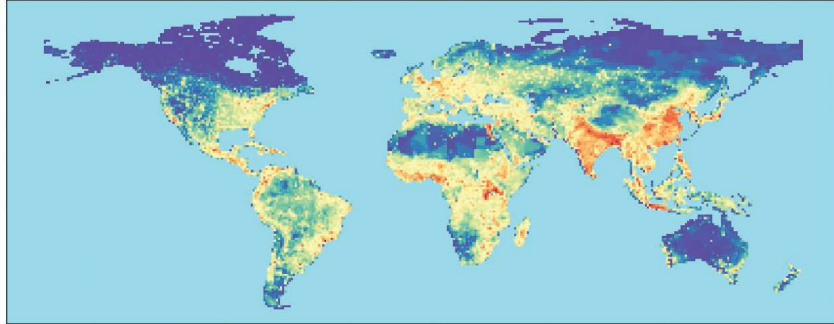
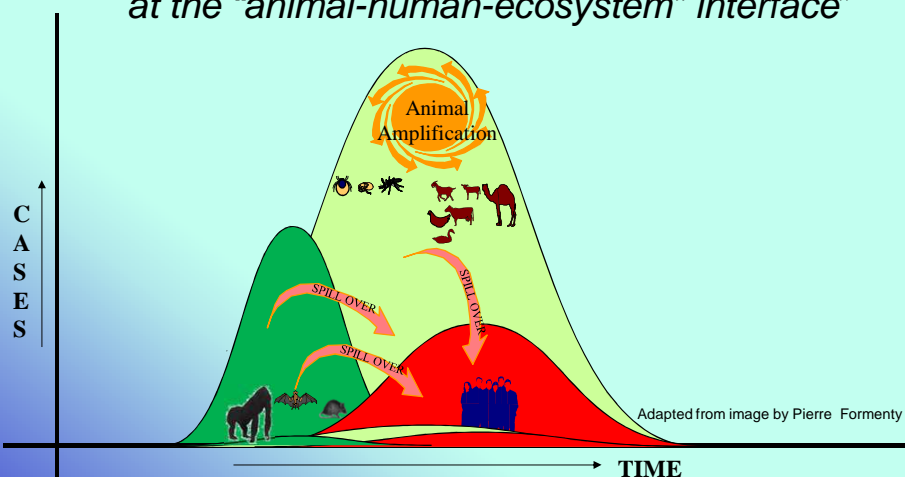


