Le Malattie Infettive emergenti e riemergenti: una sfida globale e il ruolo della risposta nazionale

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Disclosures

I have received funding for membership of Advisory Boards, for the preparation of educational materials, for research and educational grants, for membership of speaker panels and for support for travel to conferences from the following companies:

- Gilead Sciences
- Viiv Healthcare
- Abbvie
- Pfizer
- GSK
- Menarini
- Moderna
- Astra Zeneca

Antimicrobial resistance

TBC, AIDS, Malaria

COVID,

……Pandemic Flu ?????????

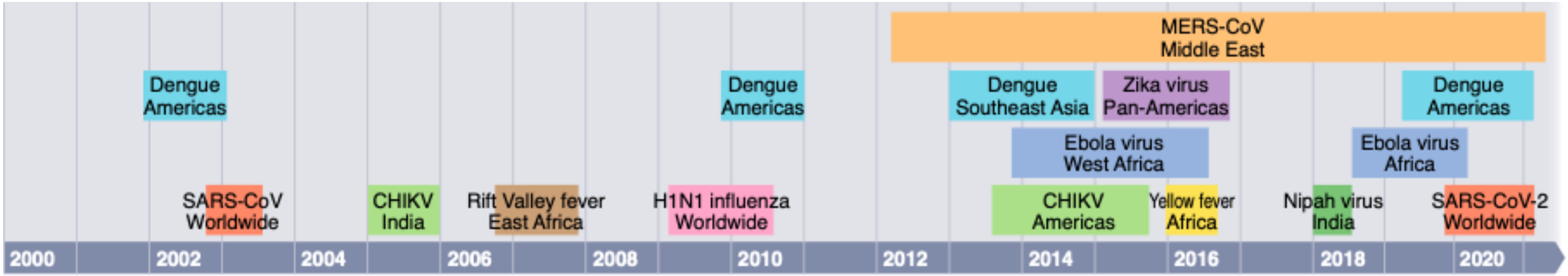
Not if.....but WHEN

Pandemics are inevitable

They recur at more-or-less cyclical intervals

Timeline of twenty-first-century viral outbreaks, from 2000 to the present day.

Viral strains and the area of outbreak are indicated along with the timeline



2022

Vaccine derived Poliovirus – Indonesia, Algeria **EBOLA** – Uganda, rep. Dem. Congo
MERS – Arabia Saudita **H5N1** – Spagna **DENGUE**- Nepal, Pakistan,Uganda
Rift Valley Fever – Mauritania **Marburg** – Ghana **Monkeypox**-Americas Europe

2023

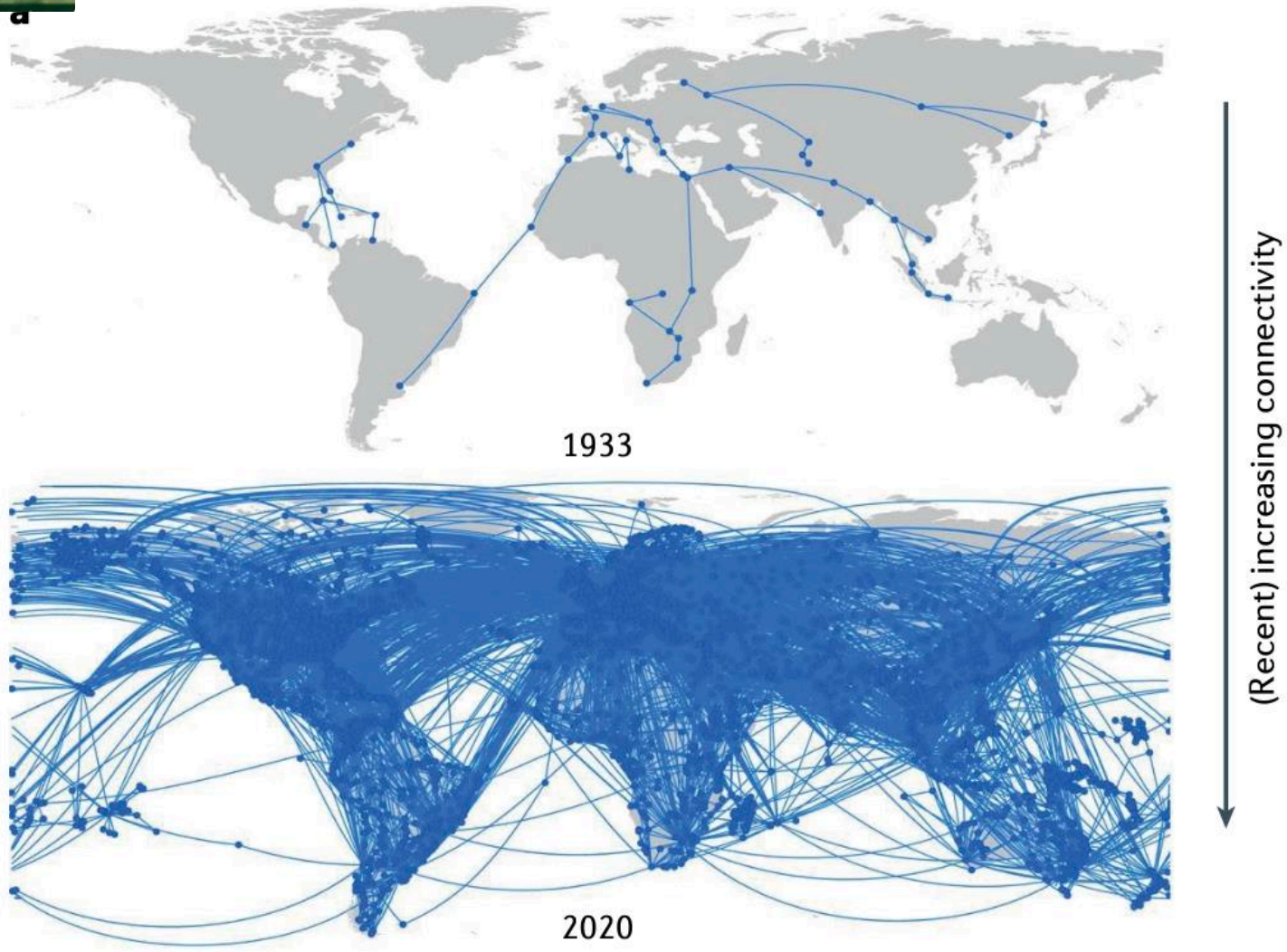
Morbillo– Sudan **EBOLA** – Uganda **MERS** – Oman **H5N1** – Ecuador
Vaccine derived Poliovirus – Sudan **Yellow fever**– AFRICA

Meganck RM NatuRe MeDiciNe | VOL 27 | MArCH 2021 | 401–410 |

GLOBALIZATION

Infectious disease in an era of global change

The global international air travel network expanded substantially from 1933 to 2020 (data from WorldPop).

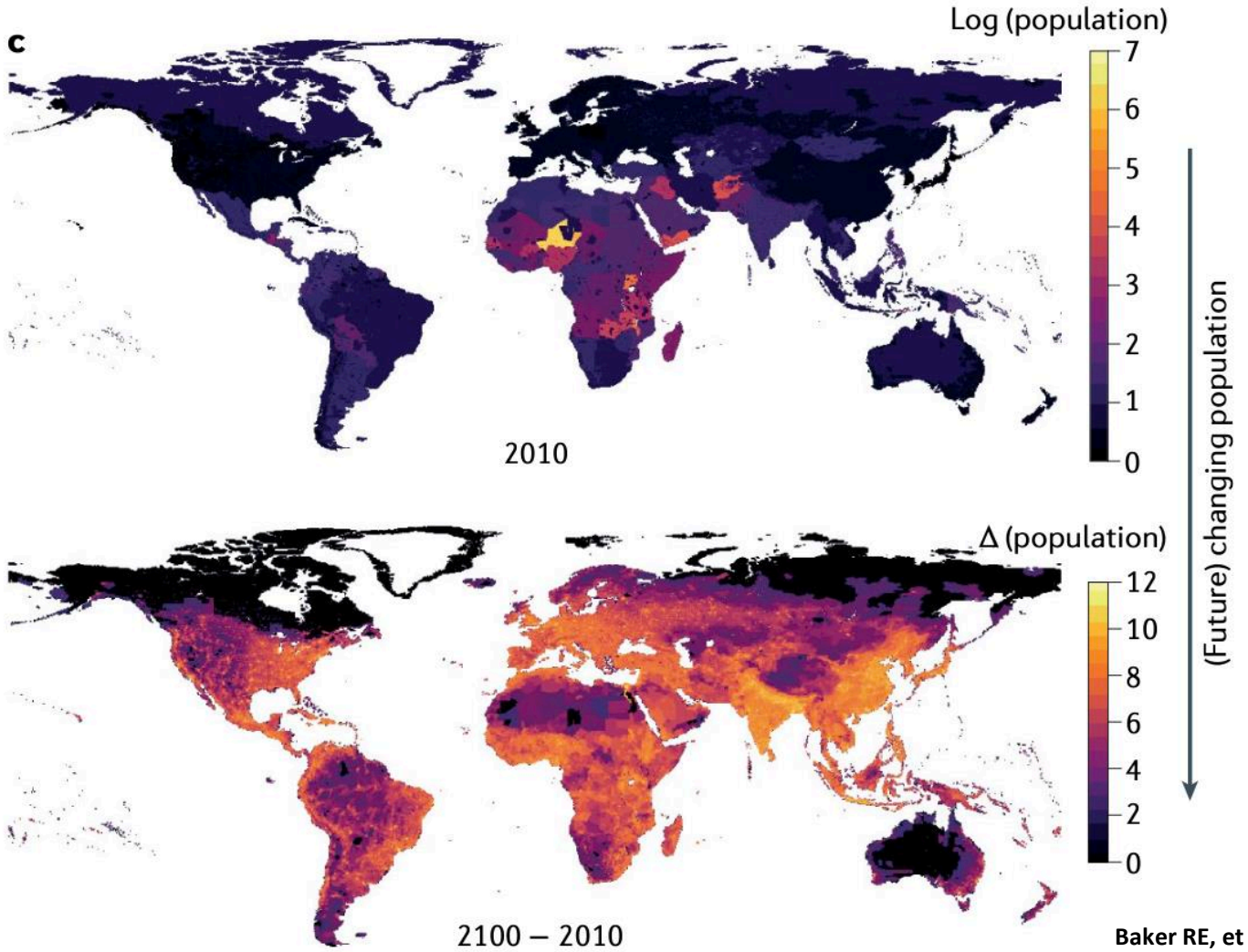


The total number of airline passengers doubled from just below two billion in 2000 to more than four billion in 2019

aker RE, et al. Nat Rev Microbiol, volume 20 | April 2022 | 193-205

Population projections in 2010 and relative population change projected until 2100

