

# L'impatto delle malattie infettive nel nostro quotidiano

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Istituto Nazionale per le Malattie Infettive L. Spallanzani, Roma

10 Maggio, 2023

TIWS meeting, Milano



CLUB DELLE  
RICERCATRICI  
TOP ITALIAN  
WOMEN  
SCIENTIST DI  
FONDAZIONE  
ONDA

CERIMONIA DI PREMIAZIONE  
*Convegno in ricordo di Rosella Silvestrini*

10 maggio 2023 | 10.30-12.30  
Sala Gonfalone, Palazzo Pirelli, Via Fabio Filzi 22, Milano





**INFECTIOUS DISEASES**

**WHO  
CARES ?**

# Leading causes of death globally based on WHO in 2019

<https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>

## Leading causes of death globally

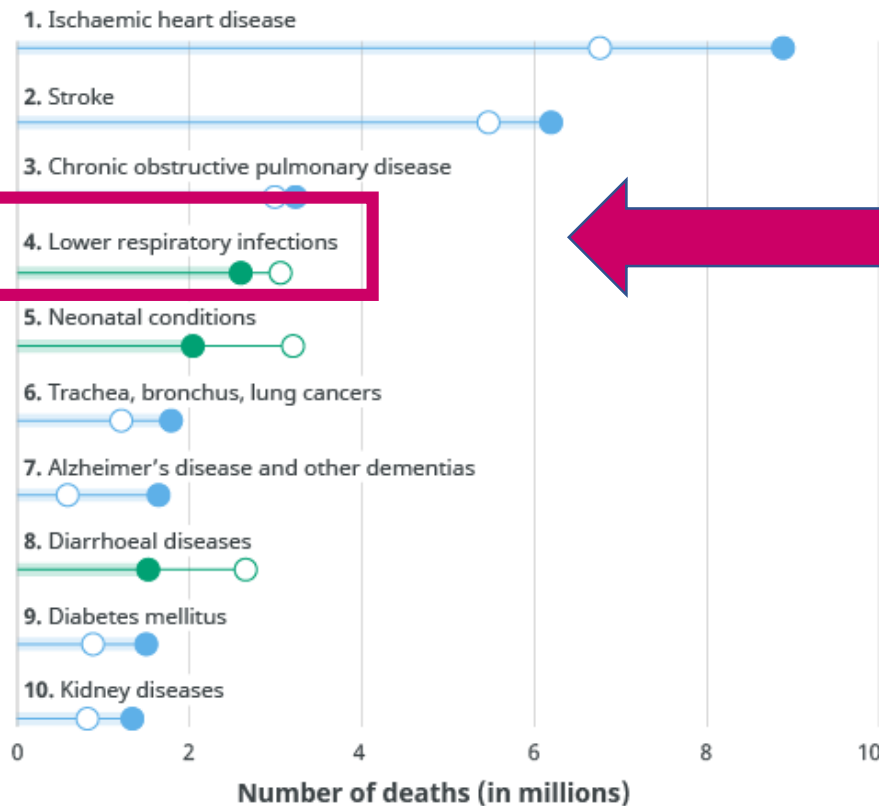
At a global level, 7 of the 10 leading causes of deaths in 2019 were noncommunicable diseases. These seven causes accounted for 44% of all deaths or 80% of the top 10. However, all noncommunicable diseases together accounted for 74% of deaths globally in 2019.



In 2019, the top 10 causes of death accounted for 55% of the 55.4 million deaths worldwide.

### Leading causes of death globally

○ 2000 ● 2019



● Noncommunicable ● Communicable ● Injuries

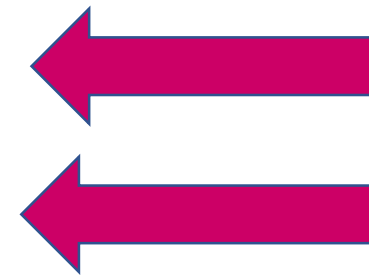


# Cause di morte in Italia nel 2020, dati ISTAT

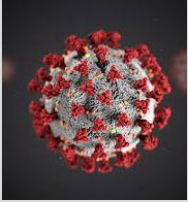

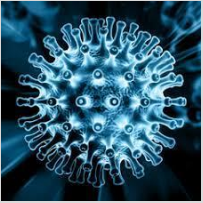

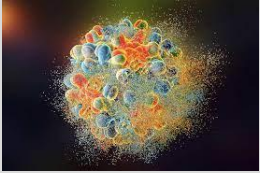
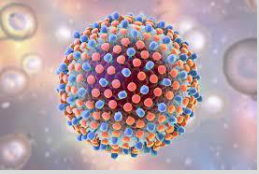
<http://dati.istat.it/>

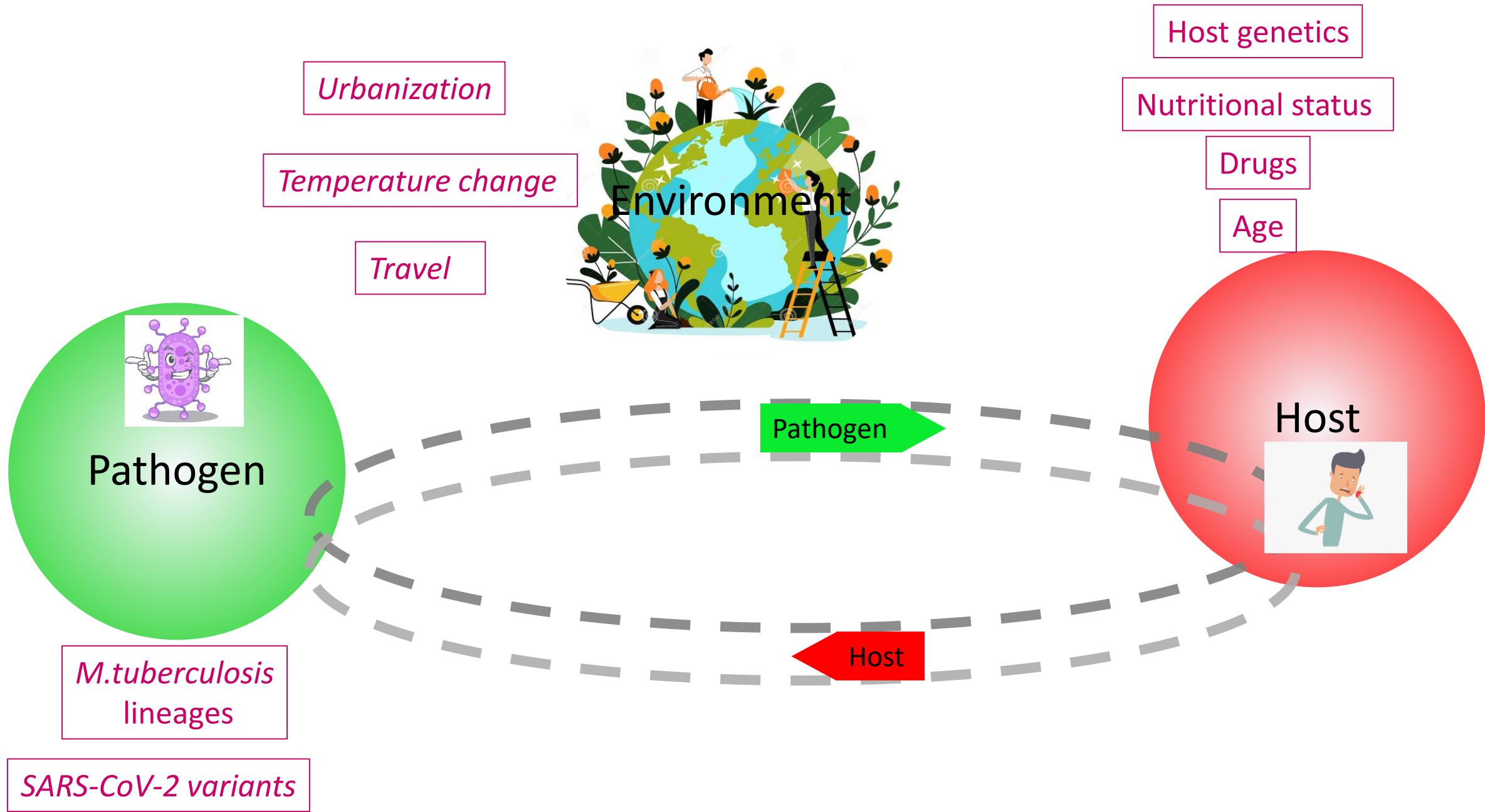
	ITALIA Ranking 2015-2019
1	Malattie sistema circolatorio
2	Tumori
3	Malattie dell'apparato respiratorio
4	Malattie endocrine, nutrizionali, e metaboliche
5	Malattie del sistema nervoso
6	Traumatismi
7	Disturbi psichici
8	Malattie dell'apparato digerente

ITALIA Ranking 2020
Malattie sistema circolatorio
Tumori
Malattie dell'apparato respiratorio
COVID-19
Malattie endocrine, nutrizionali, e metaboliche
Malattie del sistema nervoso
Disturbi psichici
Sintomi e stati mal definiti