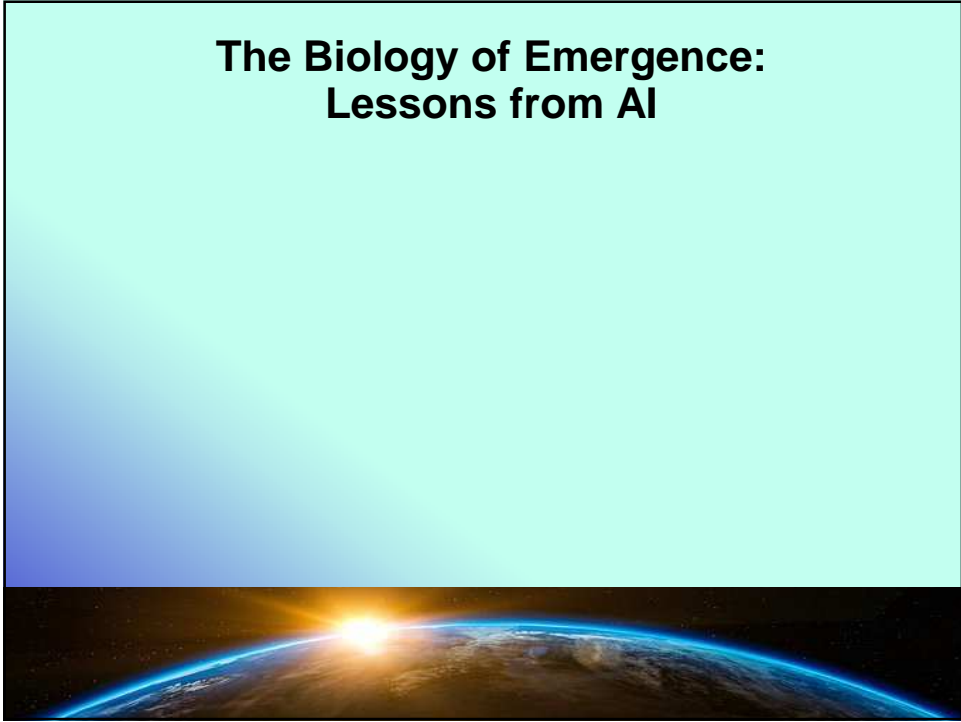
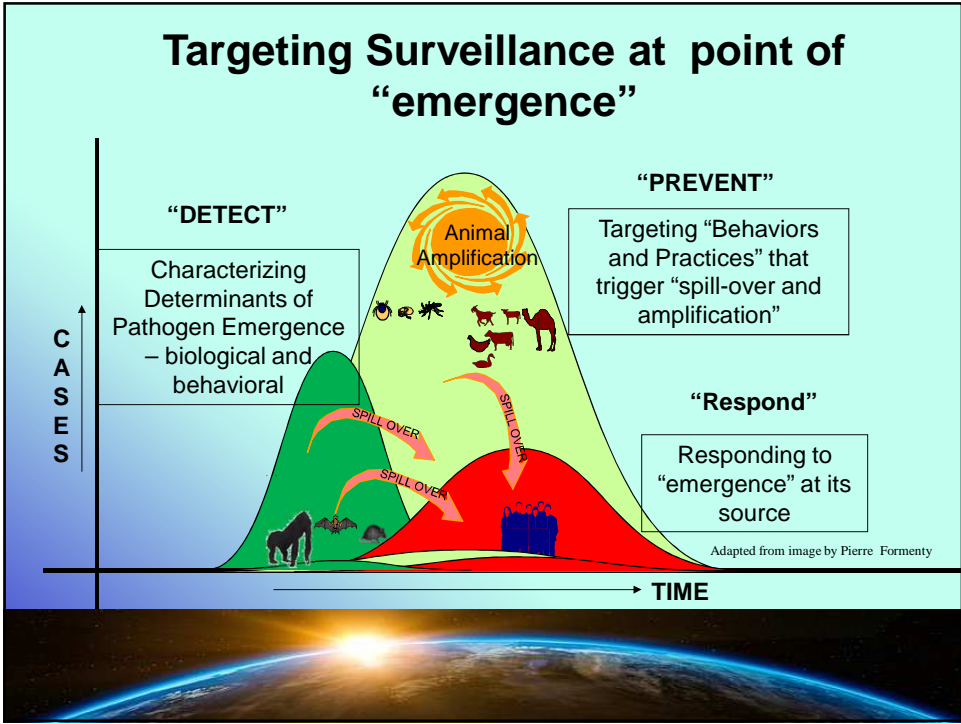
Figure 3. Hotspots II Map: Predicted relative risk of EID occurrence after adjusting for reporting bias. ‘Heat map’ scale Blue = lower risk through to Red = higher risk