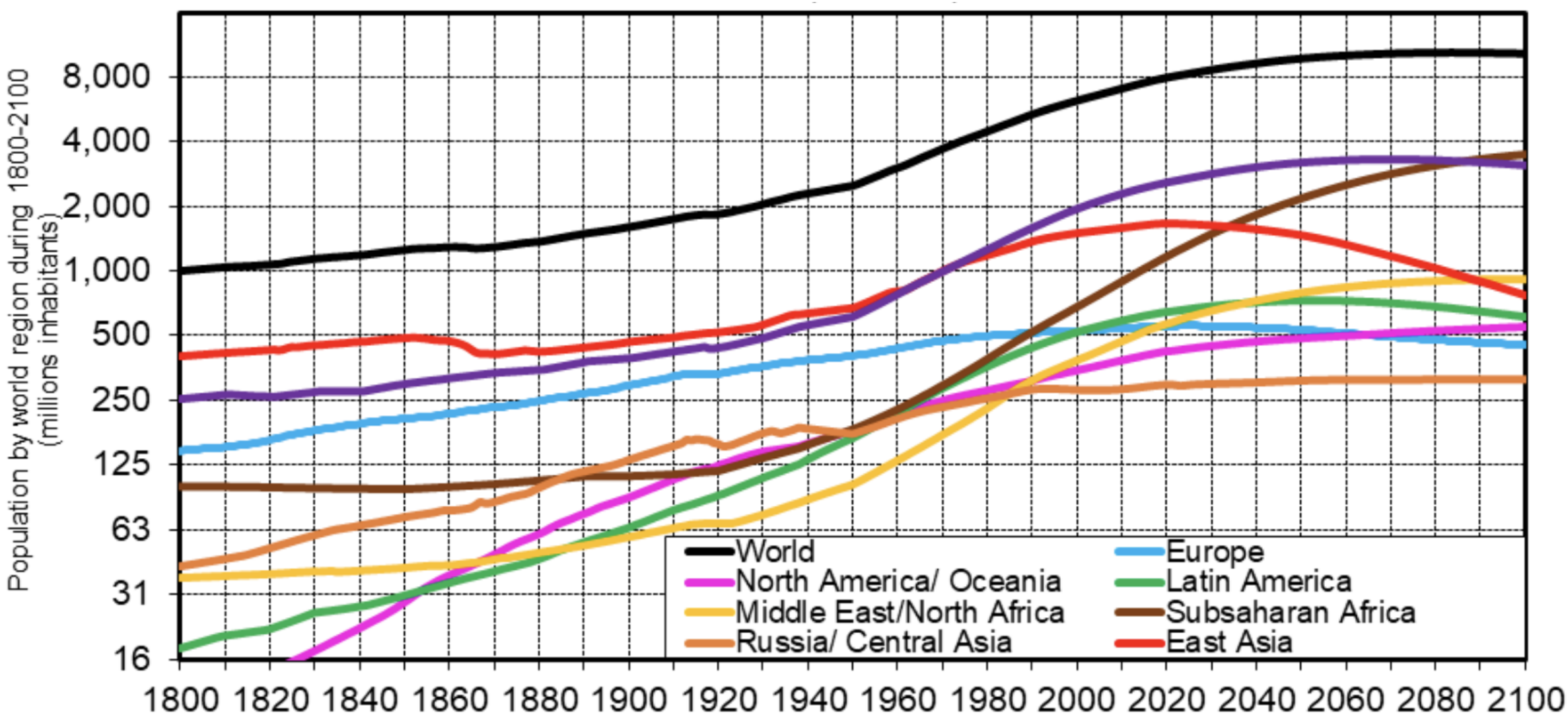
(source NASA Socioeconomic Data and Applications Center).



Anno	Popolazione/mondo (miliardi)	
1804	1,0	
1900	1,6	123 aa
1927	2	
1950	2,5	
1960	3,032	48 aa
1970	3,690	
1980	4,442	
1990	5,293	40 aa
2000	6,144	
2010	6,970	
2020	7,821	
2050	9,7	
2080	10,4	

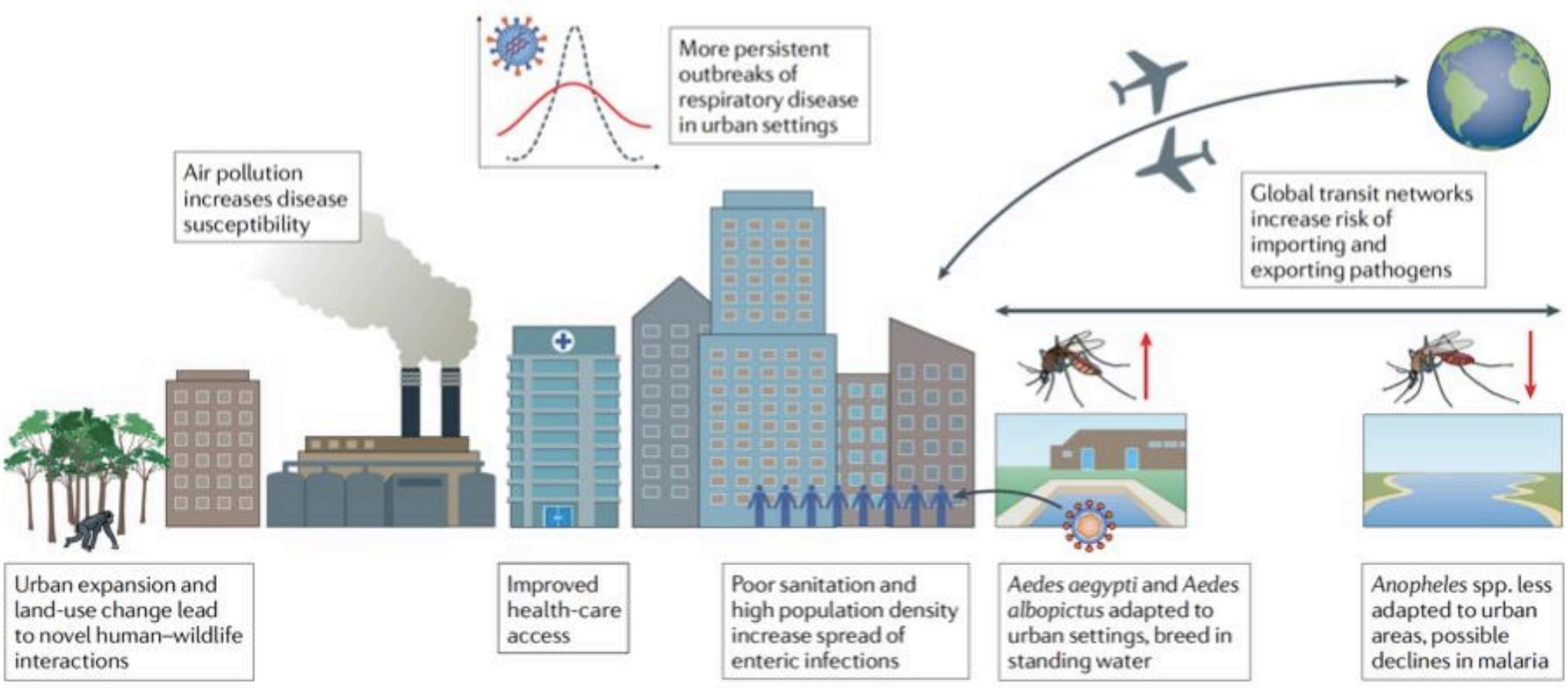
Baker RE, et al. Nat Rev Microbiol, volume 20 | April 2022 | 193-205

Population by world Region, 1800-2100 (millions)



Infectious disease in an era of global change

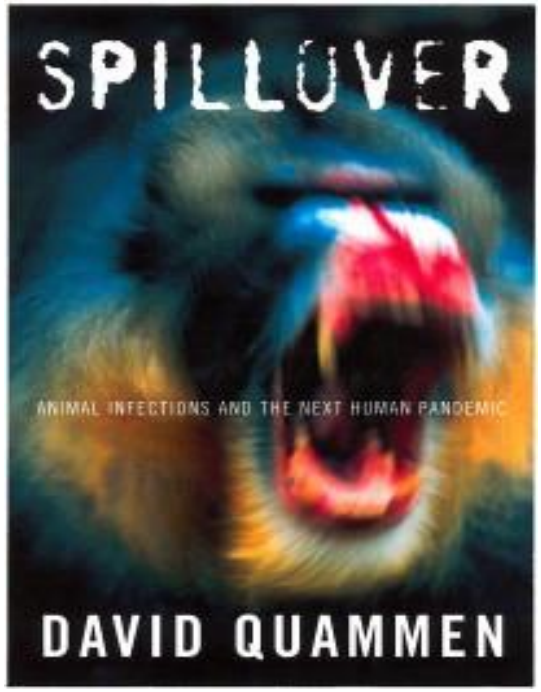
Rapid rates of urbanization in low-income and middle-income countries, and the increase in populations residing in crowded, low-quality dwellings, have created new opportunities for the emergence of infectious diseases



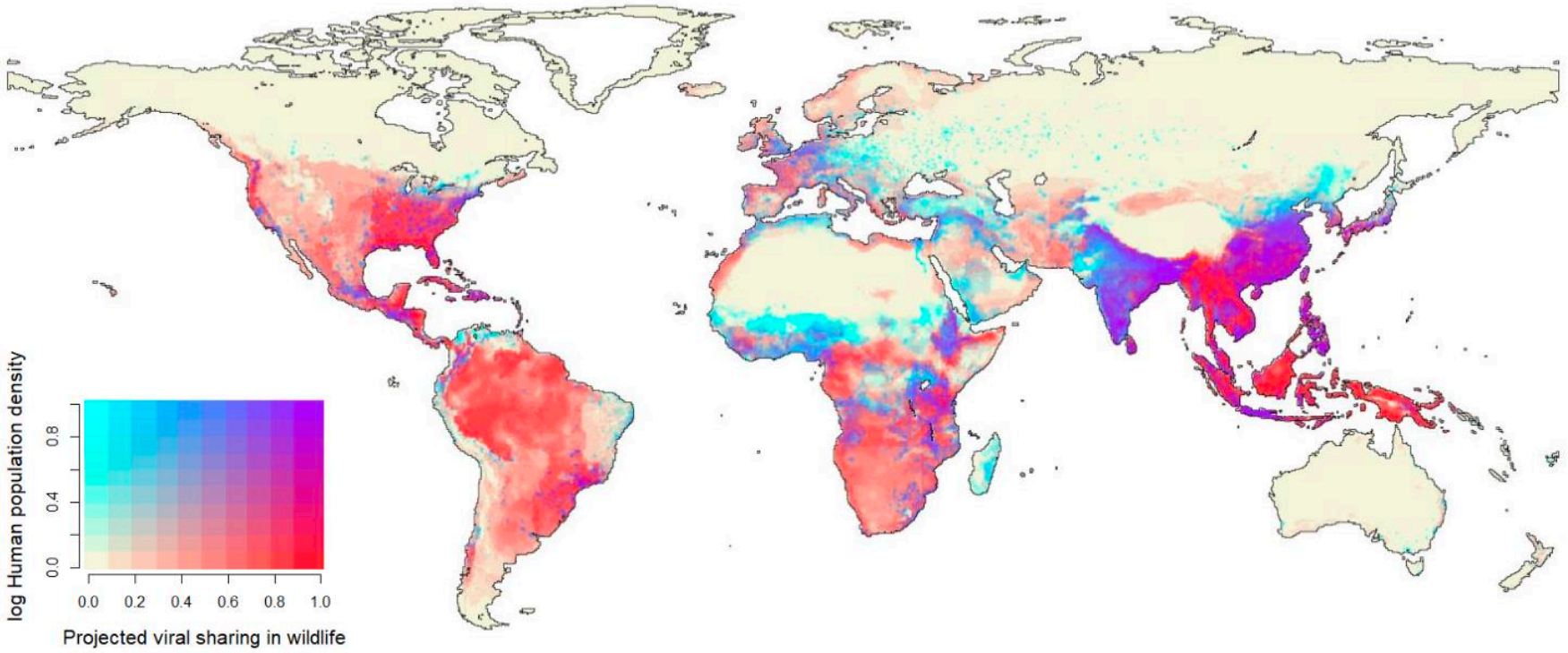
Baker RE, et al. Nat Rev Microbiol, volume 20 | April 2022 | 193-205

bioRxiv
THE PREPRINT SERVER FOR BIOLOGY

Novel viral sharing events coincide with population centers



Human population density

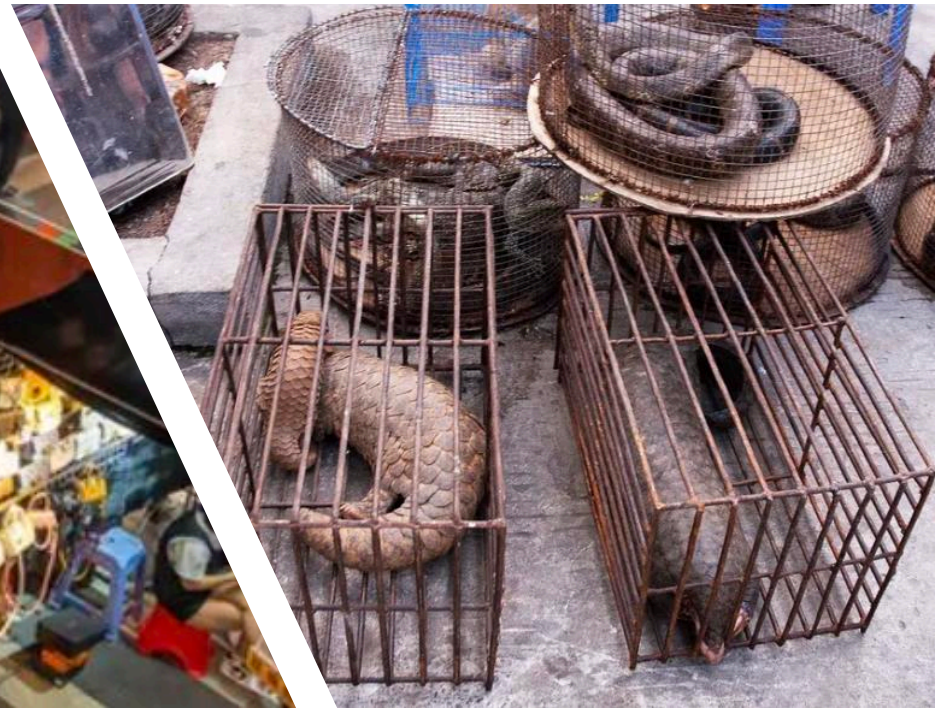


In 2070 human population centers in equatorial Africa, south China and southeast Asia will overlap with projected hotspots of cross-species viral transmission in wildlife.