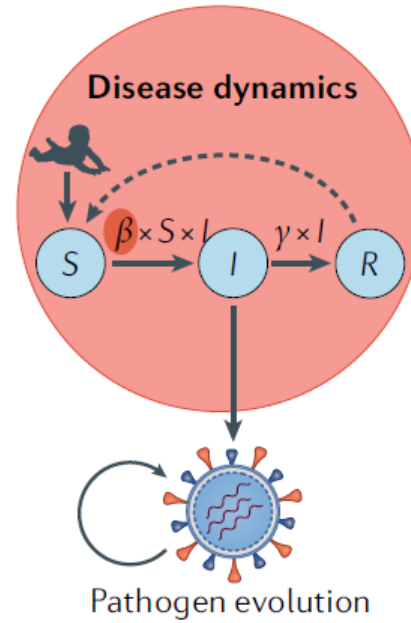
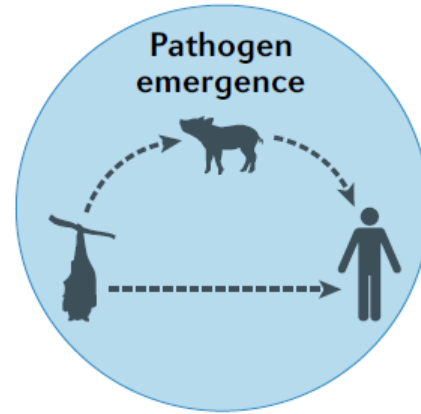


# Malaria, HIV, tuberculosis, COVID-19, HBV, HCV infections: estimated cases

	<b>SARS-CoV-2</b>	<b>Malaria</b>	<b>HIV</b>	<b>Mycobacterium tuberculosis</b>	<b>HBV</b>	<b>HCV</b>
						
<b>Year</b>	<b>2020</b>	2017	2020	2020	2020	2020
<b>World cases</b>	<b>80 million</b>	247 milion	38 million	9.9 million	296 million	58 million
<b>World Mortality</b>	<b>1.7 million</b>	619,000	680,000	1.5 million	820,000	290,000
<b>Italy cases</b>	<b>2.201.000</b> (new cases)	Around 800 cases	130,000 (prevalent cases) 1770 (new infections)	4000 (new cases)	700.000 (prevalent cases)	500.000 (prevalent cases)



# Effects of climatic, technological and demographic change on disease emergence, dynamics and spread



<b>Climatic change</b>	Drives range shifts for reservoir species	Affects transmission and susceptibility	Affects the geographical range of vectors
<b>Technological change</b>			
Transportation	Improved global surveillance		Air transit and high-speed rail affect pace and range of spread
Health care		Vaccination affects dynamics	Improved care reduces burden
<b>Demographic change</b>			
Population growth and land use	Increased contact with reservoir species	Population numbers affect evolution, birth rates affect dynamics	Larger population travelling
Urbanization	Depends on species	Density affects contact rate	Urban population more connected
Ageing	Immunosenescence affects spillover risk	Ageing population increases transmission	Possible larger burden

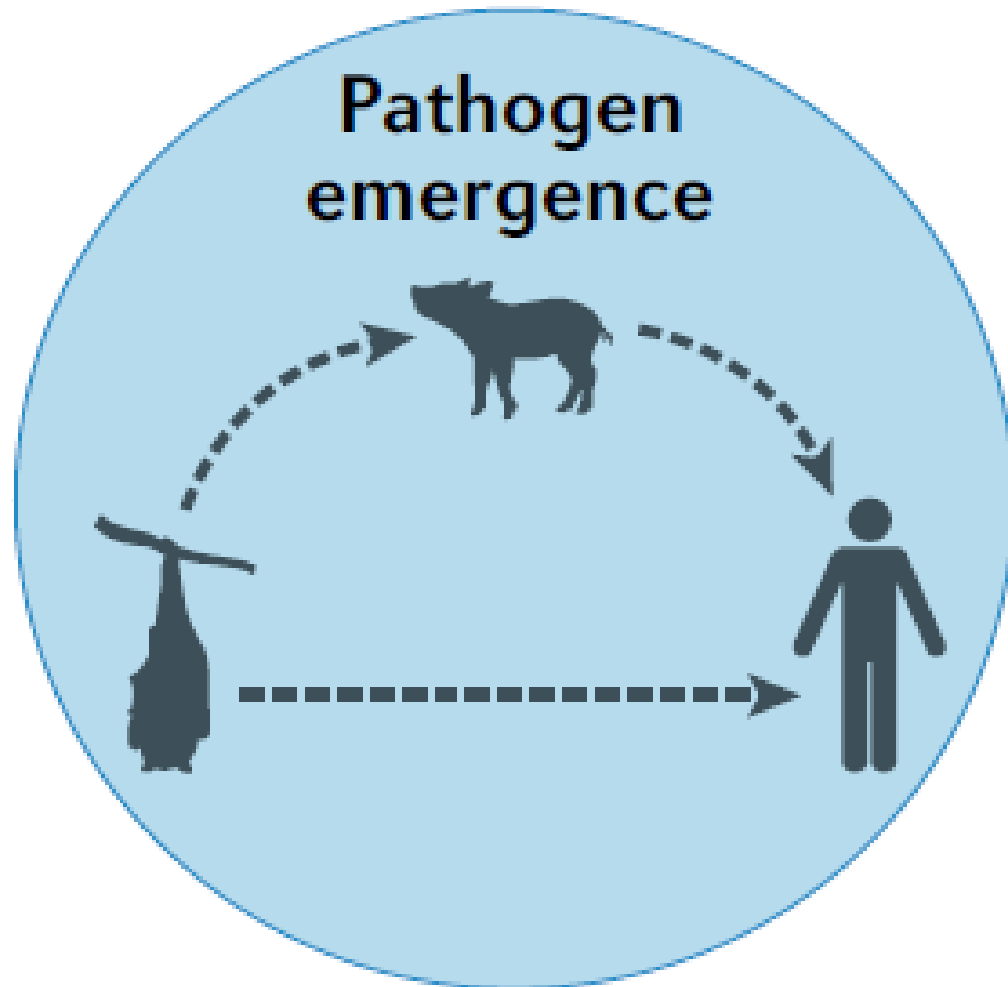
Baker et al,

Nature  
Reviews |  
Microbiology,  
2022



# Pathogen emergence

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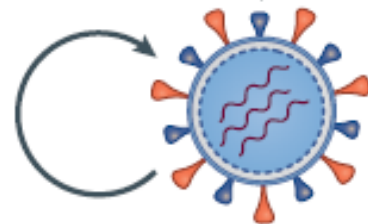
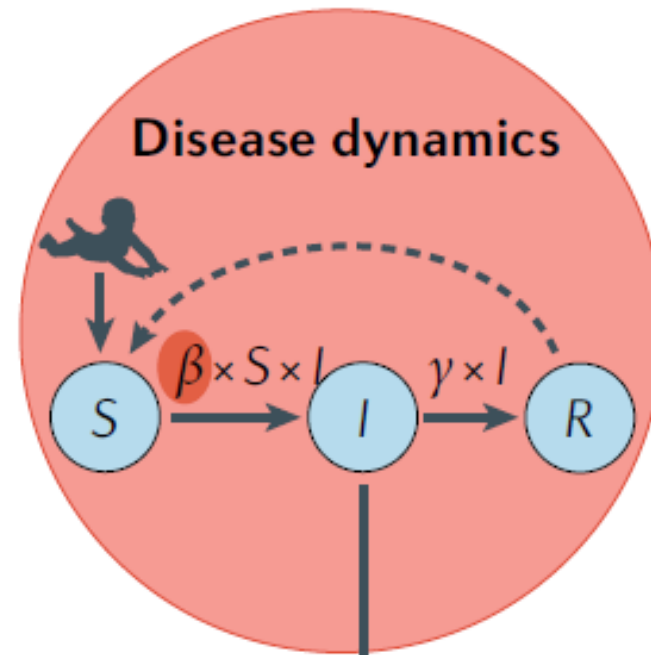
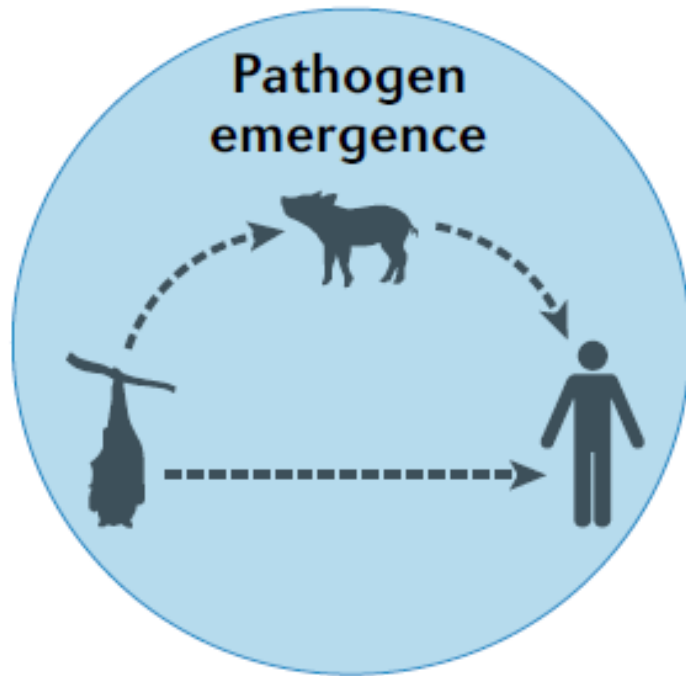


- ❑ Recent decades have seen repeated pathogen emergence from wild or domestic animal reservoirs into human populations, from HIV-1 and HIV-2, to the 1918 influenza virus, to Middle East respiratory syndrome coronavirus, to SARS- CoV-2.
- ❑ For a novel pathogen to become a threat to human populations:
  - ❑ **contact** between humans and the animal reservoir must occur;
  - ❑ the pathogen must either have or evolve the capacity for human- to- human transmission,
  - ❑ this human- to- human transmission must enable expansion of the pathogen's geographical range beyond the zone of spillover.



