

# One Health approaches to pandemic prevention

One Health Aotearoa

David T S Hayman

7 December 2021

## Acknowledgements

### (References)

- <sup>m</sup>EpiLab
- WHO-Convened “Origins” team
- IPBES Workshop team
- OHHLEP

### Funding

- Royal Society Te apārangi
- Bryce Carmine & Anne Carmine (née Percival), through the Massey University Foundation

RUTHERFORD  
DISCOVERY FELLOWSHIPS

ROYAL  
SOCIETY  
TE APĀRANGI

- Thanks

- Coronavirus disease (COVID-19) highlights the threat of emerging diseases
- Increasing acknowledgement on One Health



May 2020: World Health Assembly requested:

WHO work with OIE\*, FAO and countries, as *a One Health approach*

1. — to identify the source of the SARS-CoV-2,  
— including the route of introduction to the human population

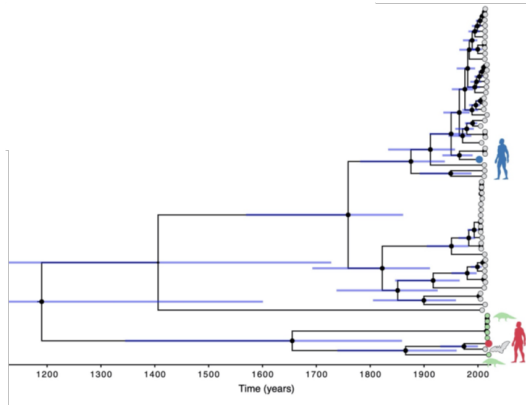
May 2020: World Health Assembly requested:

WHO work with OIE\*, FAO and countries, as *a One Health approach*

1. — to identify the source of the SARS-CoV-2,  
— including the route of introduction to the human population
2. with aims to:  
— help prevent both reinfection with the virus in animals and humans  
— identify potential zoonotic reservoirs

to reduce future risk of zoonotic diseases

## SARS-CoV-2 origins in bats, but pathway, source & timing are unknown



**Figure:** Boni *et al*, Nature Microbiology (2020)

Joint international team examined 4 scenarios for SARS-CoV-2's emergence in Wuhan:

## 1) direct zoonotic transmission to humans (spillover)



**Figure:** São Tomè, photo Ricardo Rocha; Peel *et al*, *Acta Chiropterologica* (2017)

## 2) introduction through an intermediate host followed by spillover



**Figure:** Masked palm civet, photo EcoHealth; Daszak *et al*, IPBES (2020)

### 3) introduction through the (cold) food chain



**Figure:** Huanan market, Wuhan; WHO-Convened Report (2021)

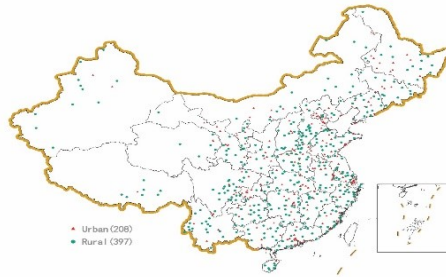
#### 4) introduction through a laboratory incident