Colin J. Carlson bioRxiv preprint first posted online Jan. 25, 2020; doi: http://dx.doi.org/10.1101/2020.01.24.918755.


爱上烤肉


A TF898

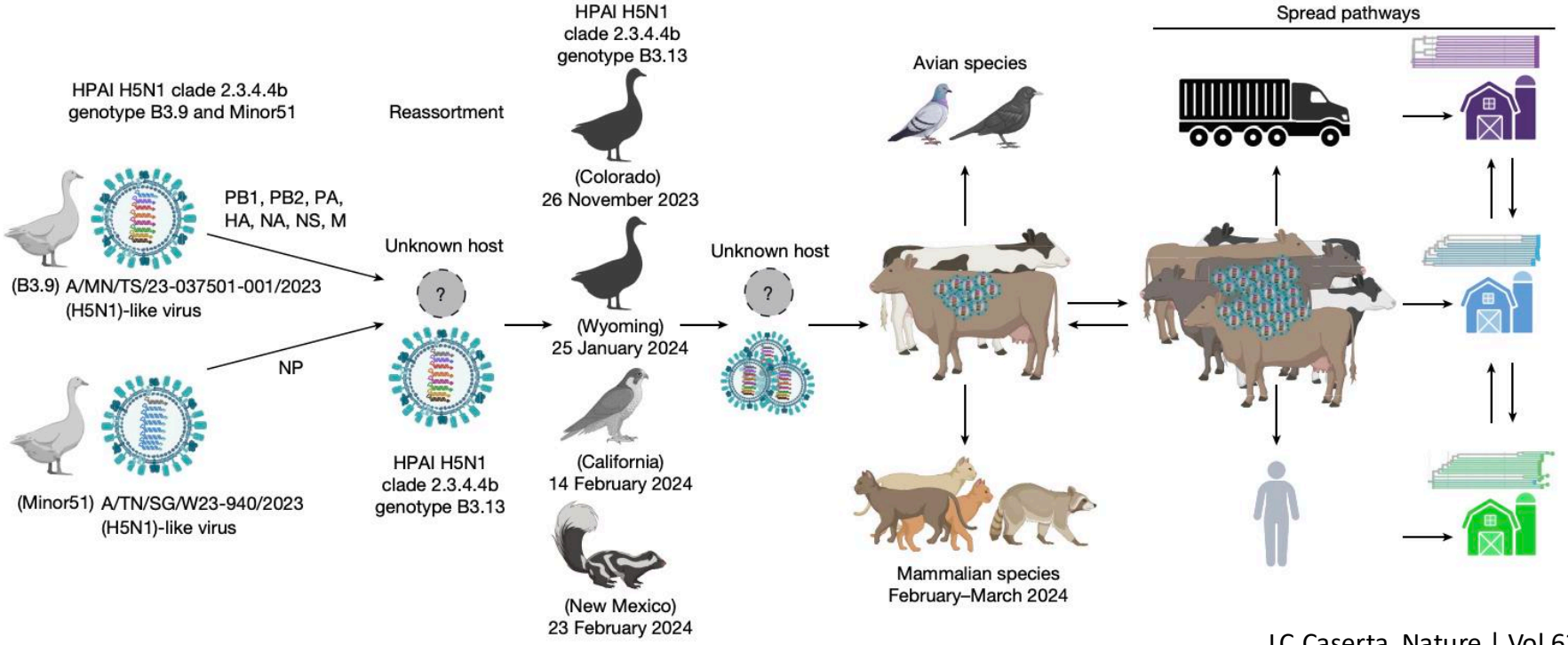


Spillover of highly pathogenic avian influenza H5N1 virus to dairy cattle

The highly pathogenic avian infuenza (HPAI) H5N1 virus clade 2.3.4.4b has caused the death of millions of domestic birds and thousands of wild birds in the USA since January 2022. Throughout this outbreak, spillovers to mammals have been frequently documented.

70 cases
1 death
(CFR: 1.4%)

Model of spillover and spread of the HPAI H5N1 genotype B3.13



LC Caserta. Nature | Vol 634 | 17 October 2024

Cumulative number of confirmed human cases for avian influenza A(H5N1) reported to WHO, 2003-2015

Country	2003-2009*		2010		2011		2012		2013		2014		2015		Total	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths
Azerbaijan	8	5									0		0	0	8	5
Bangladesh	1	0									0		0	0	7	1
Cambodia	9	7									4		0	0	56	37
Canada	0	0									0		0	0	1	1
China	38	25									0		5	1	52	31
Djibouti	1	0									0		0	0	1	0
Egypt	90	27									14		136	39	346	116
Indonesia	162	134									2		2	2	199	167
Iraq	3	2									0		0	0	3	2
Lao People's Democratic Republic	2	2									0		0	0	2	2
Myanmar	1	0									0		0	0	1	0
Nigeria	1	1									0		0	0	1	1
Pakistan	3	1									0		0	0	3	1
Thailand	25	17									0		0	0	25	17
Turkey	12	4									0		0	0	12	4
Viet Nam	112	57	7	2	0	0	4	2	2	1	2	2	0	0	127	64
Total	**468**	**282**	**48**	**24**	**62**	**34**	**32**	**20**	**39**	**25**	**52**	**22**	**143**	**42**	**844**	**449**

H5N1
844 cases
449 deaths
53% mortality rate

* 2003-2009 total figures. Breakdowns by year available on next table

Total number of cases includes number of deaths
WHO reports only laboratory cases
All dates refer to onset of illness

Source: WHO/GIP, data in HQ as of 17 July 2015

World Health Organization

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 27, 2005 VOL. 352 NO. 4

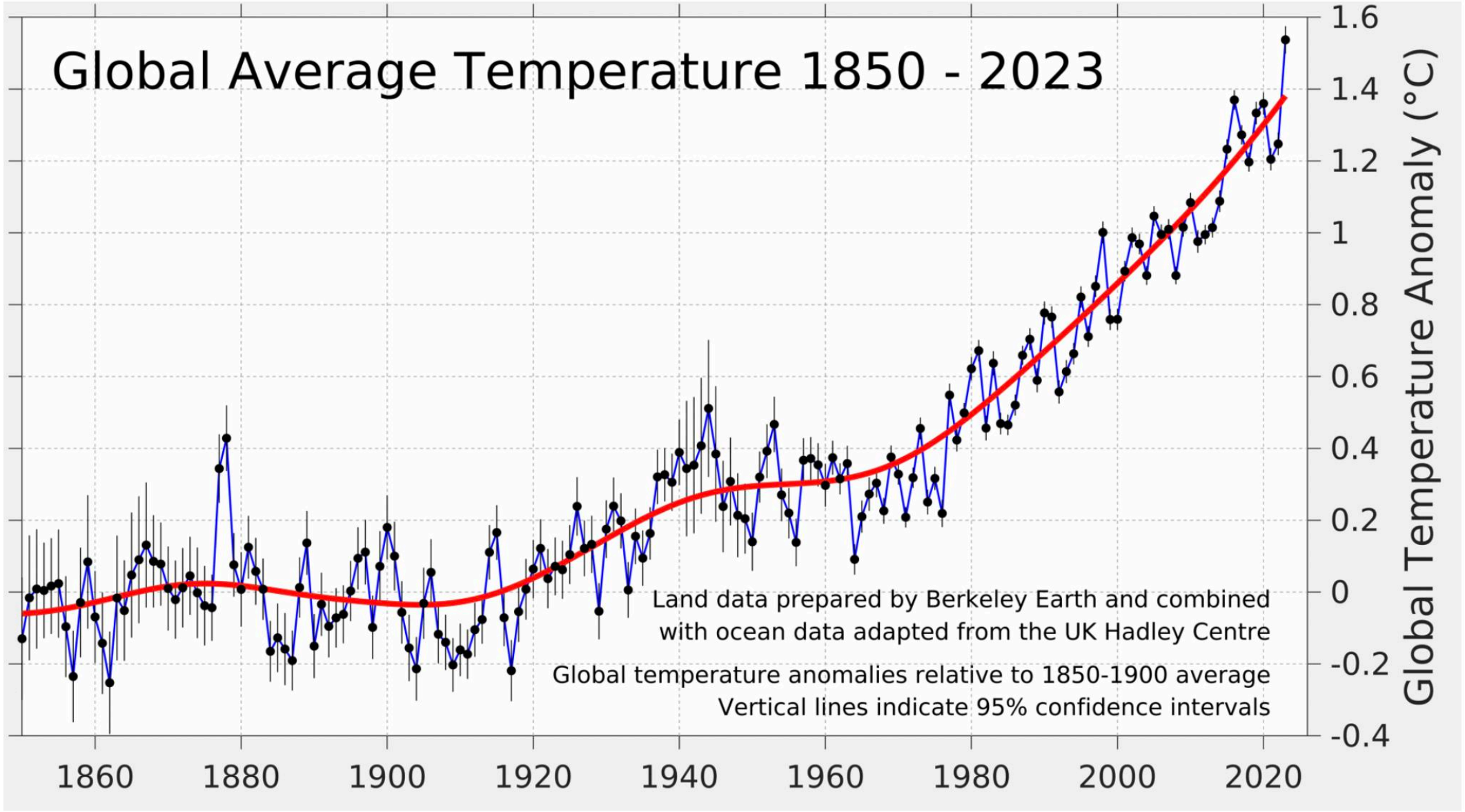
Probable Person-to-Person Transmission of Avian Influenza A (H5N1)

Kumnuan Ungchusak, M.D., M.P.H., Prasert Auewarakul, M.D., Scott F. Dowell, M.D., M.P.H., Rungrueng Kitphati, M.D., Wattana Auwanit, Ph.D., Pilaipan Puthavathana, Ph.D., Mongkol Uiprasertkul, M.D., Kobporn Boonnak, M.Sc., Chakrarat Pittayawonganon, M.D., Nancy J. Cox, Ph.D., Sherif R. Zaki, M.D., Ph.D., Pranee Thawatsupha, M.S., Malinee Chittaganpitch, B.Sc., Rotjana Khontong, M.D., James M. Simmerman, R.N., M.S., and Supamit Chunsutthiwat, M.D., M.P.H.