# Pathogen emergence, disease dynamics and global spread

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Pathogen evolution

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# Global demographic growth

Global population size and annual growth rate: estimates, 1950-2022, and medium scenario with 95 per cent prediction intervals, 2022-2050

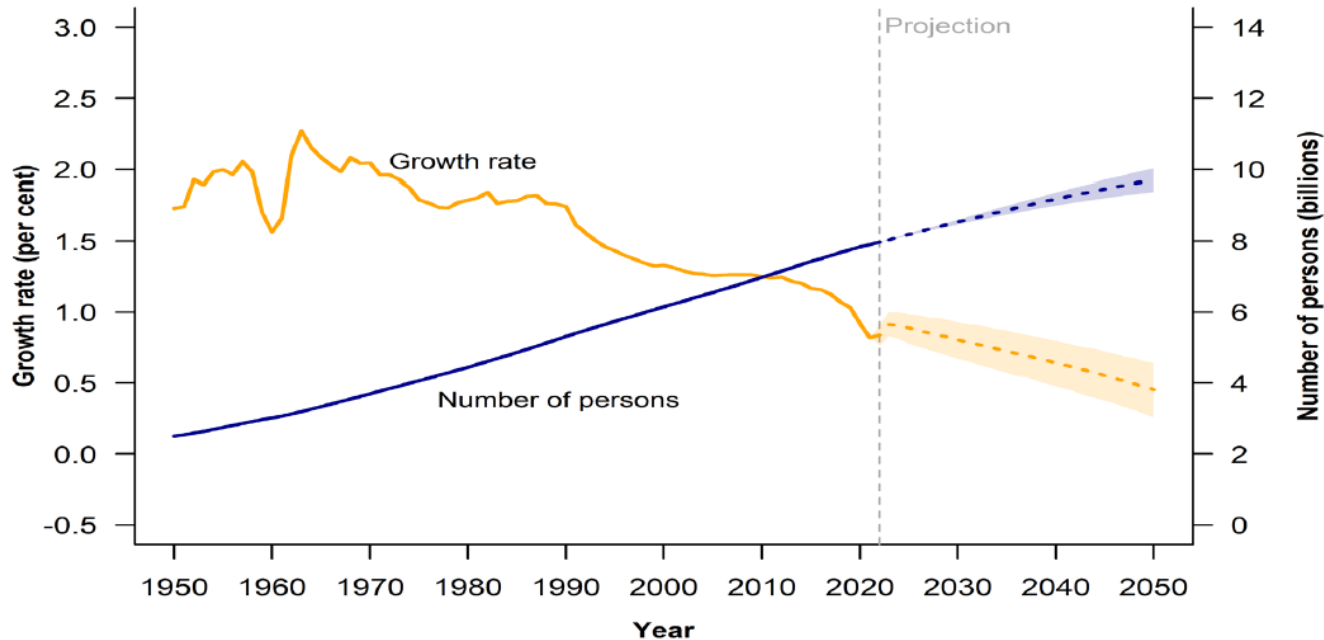
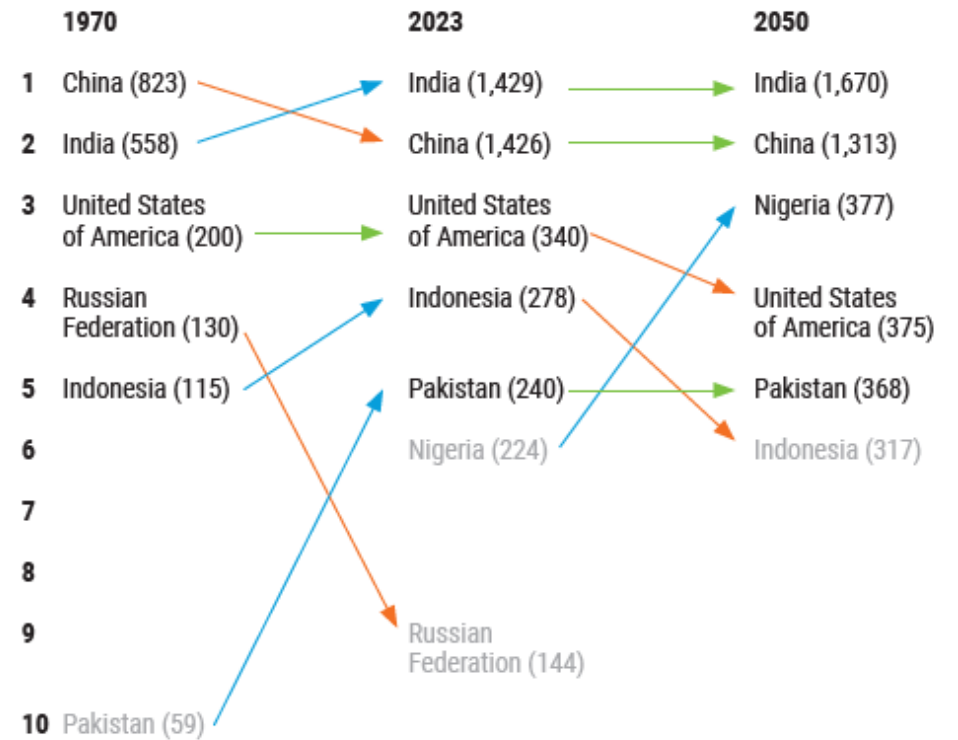


Figure 2  
Top five most populous countries, estimates for 1970 and projections for 2023 and 2050



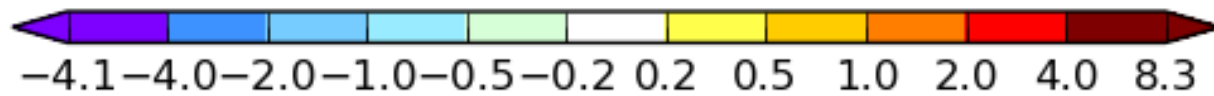
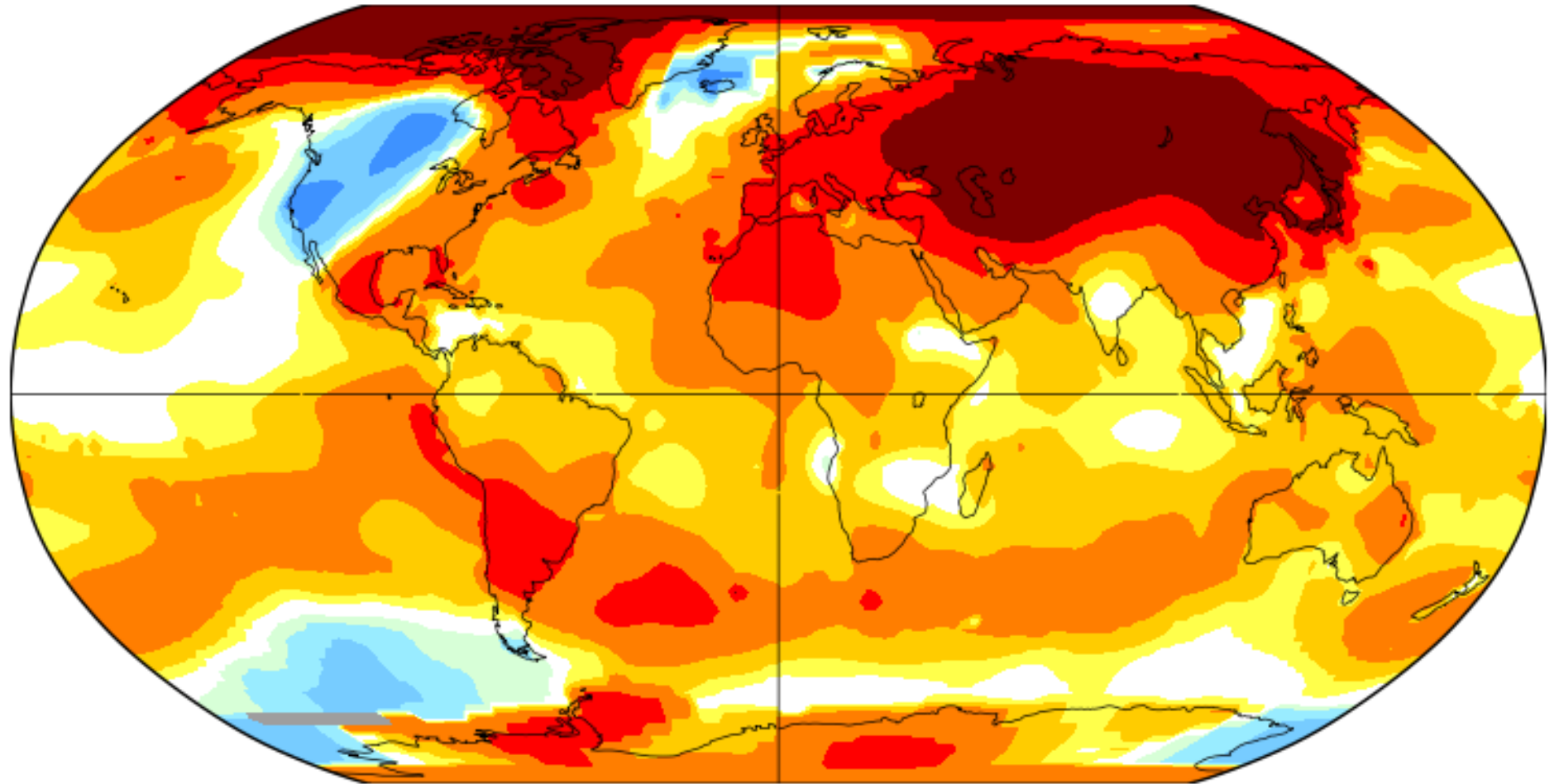
**Note:** Numbers in parentheses refer to total population (in millions) on 1 July of the referenced year.