**Figure:** Wuhan Institute of Virology; Reuters / Thomas Peter (2021)

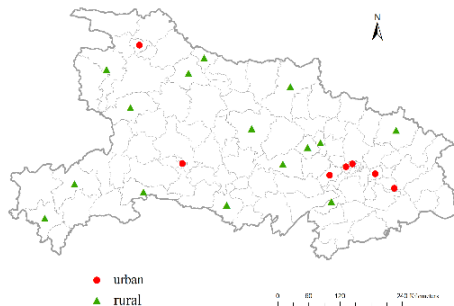


## Mortality data



**Figure:** National surveillance data; WHO-Convened Report (2021)

## Mortality data



**Figure:** Hubei surveillance data; WHO-Convened Report (2021)

## All cause mortality: time

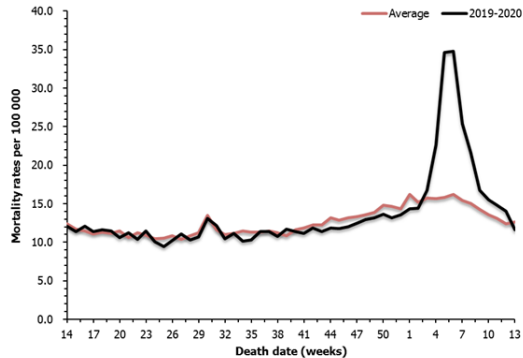
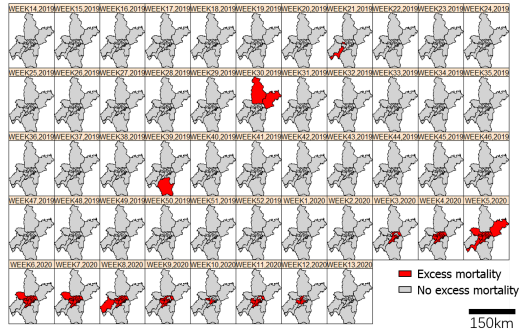


Figure: Wuhan; WHO-Convened Report (2021)



**Figure: Districts in Wuhan; WHO-Convened Report (2021)**

## Covid-19 case map

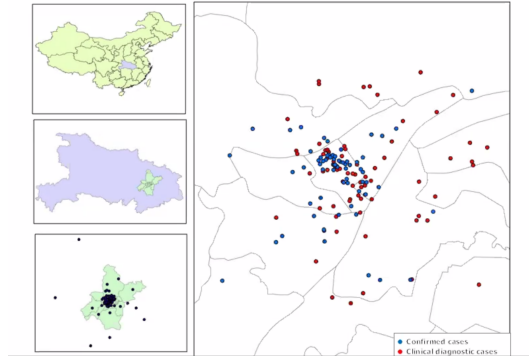


Figure: WHO-Convened Report (2021)

## Huanan market exposure for week 1 cases

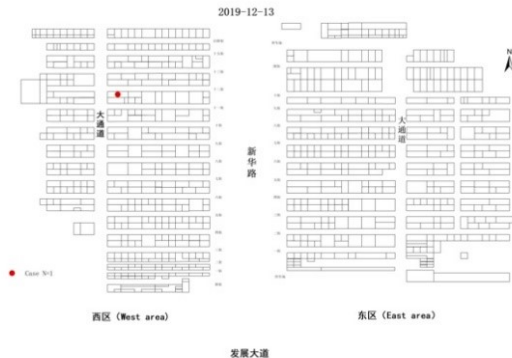


Figure: WHO-Convened Report (2021)

## Huanan market exposure for week 3 cases

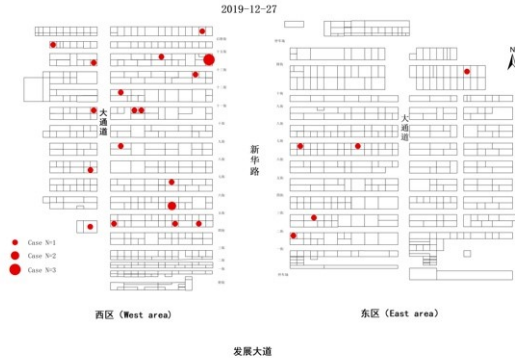


Figure: WHO-Convened Report (2021)

## Huanan market exposure

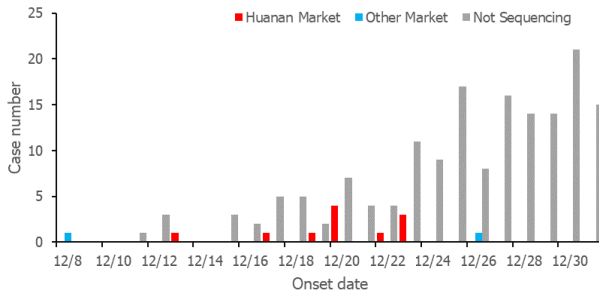


Figure: WHO-Convened Report (2021)