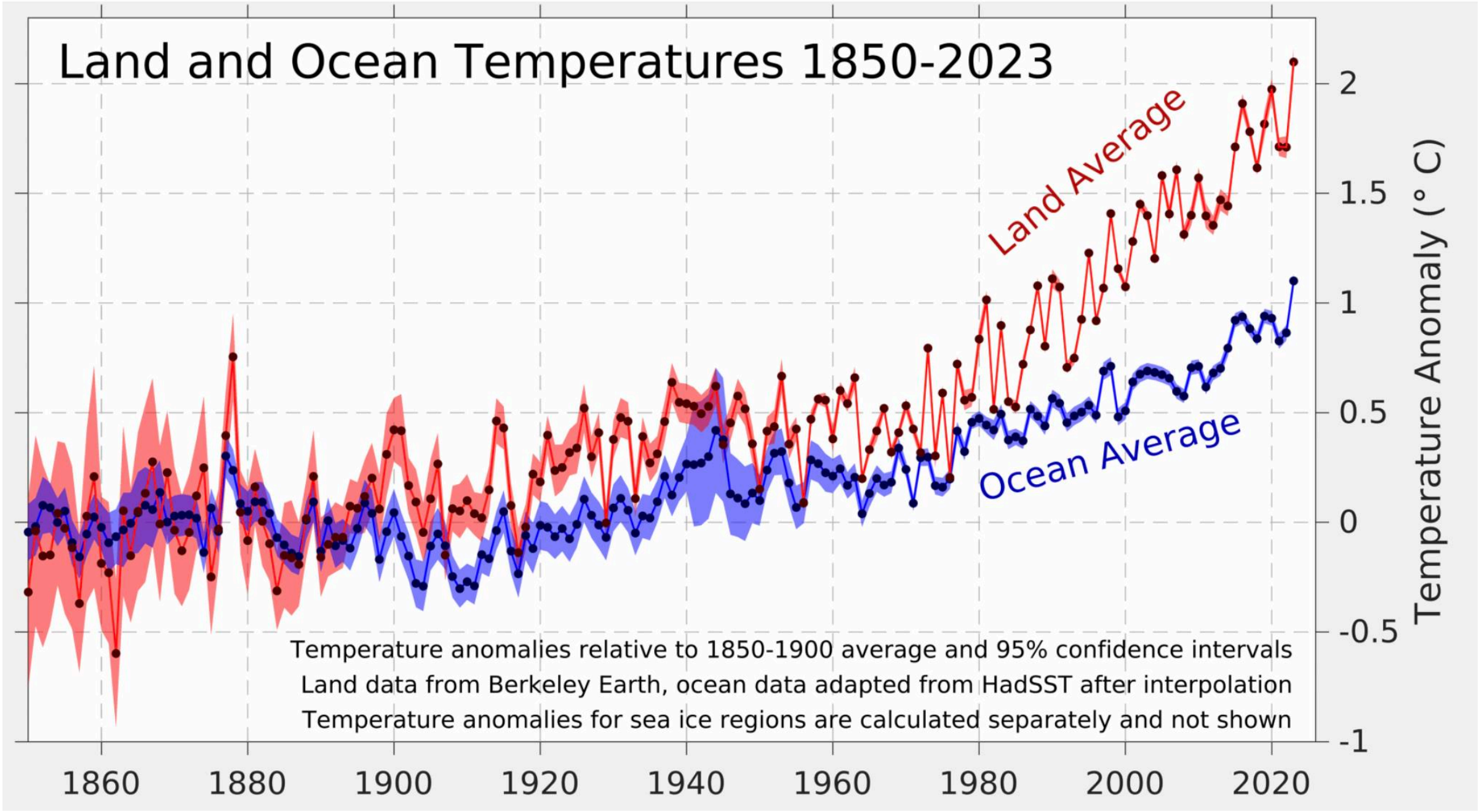
La mutazione PB2-E627K, trovata recentemente in isolati umani aumenta l'efficienza polimerasica e il rischio di trasmissibilità interumana


CLIMATE
CHANGE

The global mean temperature in 2023 is estimated to have been 1.54 ± 0.06 °C (2.77 ± 0.11 °F) above the average temperature from 1850-1900, a period often used as a pre-industrial baseline for global temperature targets.



Berkeley Earth (a California-based non-profit research organization) analysis



Berkeley Earth (a California-based non-profit research organization) analysis

Climate change will drive novel cross-species viral transmission

Between 10,000 and 600,000 species of mammal virus are estimated to have the potential to spread in human populations, but the vast majority are currently circulating in wildlife, largely undescribed and undetected by disease outbreak surveillance.

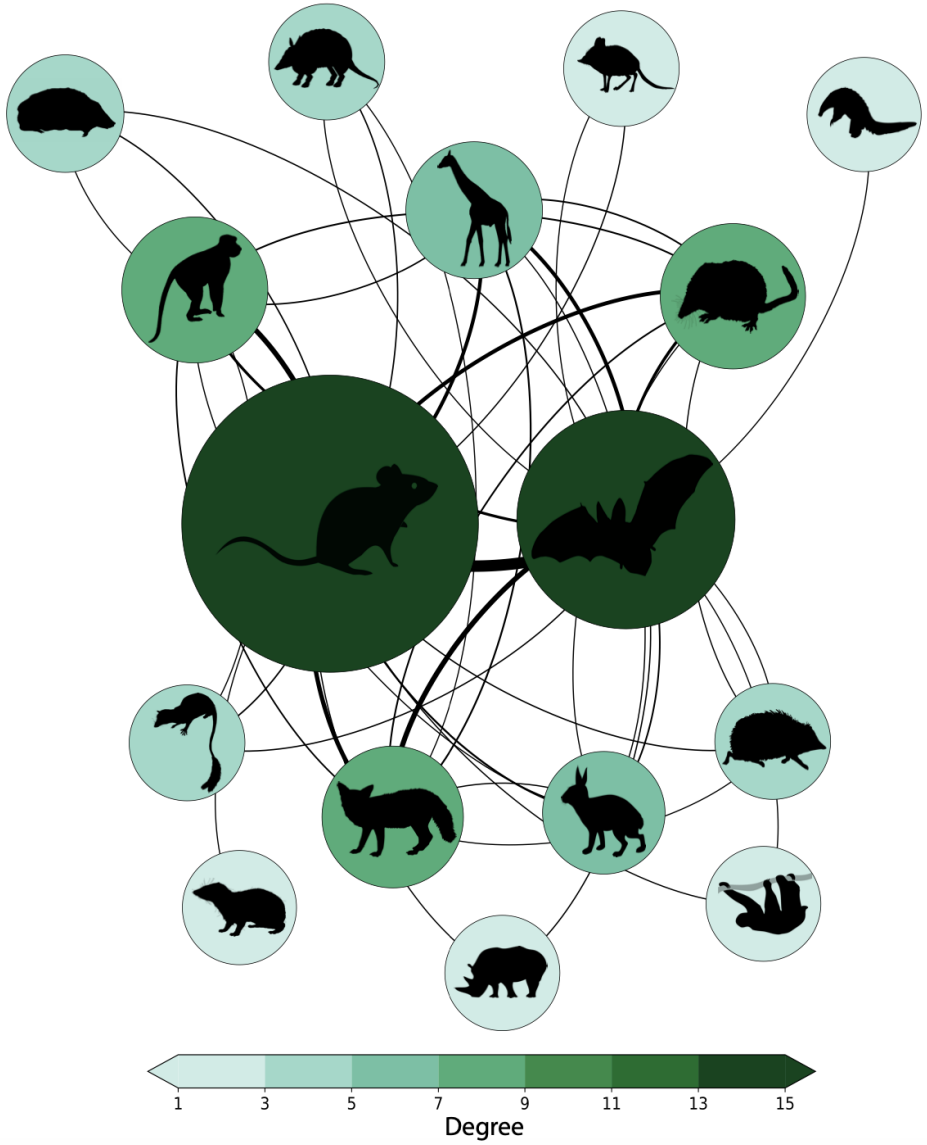
We map potential hotspots of viral sharing, using a phylogeographic model of the mammal-virus network, and projections of geographic range shifts for 3,870 mammal species under climate change and land use scenarios for the year 2070.

Colin J. Carlson bioRxiv preprint first posted online Jan. 25, 2020; doi: http://dx.doi.org/10.1101/2020.01.24.918755.

Climate change will drive novel cross-species viral transmission

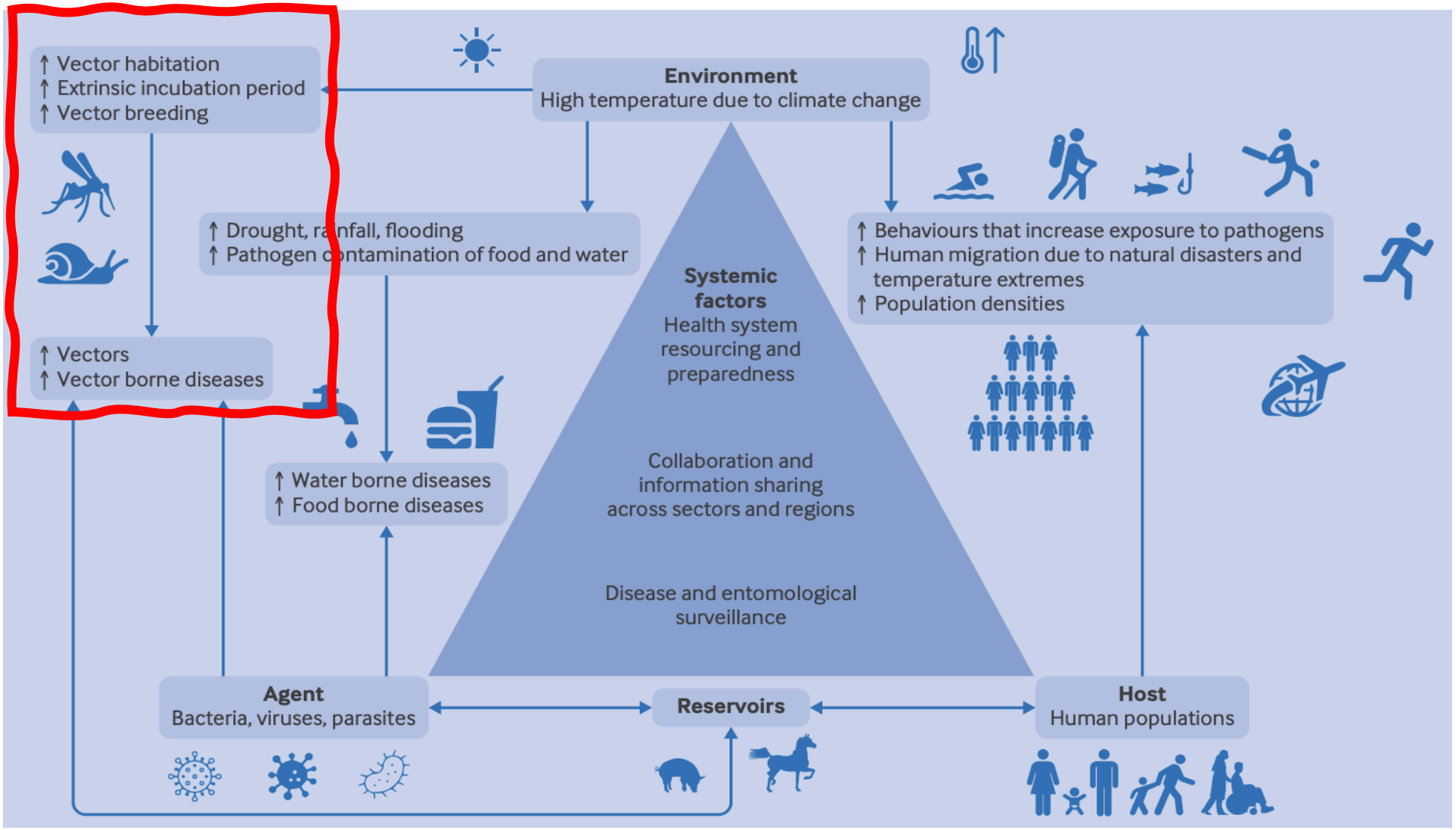
The mammal-virus network.
The present-day viral sharing network by mammal order inferred from modeled pairwise predictions of viral sharing probabilities. The expected number of shared viruses with most sharing existing among the most species and closely-related groups.