**Data source:** United Nations, *World Population Prospects 2022*, <https://population.un.org/wpp/>.

March 2023

L-OTI(°C) Anomaly vs 1951-1980

1.21



[https://data.giss.nasa.gov/gistemp/maps/index\\_v4.html](https://data.giss.nasa.gov/gistemp/maps/index_v4.html)



# Climate change



[https://www.google.com/search?q=climate+change&safe=active&rlz=1C1GCEU\\_itIT852IT852&xsrf=APwXEdf3JBo4CvILs2JNQUpUD8twbMLsg:1683300912689&source=Inms&tbn=isch&sa=X&ved=2ahUKEwi5rs3HwN7-AhVGZ8AKHckGDhgQ\\_AUoAnoECAEQBA&biw=1280&bih=577&dpr=1.5](https://www.google.com/search?q=climate+change&safe=active&rlz=1C1GCEU_itIT852IT852&xsrf=APwXEdf3JBo4CvILs2JNQUpUD8twbMLsg:1683300912689&source=Inms&tbn=isch&sa=X&ved=2ahUKEwi5rs3HwN7-AhVGZ8AKHckGDhgQ_AUoAnoECAEQBA&biw=1280&bih=577&dpr=1.5)



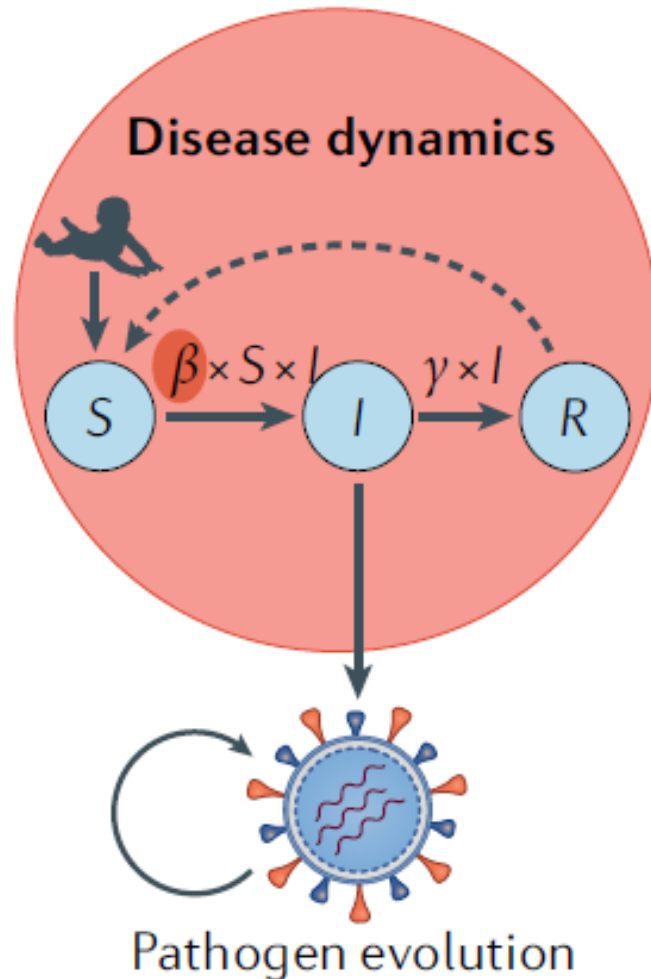
# Impacts of urbanization on infectious disease

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# Infectious disease dynamics

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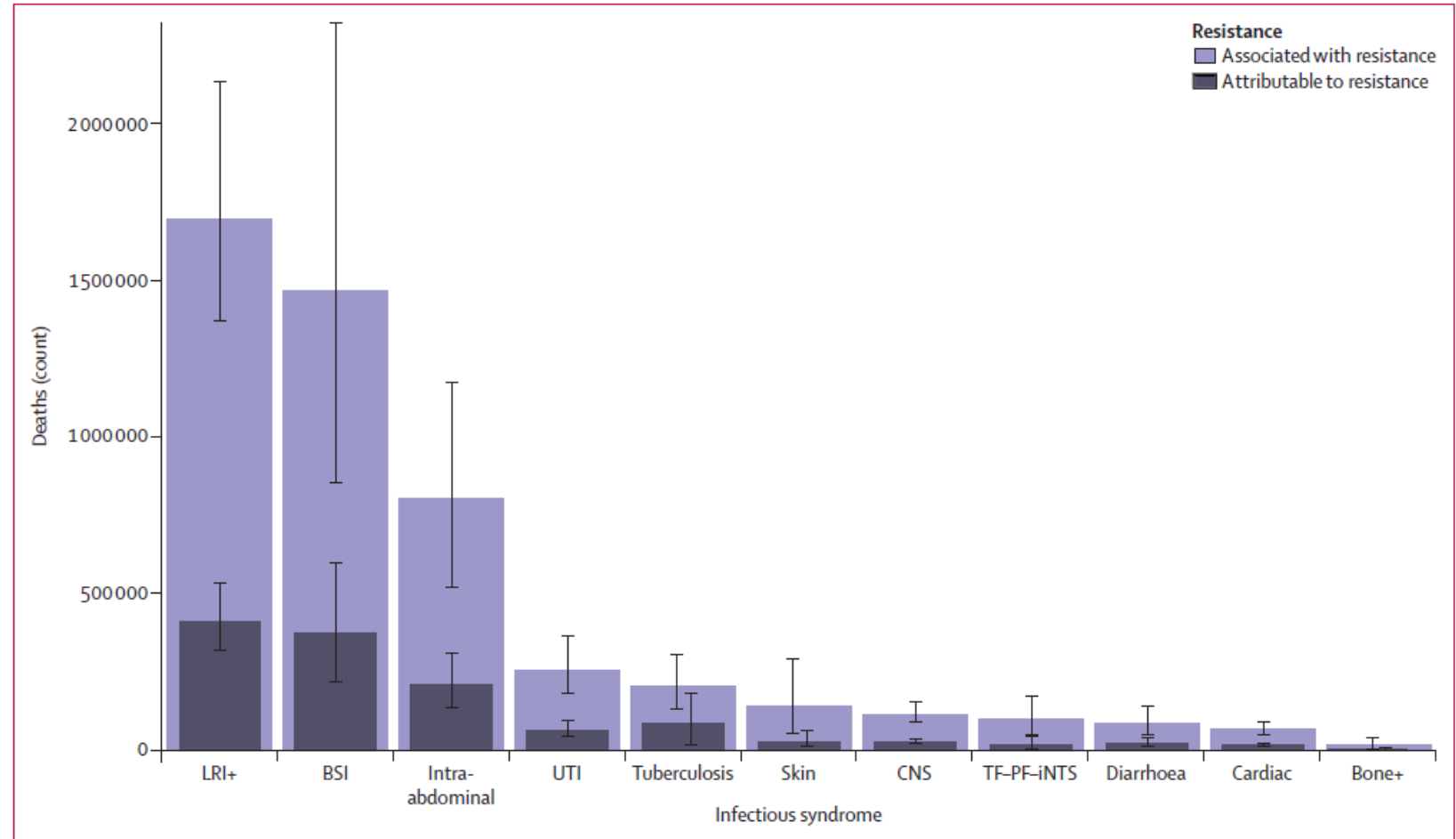
- Density of the population may have an impact on the:
  - Evolution of transmissible pathogens
  - Pathogens and or vectors can rapidly replicate with higher temperature conditions
  - Rapidity of the pathogen transmission