Source: USAID/Predict-EcoHealth Alliance

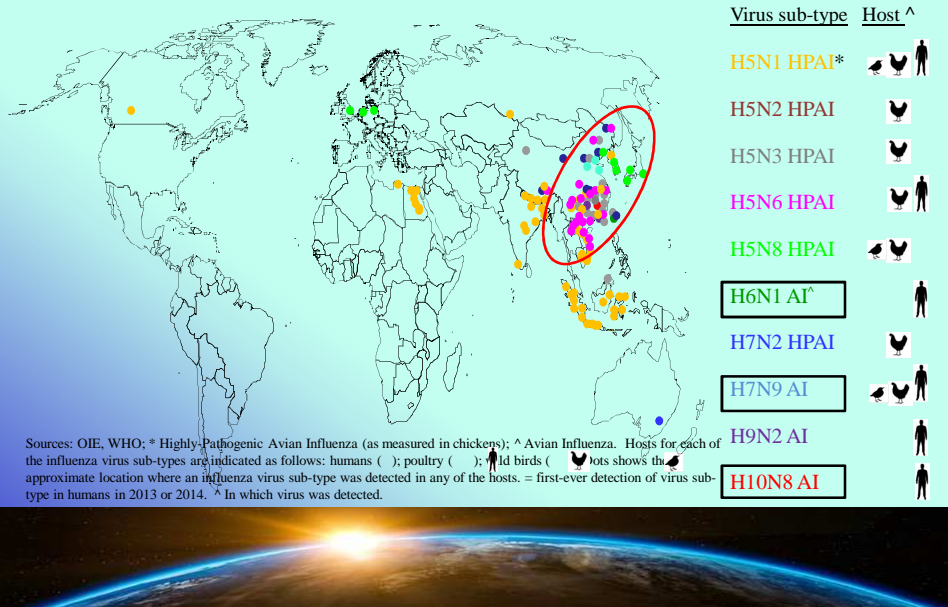
The “ecology” of disease emergence

at the “animal-human-ecosystem” interface

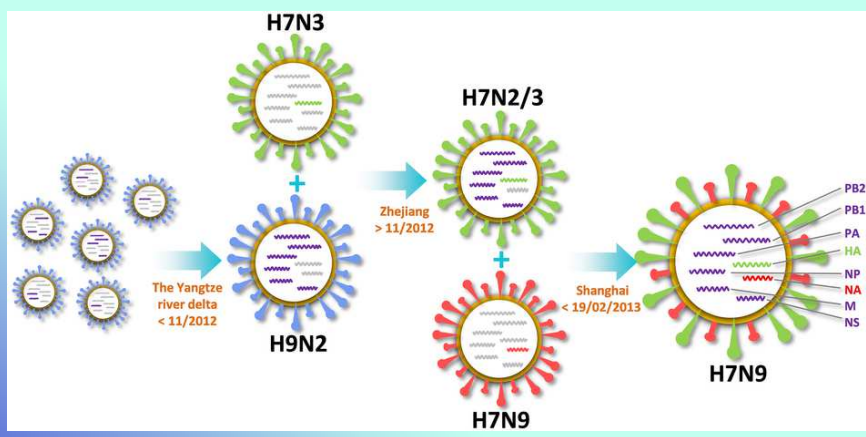




Monitoring Evolution of Avian Influenza Viruses



Re-assortment: Driving the Emergence of New Influenza Variants



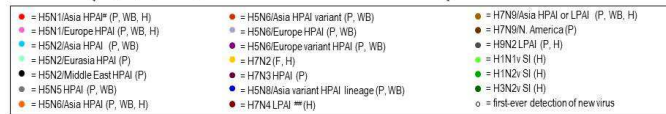
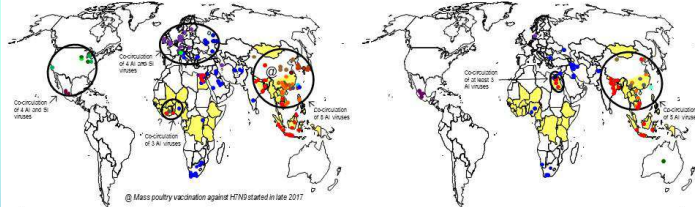
Recent Detection of Avian and Swine Influenza Viruses in Animals and Humans[^]

Nov 2017-Oct 2018

→ 737 bird outbreaks and 35 human infections with 14 A/I/SI sub-types/variants (9 of which are zoonotic)