Nodes are sized by total number of species in that order in the host-virus association dataset, color is scaled by degree.



Colin J. Carlson bioRxiv preprint first posted online Jan. 25, 2020; doi: http://dx.doi.org/10.1101/2020.01.24.918755.

The impact of increasing temperatures due to climate change on infectious diseases



BMJ 2024;387:e079343

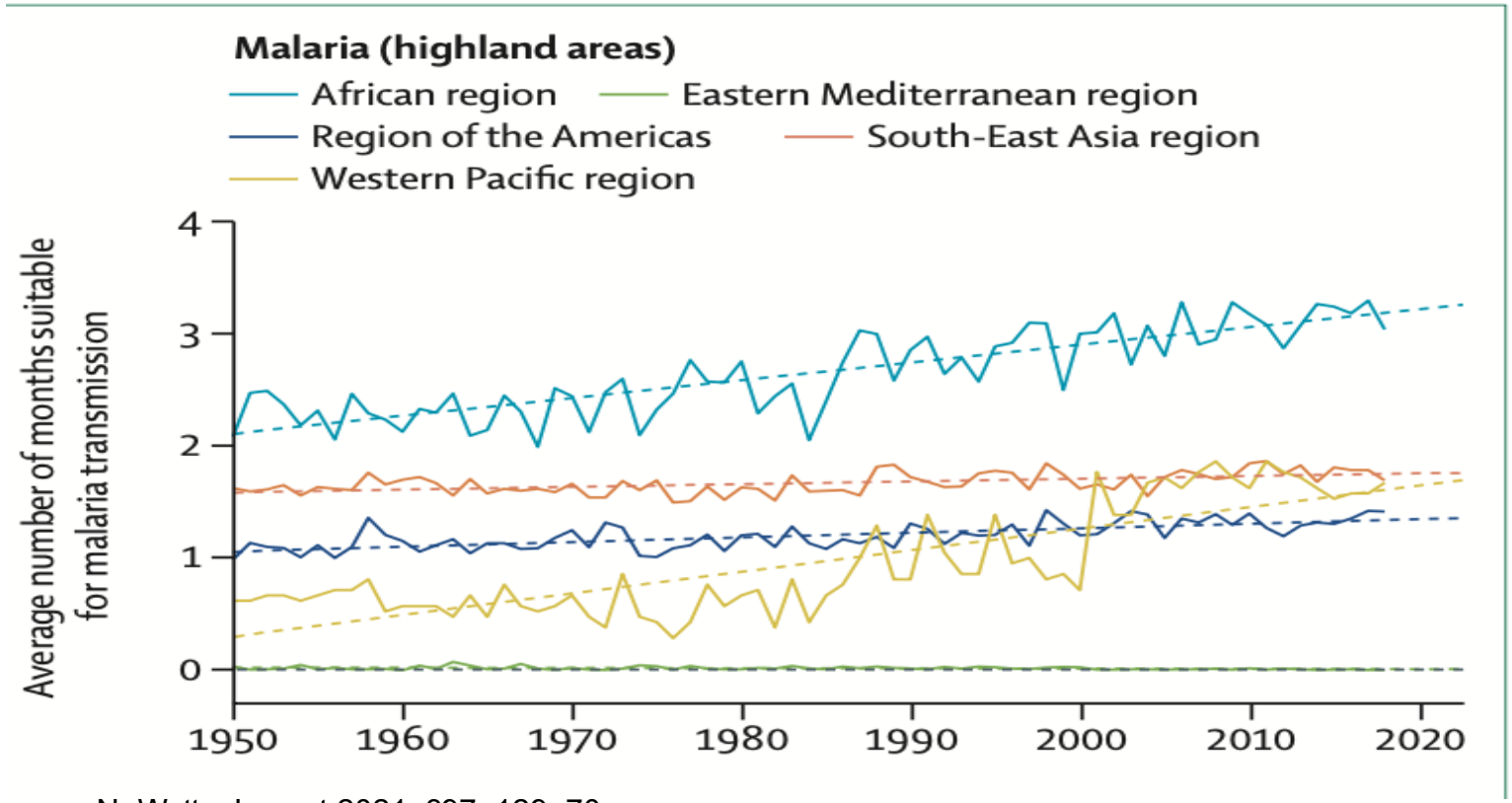
The nightmare Oziem Turkmen Recem (Izmir, Turkiye)

The 2020 report of the *Lancet* Countdown on health and climate change: responding to converging crises

Change in climate suitability for infectious diseases

Solid lines represent the annual change.
Dashed lines represent the trend since 1950 for malaria

Average of months suitable for malaria transmission



N. Watts. Lancet 2021; 397: 129–70

World Health Organization

2024 Malaria World Report

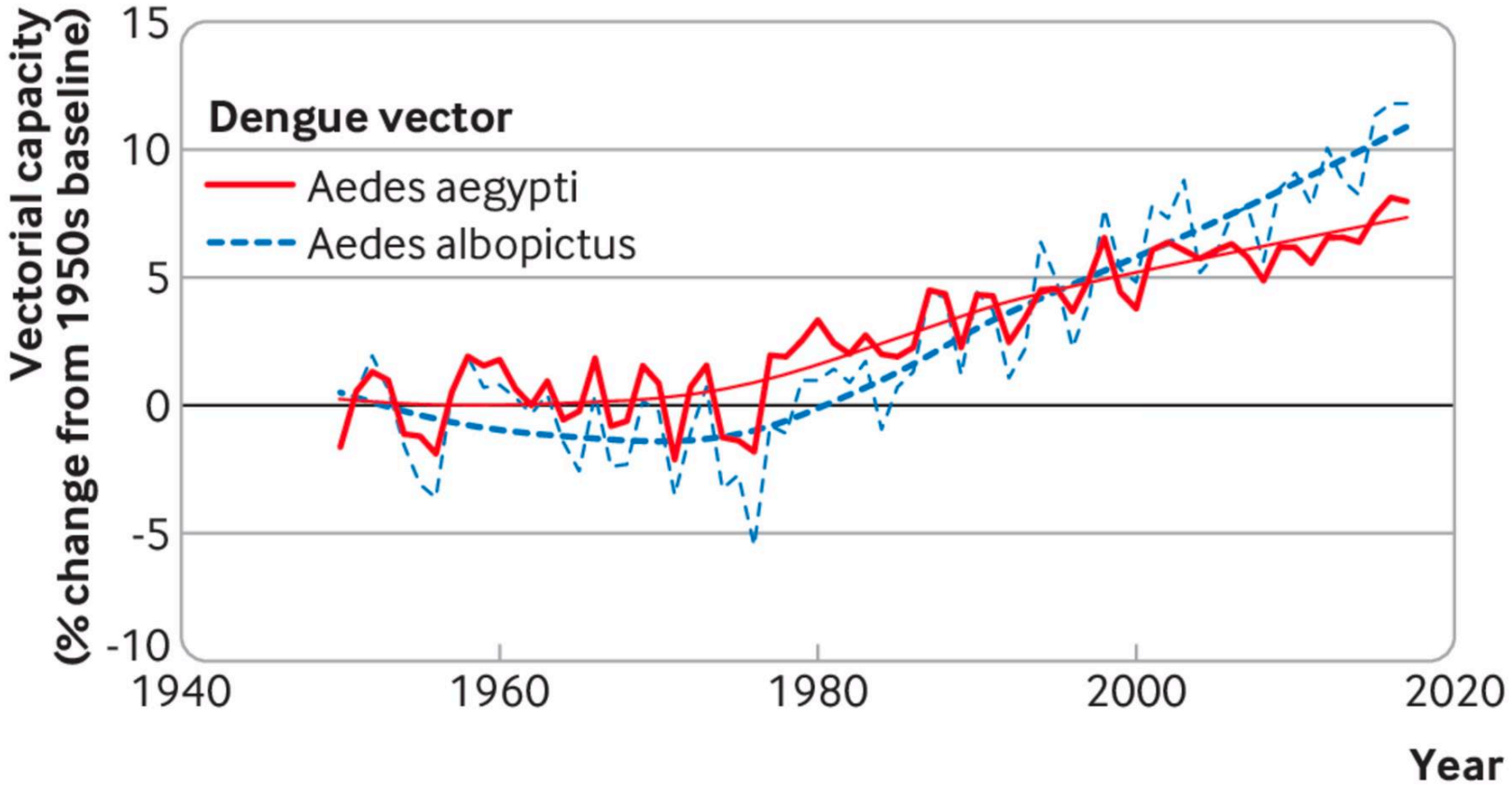
In 2023, malaria caused **262 million** clinical episodes and **597K deaths.**

76% of all deaths in Africa were among children aged **under 5 years** in 2023.

CLIMATE CHANGE AND COMMUNICABLE DISEASES

Tracking infectious diseases in a warming world

Mathematical models of dengue vectorial capacity for *A aegypti* and *A albopictus* mosquitoes reveal temporal changes in the potential for dengue transmission due to a warming climate since 1950.



In 2015-2019 global climate suitability for the transmission of dengue increased by 8.9% for *Aedes aegypti* and 15.0% for *Aedes albopictus*.

Kris A Murray *BMJ* 2020;371:m3086

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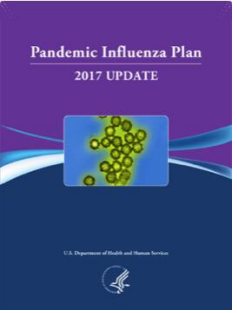
The Perpetual Challenge of Infectious Diseases

Factors involved in infectious disease emergence

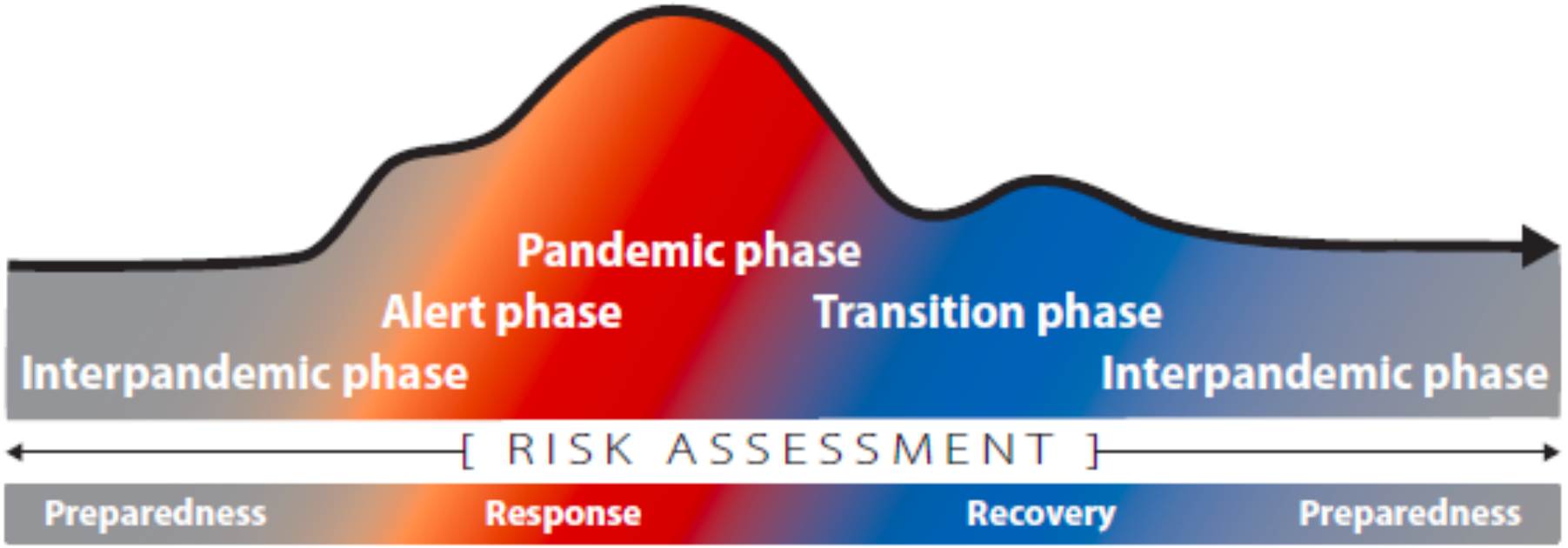
- Human demographics and behaviour
- Economic development and land use
- War (intent to harm) and famine, poverty and social inequality
- International trade and commerce
- Human susceptibility to infection
- Breakdown of public-health measures (lack of political will)
- Technology and industry
- Microbial adaptation
- Changing ecosystems, climate and weather