# Estimated 4.95 million deaths associated with bacterial AMR in 2019

Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis

Antimicrobial resistance collaborators, Lancet 2022

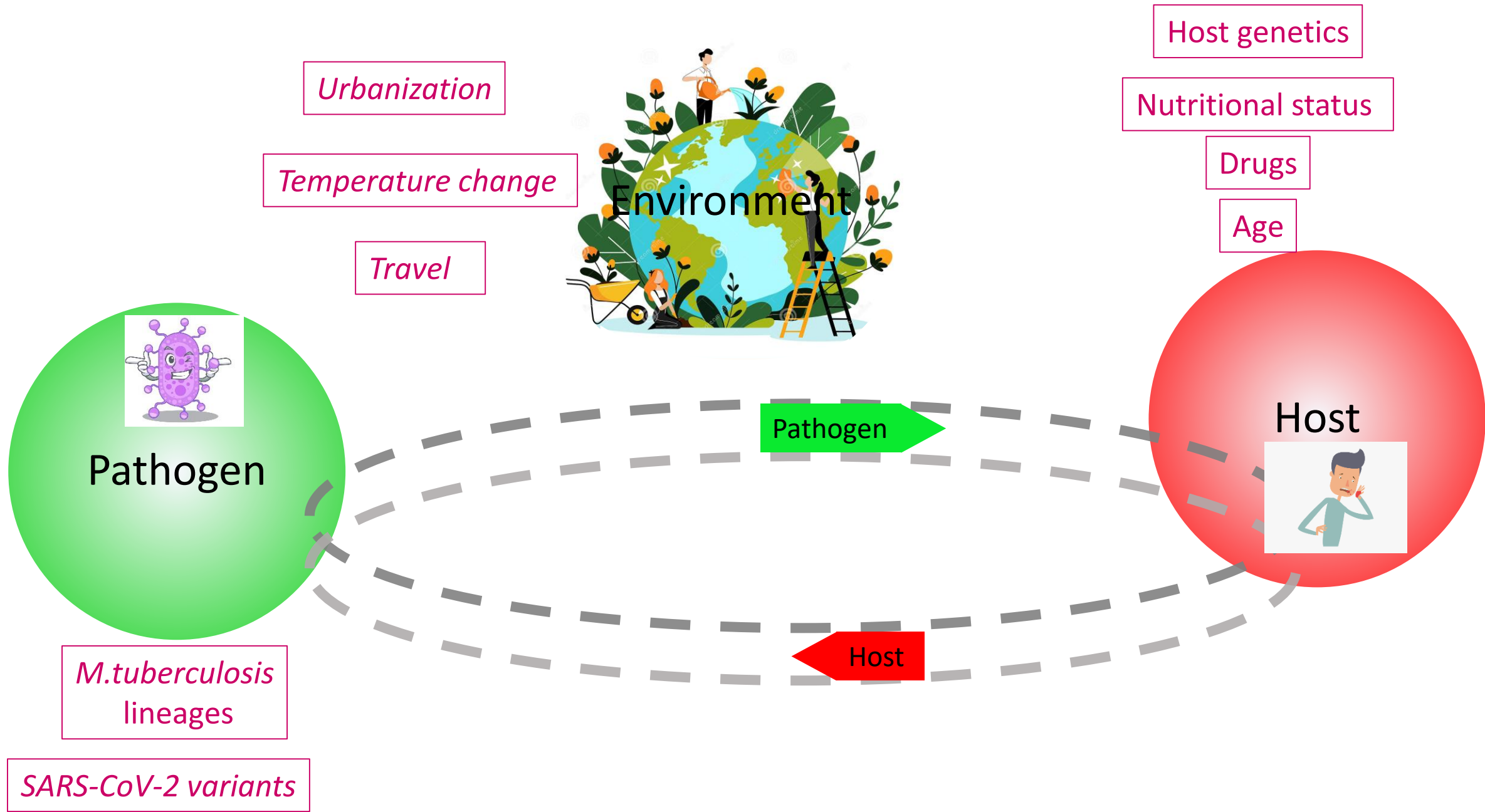
[https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(21\)02724-0/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)02724-0/fulltext)



**Figure 3: Global deaths (counts) attributable to and associated with bacterial antimicrobial resistance by infectious syndrome, 2019**

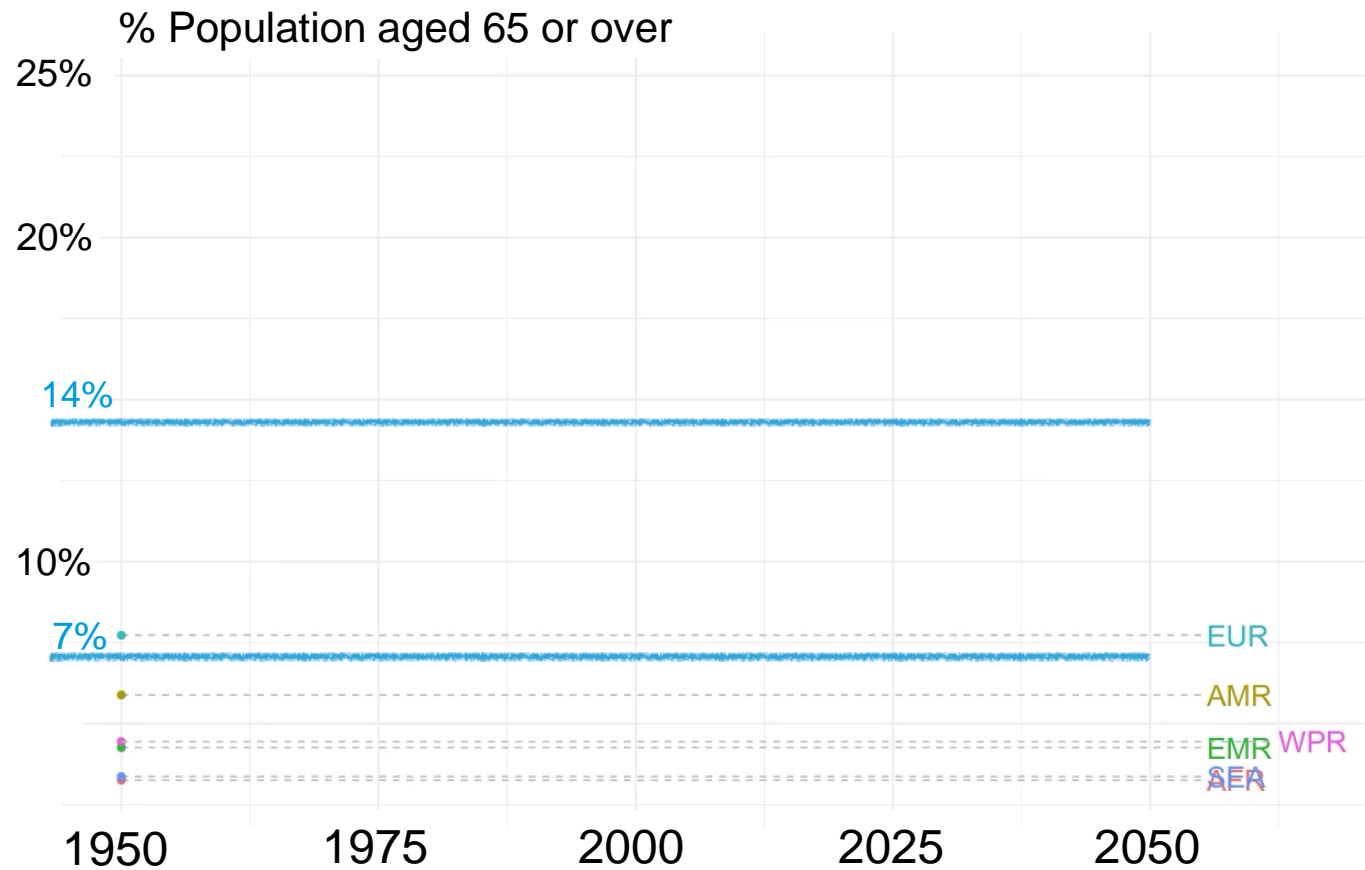
Estimates were aggregated across drugs, accounting for the co-occurrence of resistance to multiple drugs. Error bars show 95% uncertainty intervals. Does not include gonorrhoea and chlamydia because we did not estimate the fatal burden of this infectious syndrome. Bone+=infections of bones, joints, and related organs. BSI=bloodstream infections. Cardiac=endocarditis and other cardiac infections. CNS=meningitis and other bacterial CNS infections. Intra-abdominal=peritoneal and intra-abdominal infections. LRI+=lower respiratory infections and all related infections in the thorax. Skin=bacterial infections of the skin and subcutaneous systems. TF-PF-iNTS= typhoid fever, paratyphoid fever, and invasive non-typhoidal *Salmonella* spp. UTI=urinary tract infections and pyelonephritis.