## Genomic analyses: early diversity & Huanan market exposure

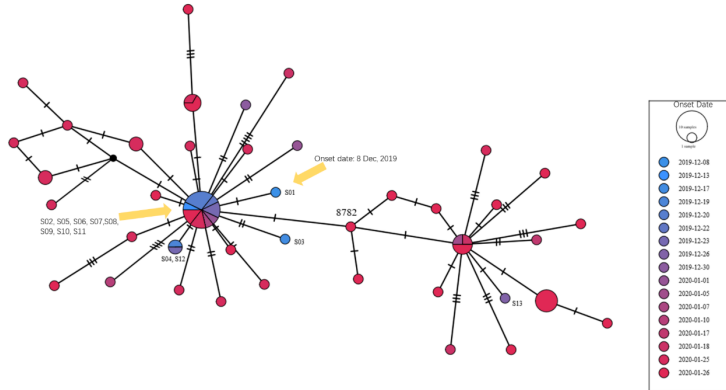
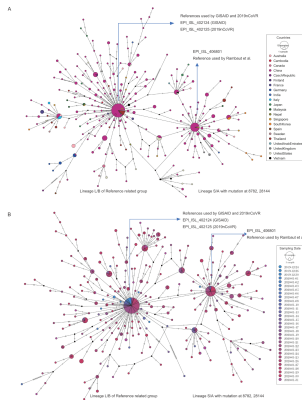


Figure: WHO-Convened Report (2021)

## Genomic analyses: structure remains in later cases



**Figure: WHO-Convened Report (2021)**

Do not know source, but provided recommendations:

- Further trace-back studies (possible cases)
- Antibody surveys
- Trace-back and community surveys (potential pathways, e.g. wildlife farms)
- Risk-targeted surveys of possible hosts (e.g. bats, farmed wildlife)
- Detailed risk-factor analysis
- Follow-up any new leads

Koopmans *et al* Nature (2021);

WHO-convened global study of origins of SARS-CoV-2 (2021)

## Bat coronaviruses

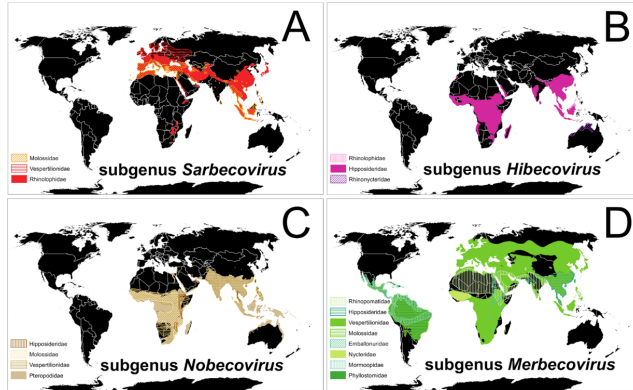


Figure: Olival et al PLOS Pathogens (2020)

One Health approach (e.g. WHA)

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

IPBES authorized a workshop on biodiversity and pandemics

## Climate and land use change



**Figure:** Uganda, photo Hayman; Muylaert *et al* PLOS One (2021)

## Agricultural intensification and expansion



Figure: IPBES (2020)

## Wildlife trade



**Figure:** Pangolins in Indonesia in 2015; Photo: Earth Tree Images; IPBES (2020)



## Wildlife trade

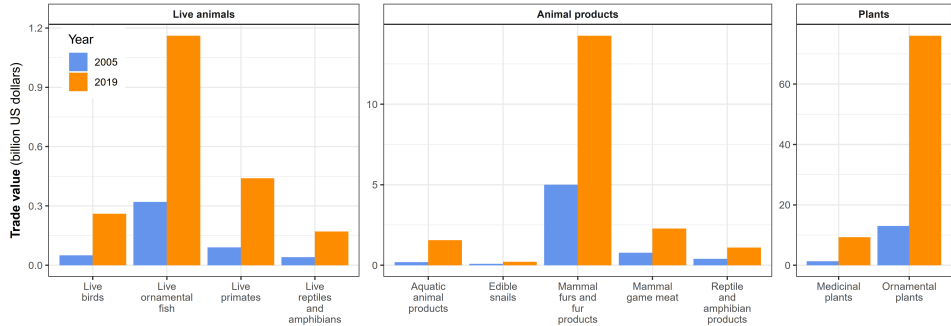
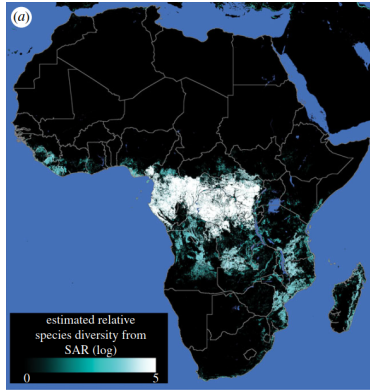