A. Fauci 366;5 february 2, 2012



Advance planning and preparedness are critical to help reduce the impact of a pandemic

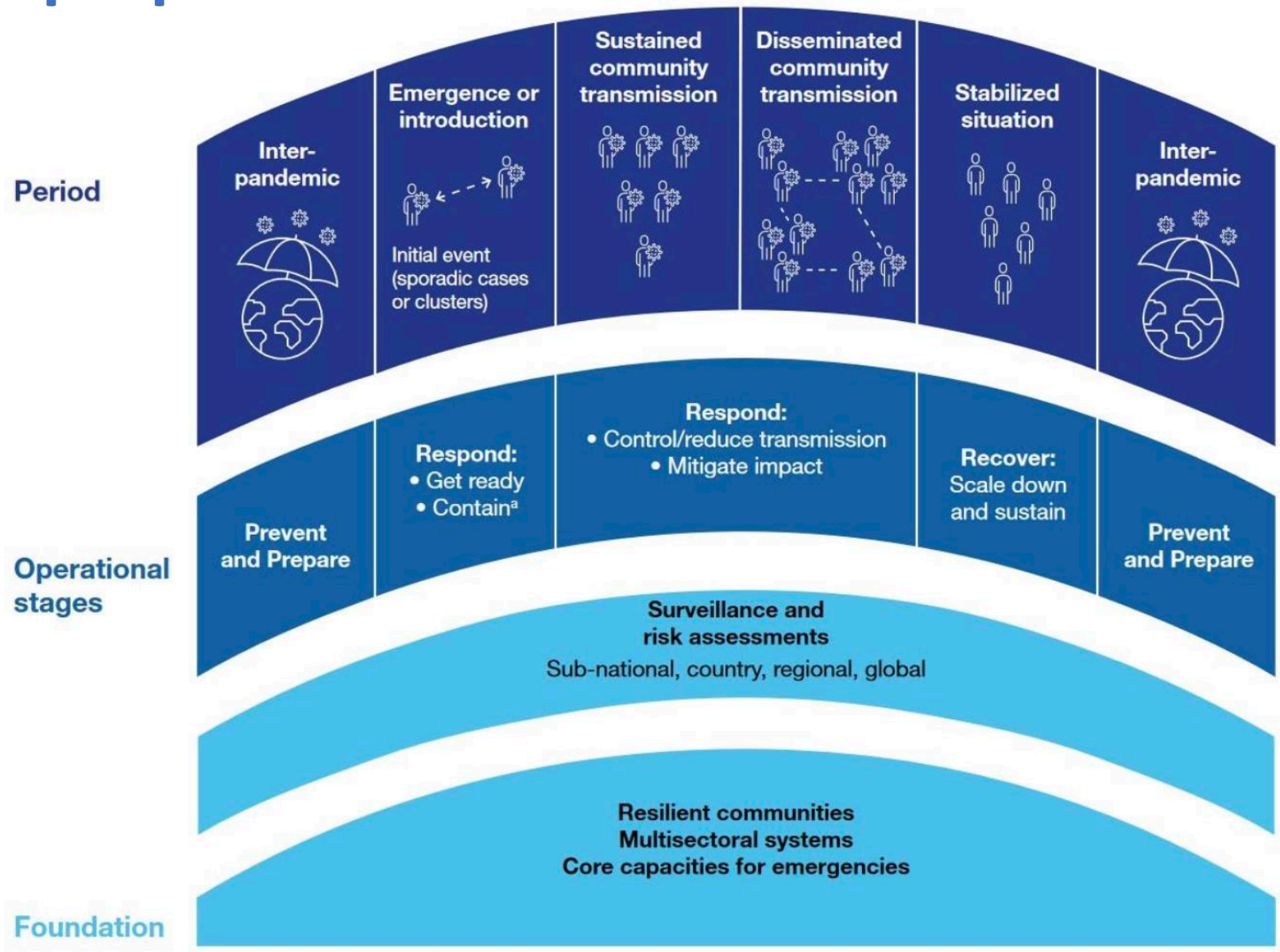
Figure 1. The continuum of pandemic phases[a]

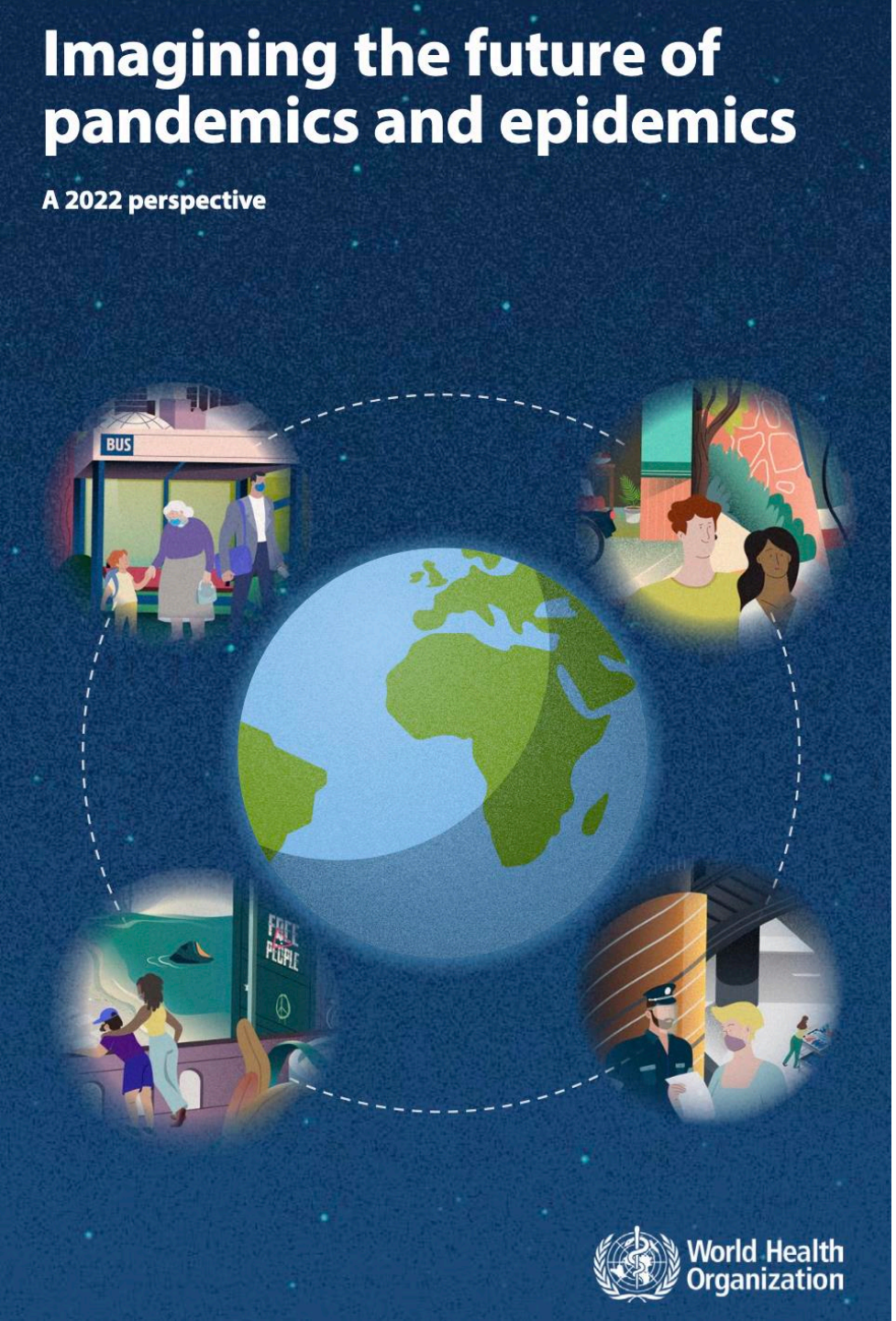


[a] This continuum is according to a "global average" of cases, over time, based on continued risk assessment and consistent with the broader emergency risk management continuum.

"*Guida alla gestione del rischio di influenza pandemica*" OMS, 2017

Modello di corrispondenza tra le fasi pandemiche e le fasi operative proposto dall'OMS





Categories

Pathogen and host characteristics

Public health and social measures

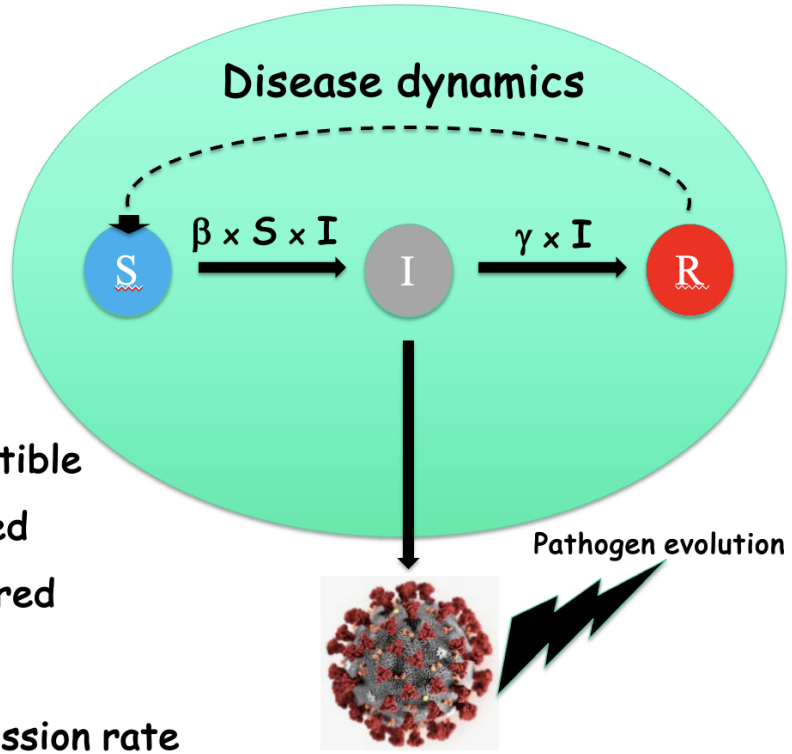
Contextual factors

Categories

Key factors

Pathogen and host characteristics

- Transmissibility
- Variant diversity and susceptibility to vaccines
- Human immunity and vulnerability levels
- Symptom range and mortality rate