# Ageing population globally

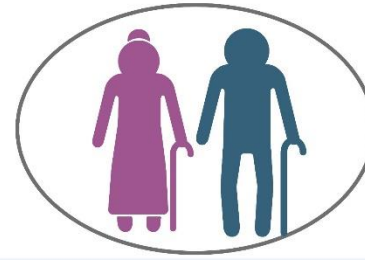


Data source: UN Population Division

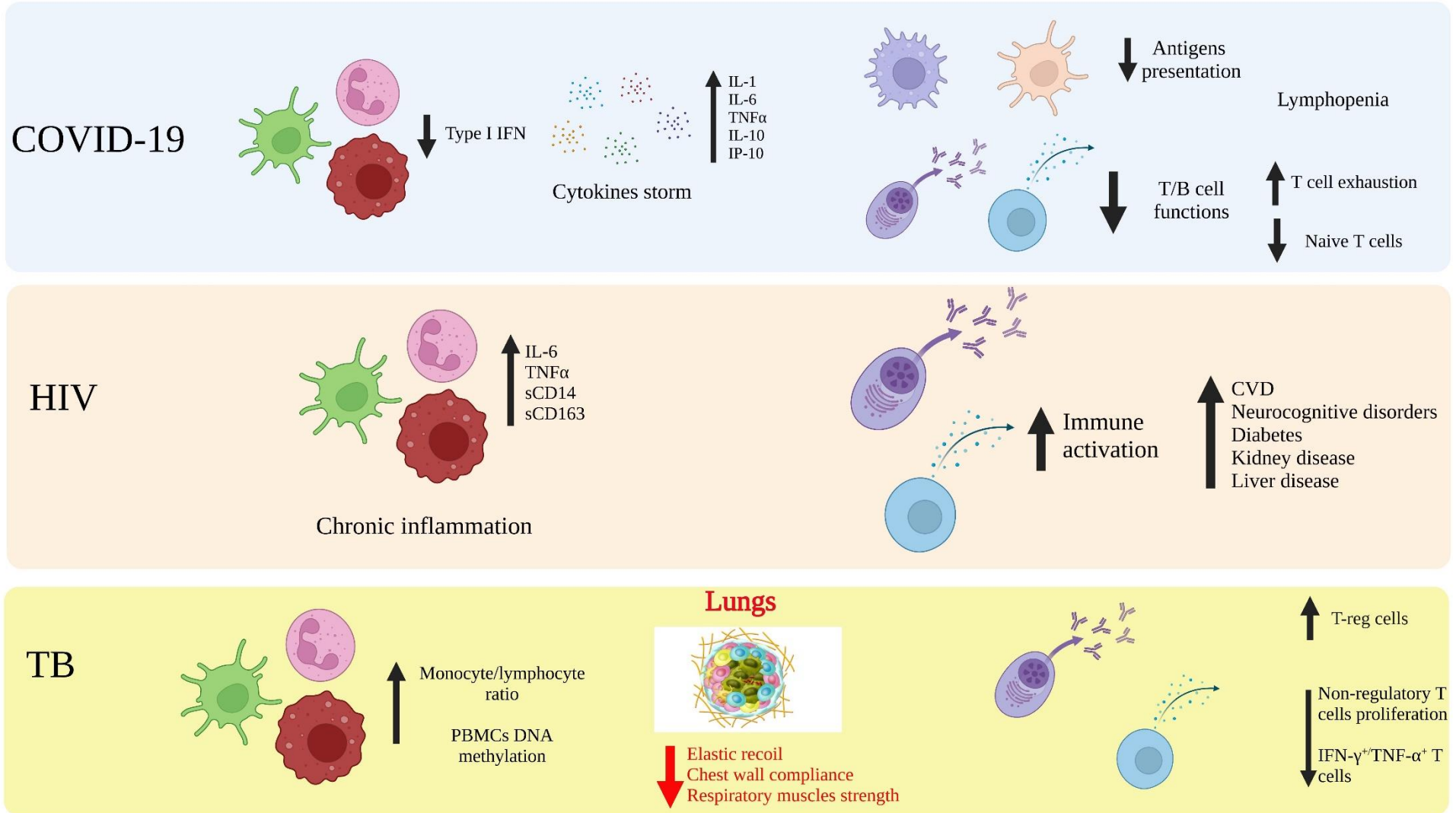
# Aging and immunity impairment and consequences on the fight against infectious diseases

Grifone et al, submitted

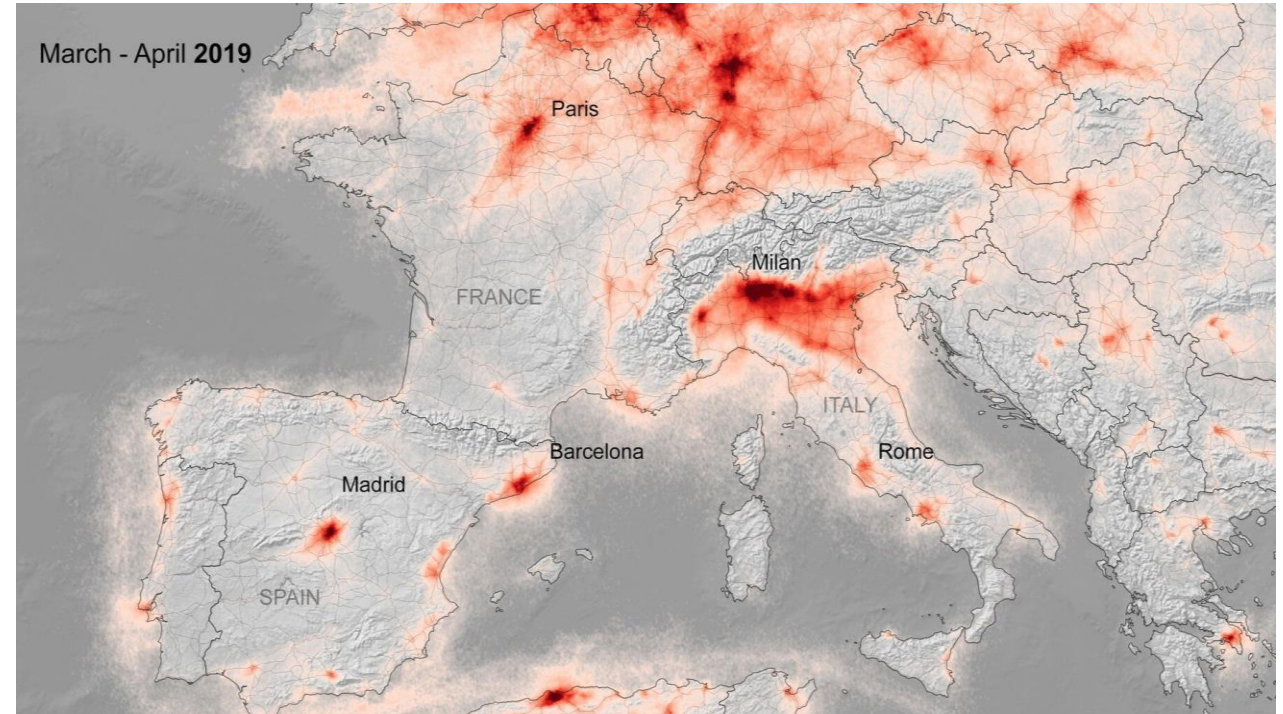
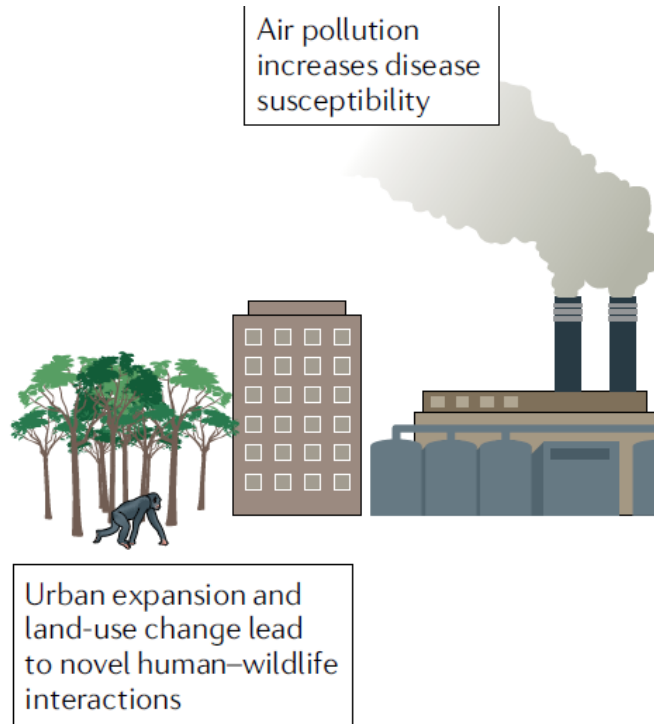
## Innate Response



## Adaptive Response



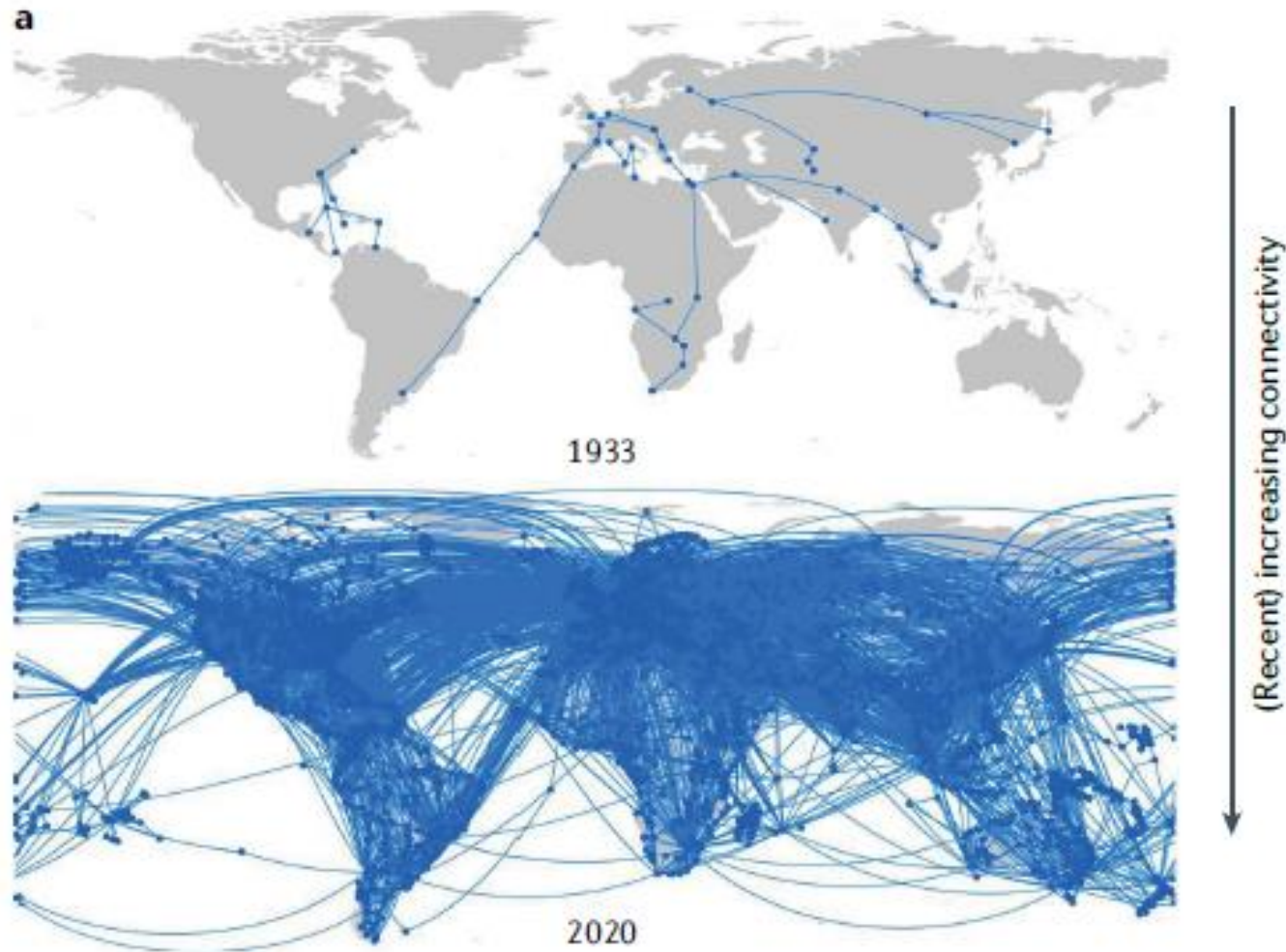
# Impacts of urbanization and pollution on infectious disease