Figure: IPBES (2020)

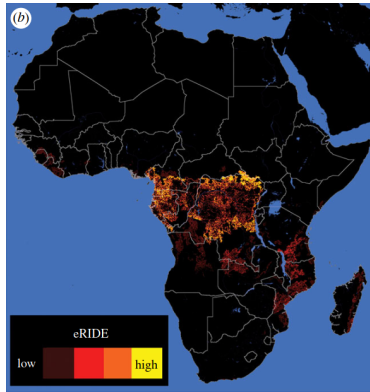
- No policy efforts to counter pandemics adequately address underlying causes.
    - e.g. CITES, OIE, WTO, IHR
  - Require assessment of drivers
  - How and where drivers make us vulnerable
  - e.g. deforestation & fragmentation in tropical forest
- African tropical forests, source of Ebola virus disease, Zika, HIV

## Forest biodiversity & the species-area relationship



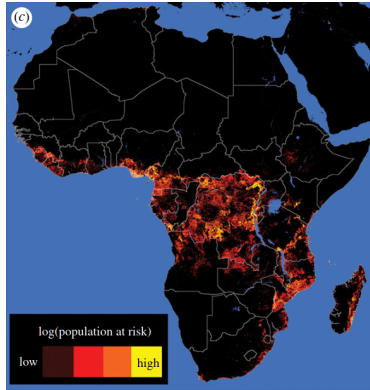
**Figure:** Biodiversity & Species-Area relationship  
Wilkinson *et al* J Royal Society Interface (2018)

## Hazard



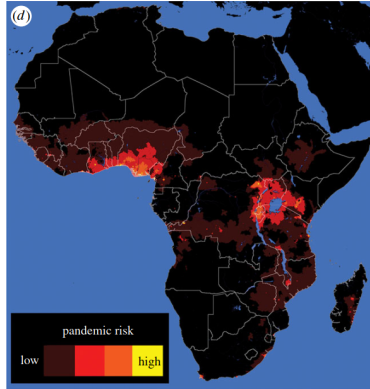
**Figure: Edge & Biodiversity**  
Wilkinson *et al* J Royal Society Interface (2018)

## Population at risk



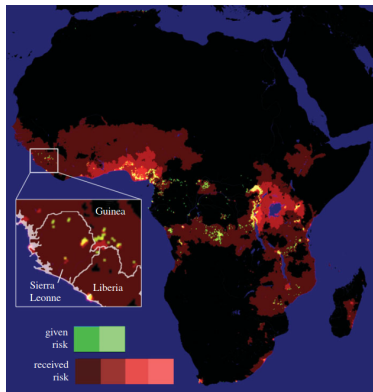
**Figure:** Sub-Saharan population density  
Wilkinson *et al* J Royal Society Interface (2018)

## Spread (gravity model)



**Figure:** Pandemic risk  
Wilkinson *et al* J Royal Society Interface (2018)

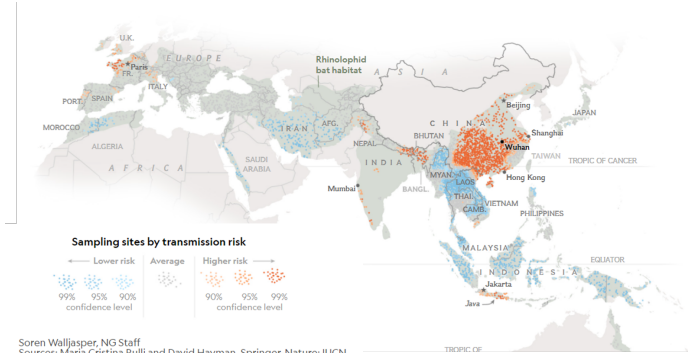
## High risk areas at the intersection



**Figure:** Wilkinson *et al* J Royal Society Interface (2018)

# SARS-related coronavirus risk

## Intersections of bat presence, land-use change, and livestock



Soren Walljasper, NG Staff

Sources: Maria Cristina Rulli and David Hayman, Springer-Nature; IUCN

**Figure:** National Geographic; Rulli *et al* Nature Food (2021)



# Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)