S: Susceptible

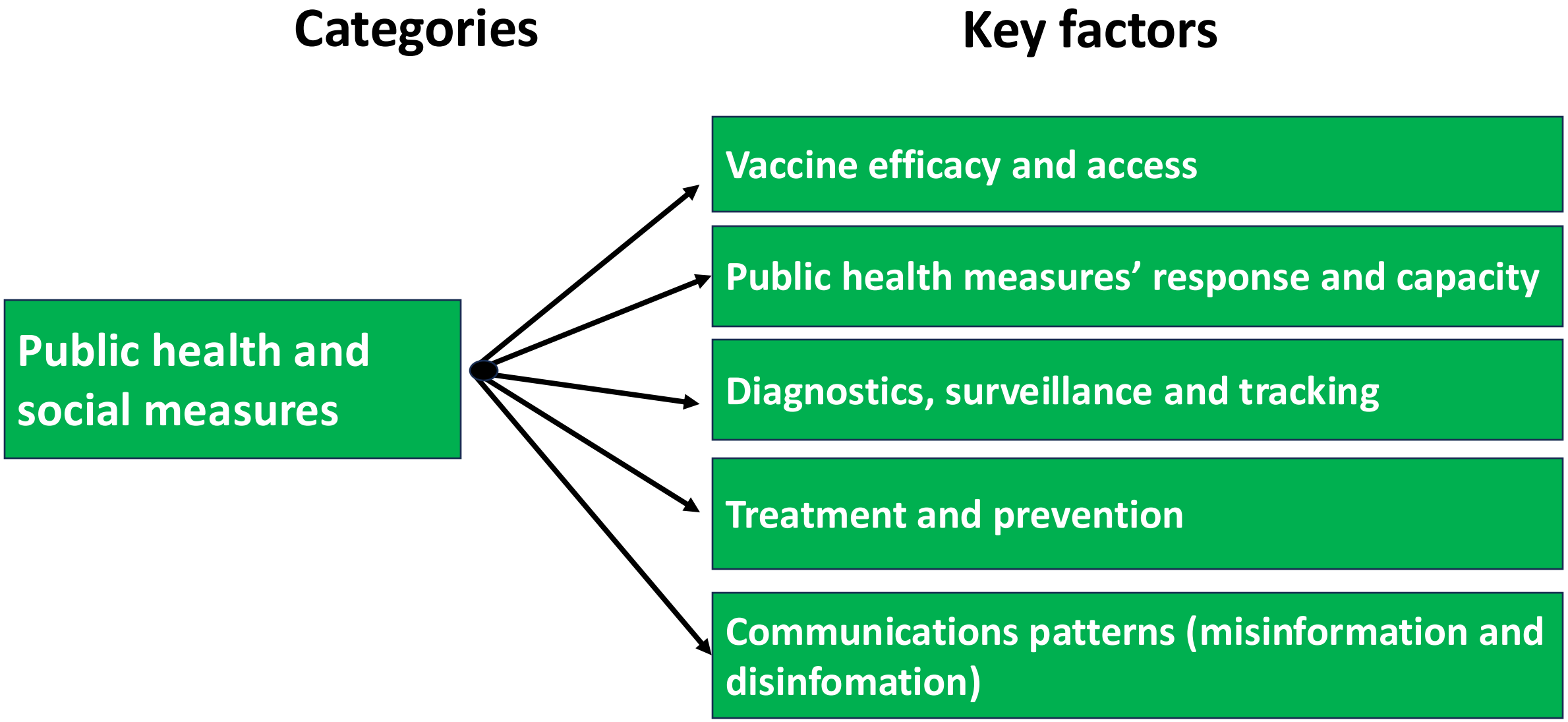
I: Infected

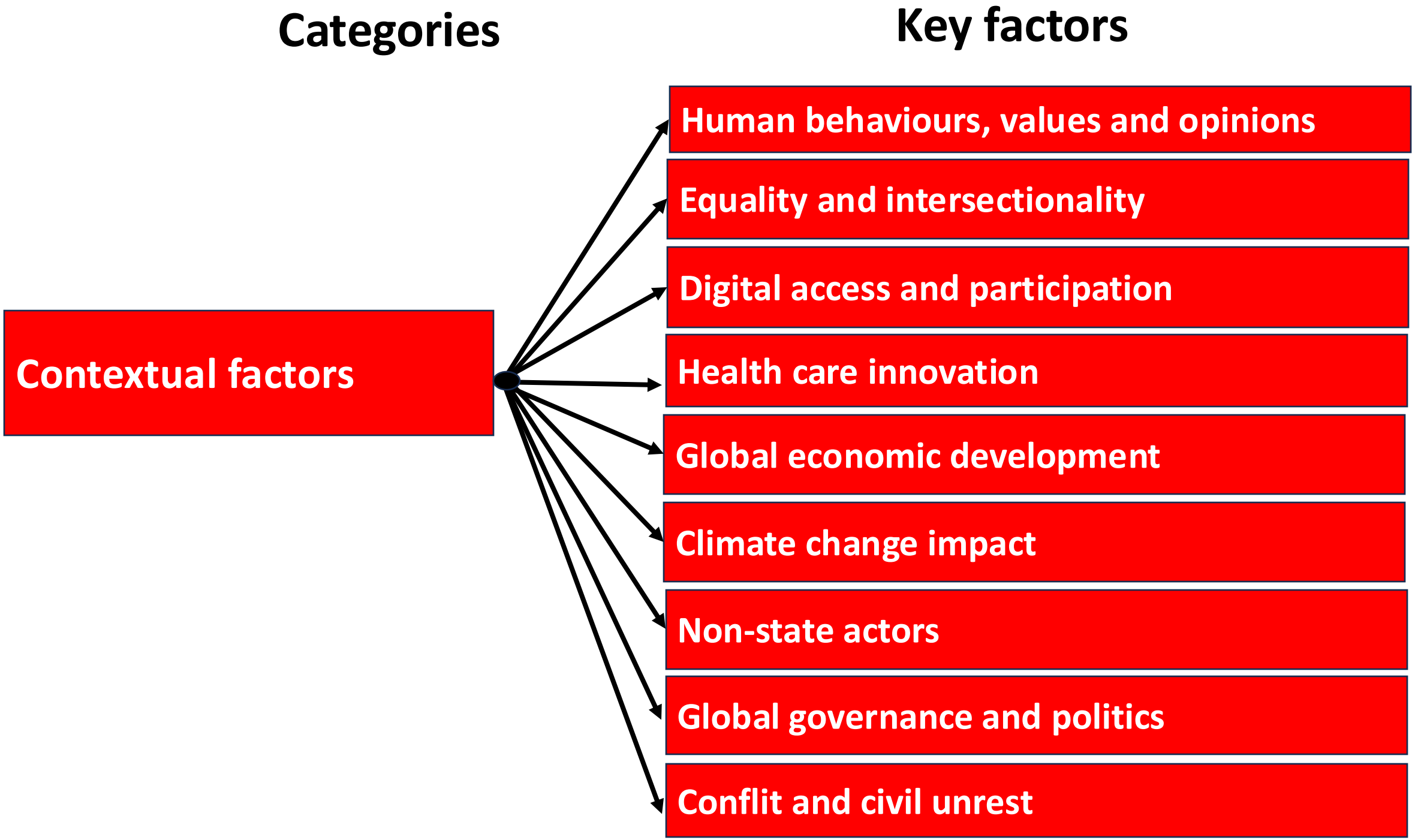
R: Recovered

β: transmission rate

γ: recovered rate

Modified, Baker RE, et al. Nat Rev Microbiol, 2022


Categories
Key factors
Public health and social measures
Vaccine efficacy and access
Public health measures' response and capacity
Diagnostics, surveillance and tracking
Treatment and prevention
Communications patterns (misinformation and disinfomation)


Categories
Key factors
Contextual factors
Human behaviours, values and opinions
Equality and intersectionality
Digital access and participation
Health care innovation
Global economic development
Climate change impact
Non-state actors
Global governance and politics
Conflit and civil unrest

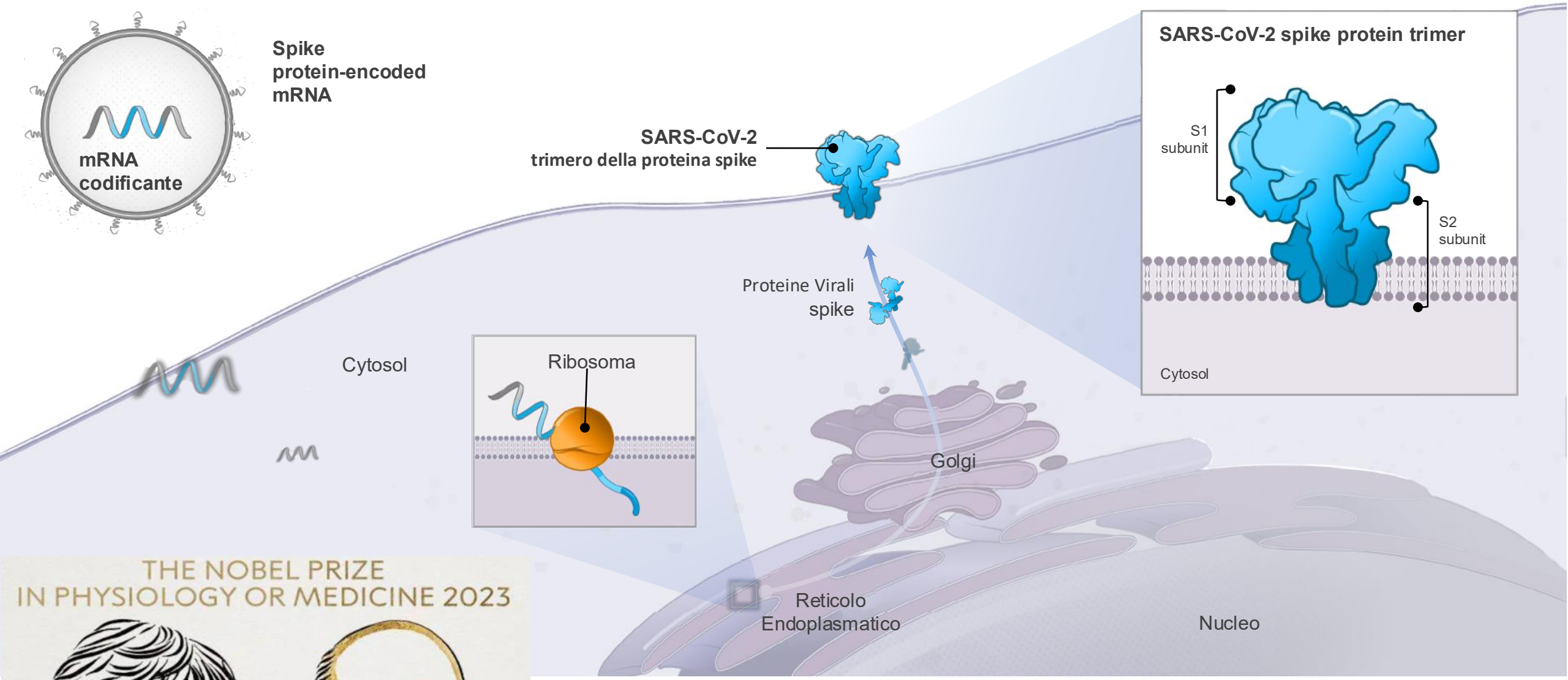
European Centre for Disease Prevention and Control