The image shows the nitrogen dioxide concentrations

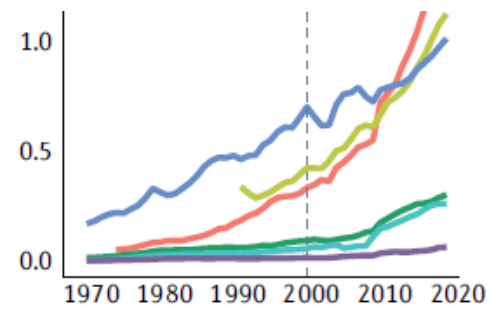
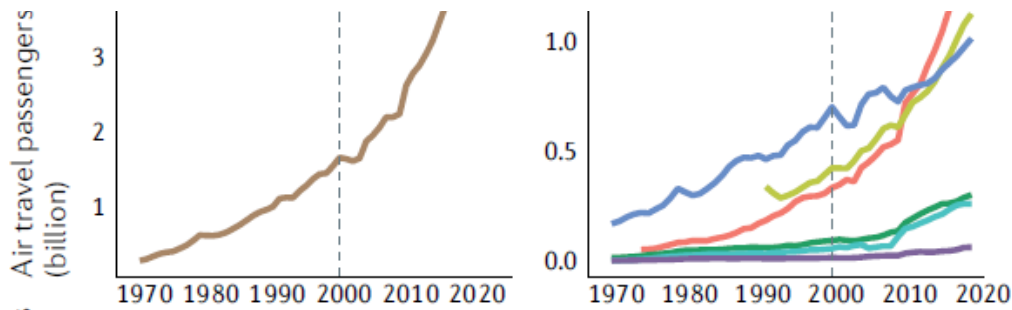
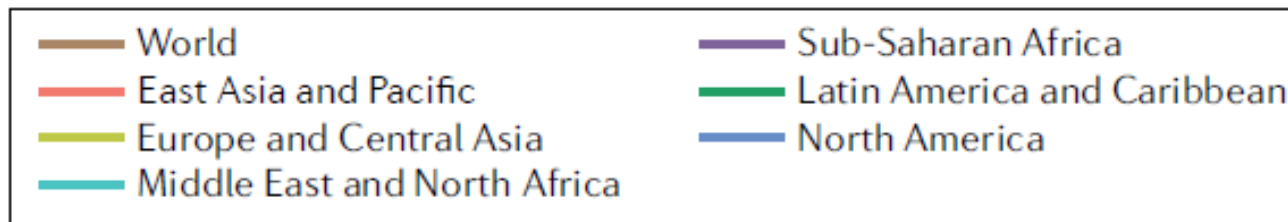
# Mapping changes to travel

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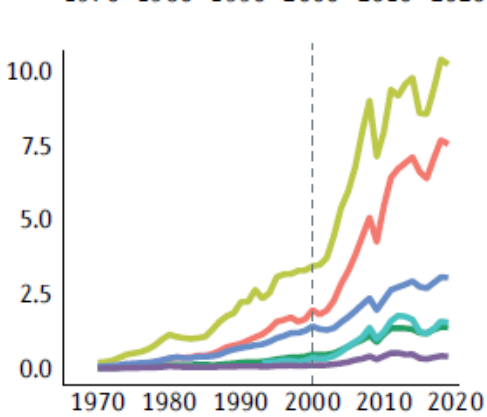
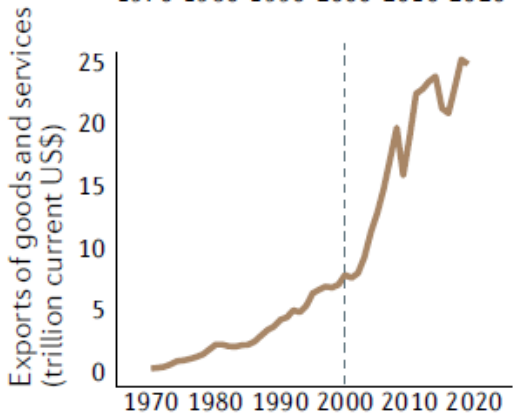


Increases in  
air travel,  
trade and  
urbanization  
at global level

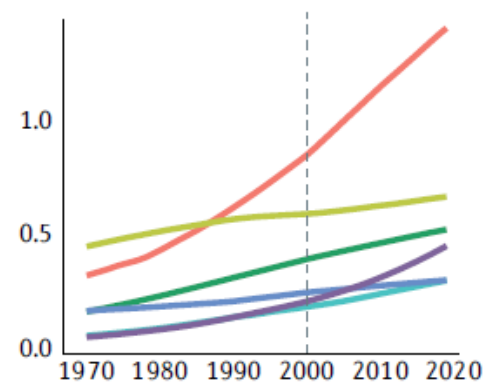
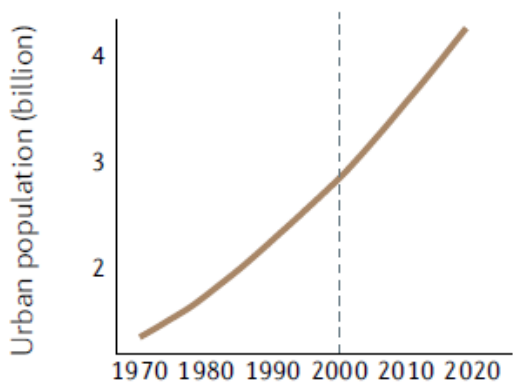
<https://data.worldbank.org/>