Nov 2018-Oct 2019

→ 180 bird outbreaks and 5 human infections with 8 A/I/SI sub-types/variants (4 of which are zoonotic)

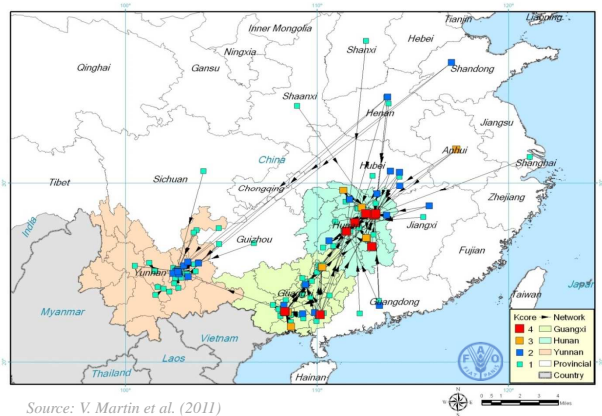


Sources = OIE, WHO, CDC, and Ministry of Agriculture/FAO (Egypt, Indonesia) reports between 11/1/17 and 5/27/19. [^] While these reports reflect known infections with animal influenza viruses, there may be additional viral circulation in these and other countries that is not detected due to limitations in surveillance and/or detection. * High-pathogenicity avian influenza (in chickens). ** Low-pathogenicity avian influenza (in chickens). □ = countries (including eastern/southeastern China, northeastern India, and most of Indonesia) using USAID avian influenza, Ebola, or other emerging pandemic threats funding between FY2017 and FY2019 for prevention, detection, and response. P = poultry; WB = wild birds; H = humans; F = feline.



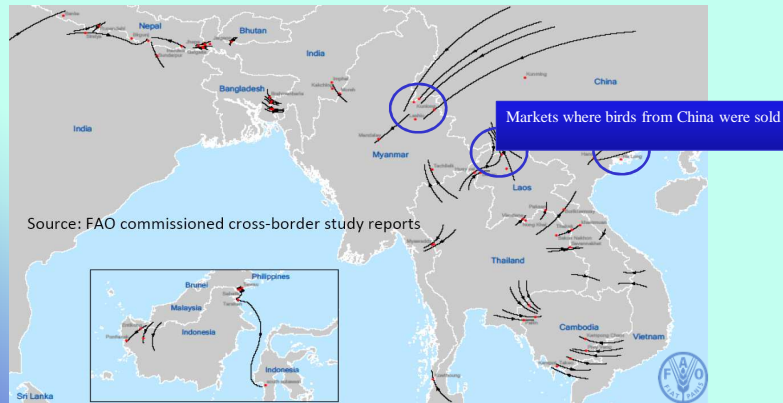
Tracking the Movement of Avian Influenzas

LBM Networks in Guangxi, Yunnan and Hunan



Source: V. Martin et al. (2011)

Cross-Border Value Chains Across the Region



Monitoring “High Risk” Markets



- Targeted markets
- Routine sampling
- Cross reference with routine monitoring ILI/SARI cases

Revolution in Diagnostics – PEN PCRs

- Allowing for “point of capture” analysis
 - Rapid – 2 hours
 - Simple – peripheral staff friendly
 - Reliable – comparable specs to RT-PCR
 - Broadly applicable: influenzas, filoviruses, ASF etc



Field Friendly



Simple



Fast



Longitudinal Influenza Surveillance Network

Routine Surveillance of “High Risk” Markets Along China-SE Asia Value Chain

2015 – present – proof of concept

- Target sites along China-Vietnam border linked to poultry value chain
- Routine monitoring for AI during influenza season
- Adjust national response policies to exploit early response
- Have preparedness & response plans in place

2018 – present

- Expand surveillance along Lao and Myanmar – China borders
- Monitor impact on diversity and re-assortment



“We can’t solve problems by using the same kind of thinking
we used when we created them”

Albert Einstein