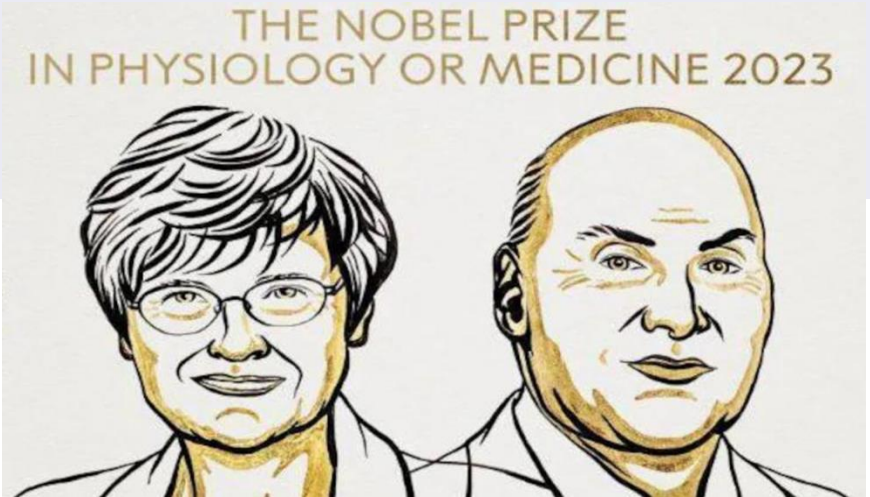
An agency of the European Union

Vaccine hesitancy

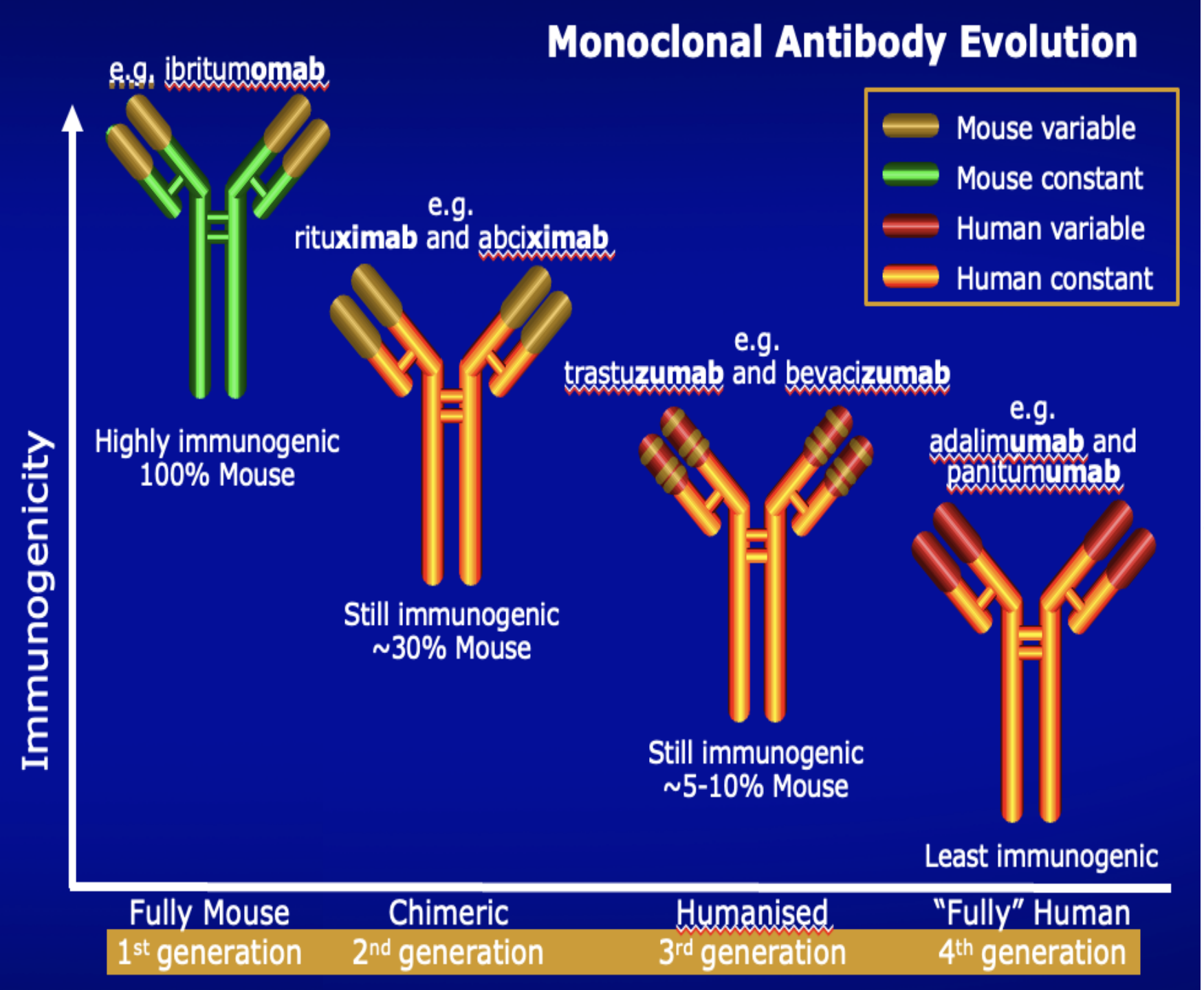
TECHNICAL REPORT

Catalogue of interventions addressing vaccine hesitancy

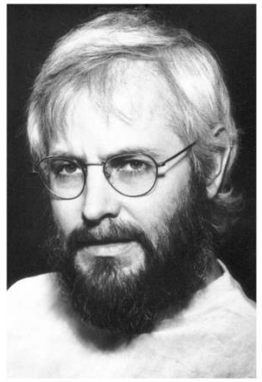




Katalin Karikó e Drew Weissman



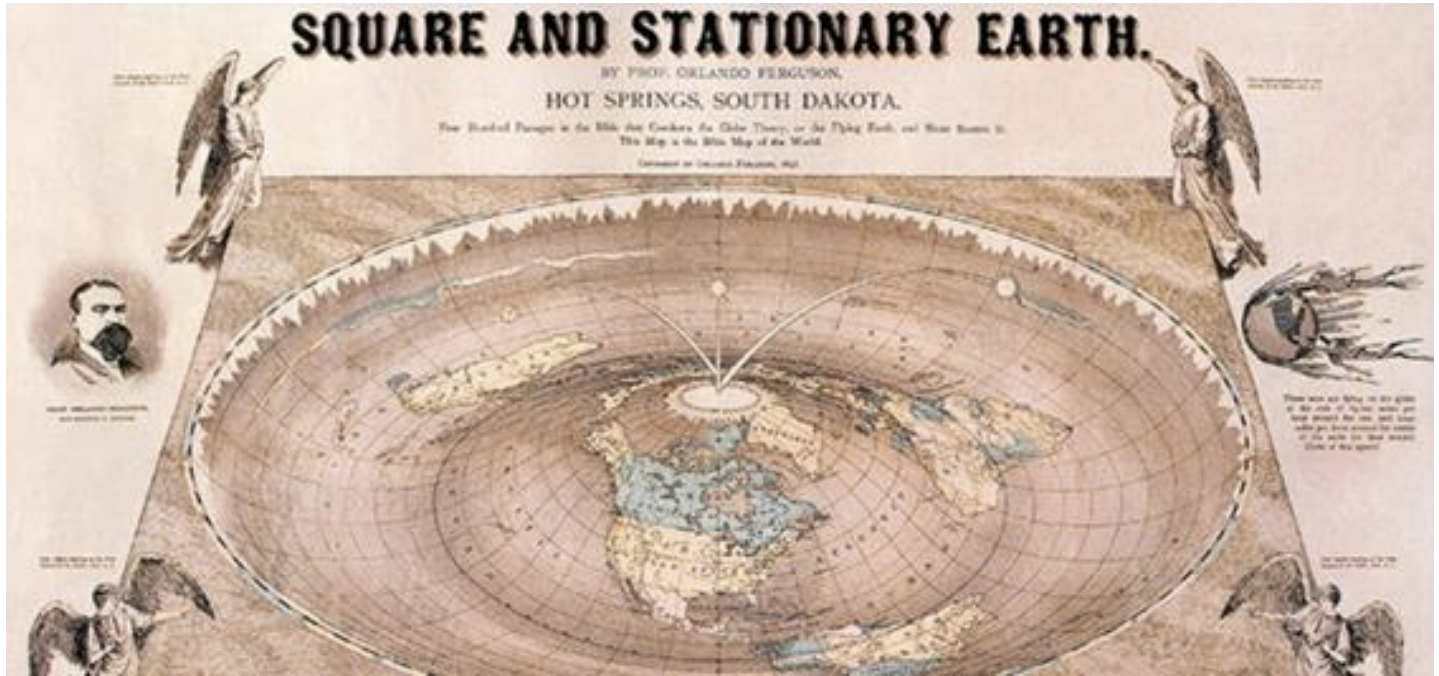
Nobel Prize in Physiology or Medicine 1984


Niels K. Jeme, Georges Kohler and César Milstein
Nobel Prize in 1984 for the development of monoclonal antibodies.

Screaming out loud J. Kluytmans (Utrecht, Netherlands)

What makes people distrust science?



Piano strategico operativo di preparazione e risposta ad una pandemia da patogeni a trasmissione respiratoria a maggiore potenziale pandemico 2025-2029

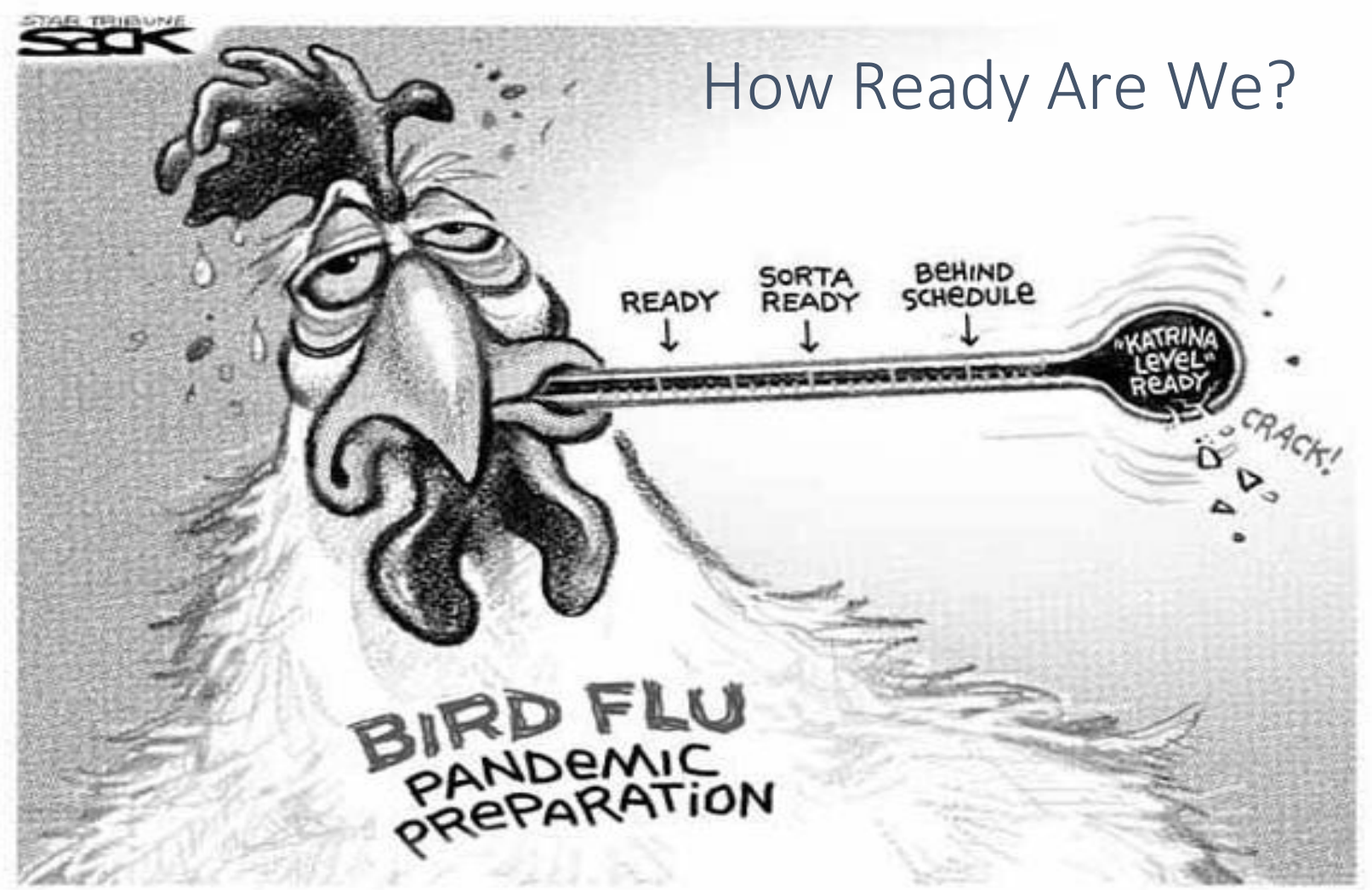
Obiettivi

Rafforzare la preparazione a livello nazionale e locale per affrontare una futura pandemia da agenti patogeni respiratori.

- **Obiettivo 1**: ridurre la trasmissione, la morbilità e la mortalità.
- **Obiettivo 2:** coordinamento a livello nazionale e locale delle emergenze
- **Obiettivo 3:** ridurre l'impatto della pandemia sui servizi sanitari e sociali
- **Obiettivo 4:** tutelare la salute degli operatori sanitari
- **Obiettivo 5:** informare, coinvolgere e responsabilizzare la comunità

"Every day a pandemic doesn't happen is another day we have to prepare.

Michael Osterholm

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