## IPBES WORKSHOP ON BIODIVERSITY AND PANDEMICS

WORKSHOP REPORT

Intergovernmental Science-Policy Platform  
on Biodiversity and Ecosystem Services



**Figure:** IPBES (2020)

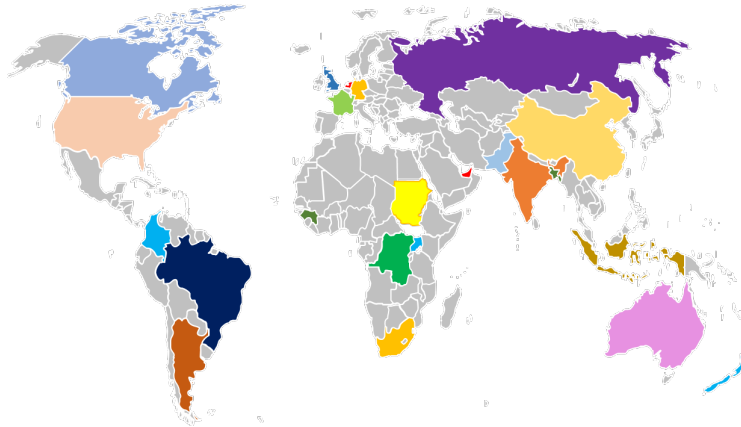
“IPBES” recommendations under 5 broad headers:

- Enabling mechanisms (e.g. High level panels)
- Increasing sustainability and reducing risk due to land use change and agricultural expansion
- Reducing risk due to wildlife trade
- Bridging knowledge gaps
- Foster a role for *all* sectors of society to engage

## WHO, OIE, FAO and UNEP launched “One Health High Level Expert Panel” (OHHLEP)



**Figure: OHHLEP (2021)**



**Figure:** National composition on OHHLEP members (2021)

## OHHLEP guidance on pandemic risk through:

- policy relevant scientific assessments on health at the human-animal-ecosystem interface
- research gaps
- long-term strategic approaches to reducing zoonotic risk,
  - with monitoring and early warning framework
  - implementing One Health, including in areas that drive risk.

1st December 2021

- World Health Assembly agreed to develop a global accord on pandemic prevention, preparedness and response
- WHO, FAO, OIE, UNEP agreed to support OHHLEP's One Health definition
  - Organisation & funding
  - Global Plan of Action for One Health is in development, aiming to mainstream and operationalize One Health at global, regional, and national levels

## Definition

1. One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems

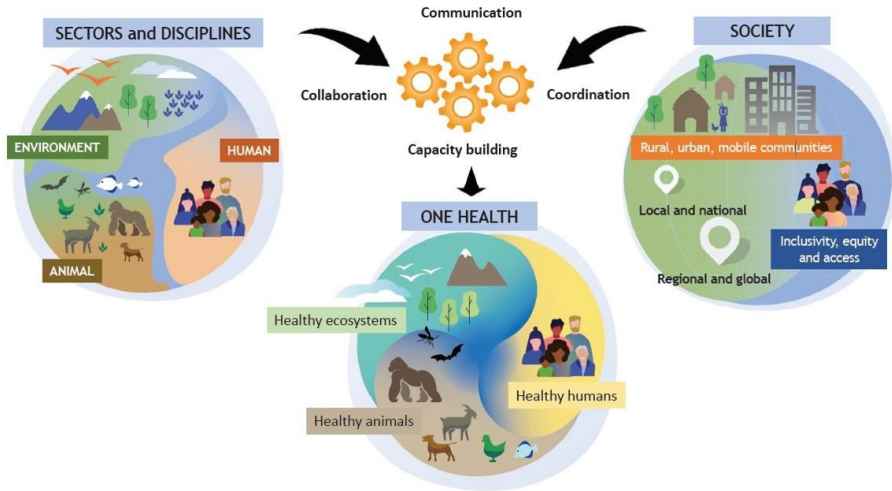
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2. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent



## Definition

1. One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems
2. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent
3. The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development



**Figure: One Health; OHHLEP (2021)**