AIR TRAVEL



GOOD EXCHANGE



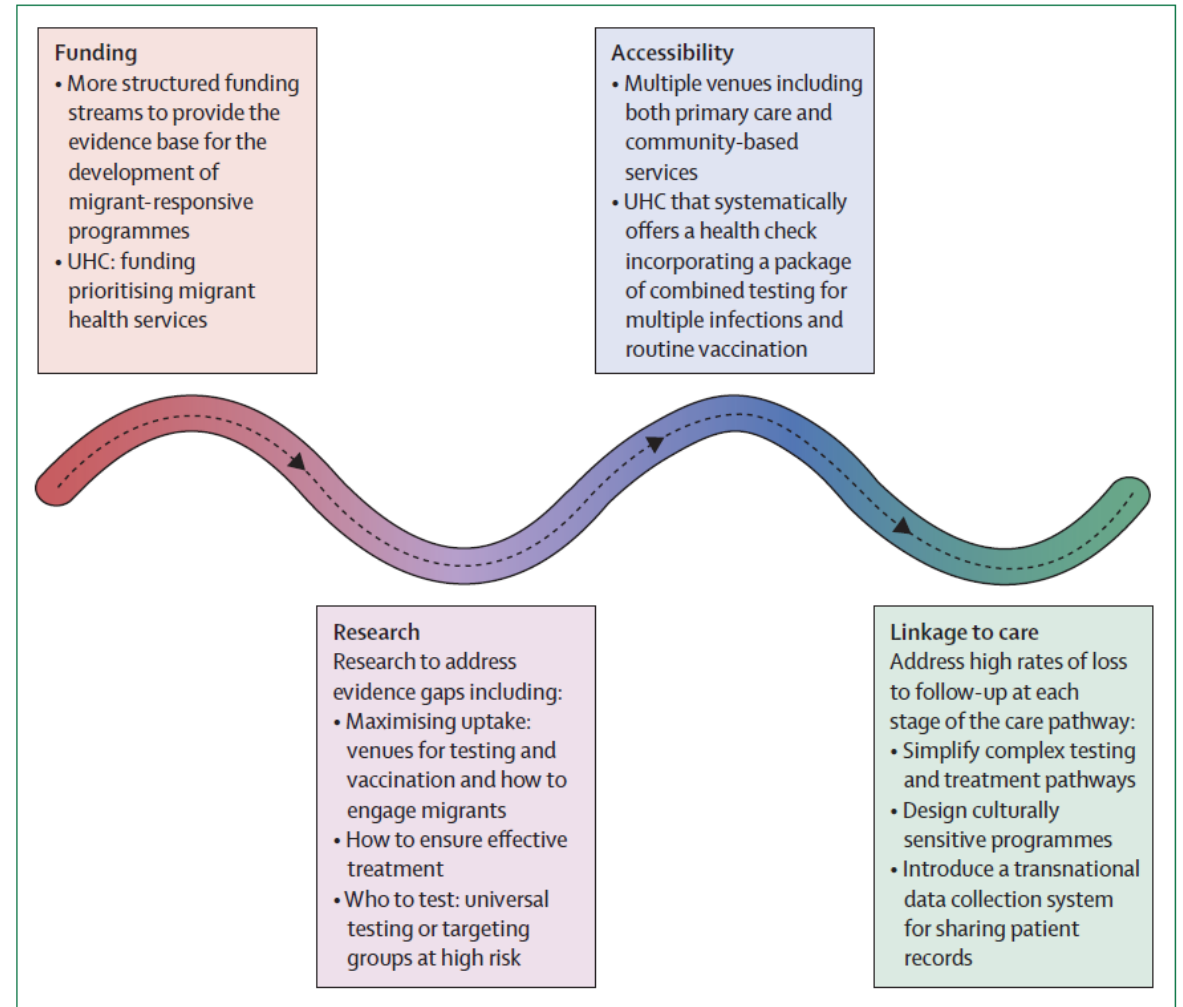
URBAN POPULATION



# Migrations impact on infectious diseases: a roadmap for integrated infectious diseases screening and vaccination of migrants.

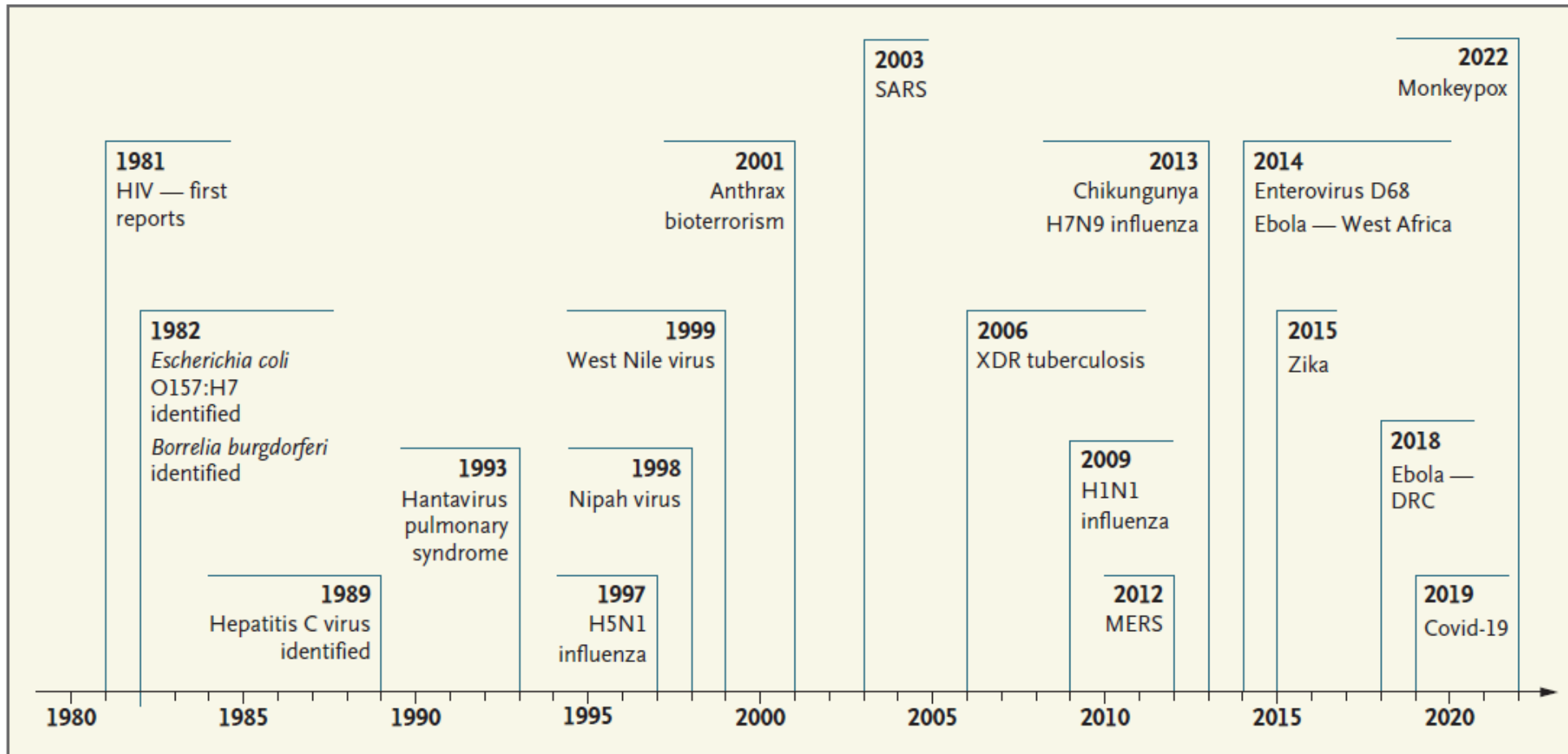
Given the movement of people between countries, there remain risks of introduction of infectious diseases, including those common and uncommon as latent tuberculosis, malaria, viral hepatitis and infection with intestinal parasites, to be imported via this mechanism.

However, the ultimate impact of these introduction events will depend largely on the population-level susceptibility and environmental suitability for sustained transmission in the destination country.



UHC=universal health coverage

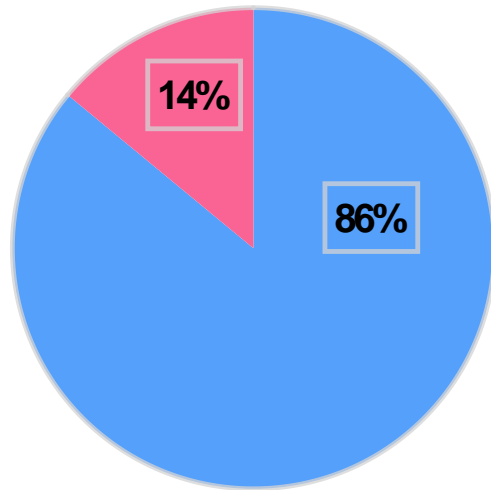
# Selected Landmark Events in Infectious-Disease Emergence Leading up to and during the Four-Decade Tenure as Fauci being NIAID Director



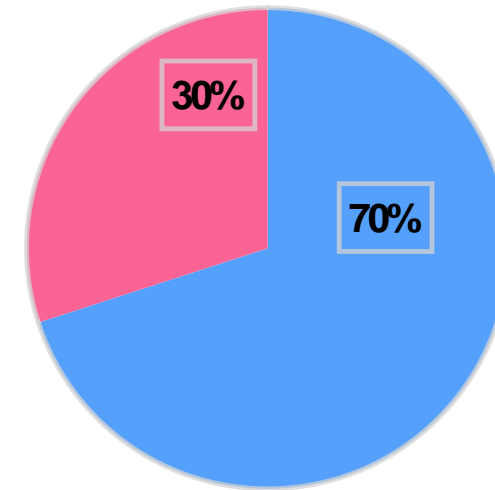
# “Gender in Infectious diseases clinical chiefs and university professors”, women proportion in Italy in 2022

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## Clinical Infectious Diseases Chiefs



## Academic Professors in Infectious Diseases



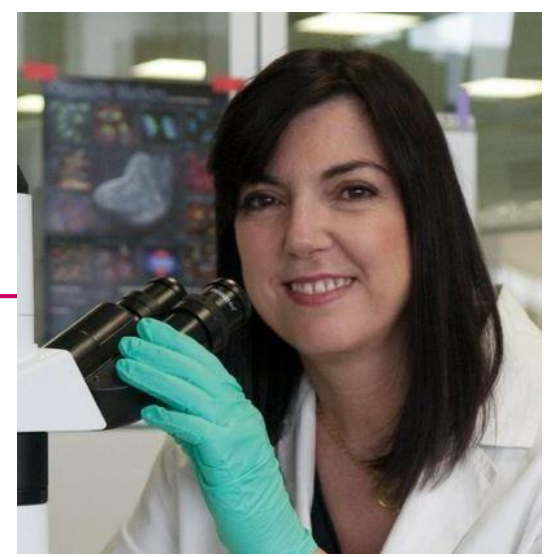
Female  
Male

Kind sharing from SIMIT,  
Professor Claudio Maria Mastroianni





# Top Italian Women Scientists



Prof Adriana Albini

## Top Italian Women scientists (H index>50)

### Promuove:

- Network tra scienziate
- Incontri istituzionali
- Incontri divulgativi
- Seminari scientifici
- Premi per giovani ricercatrici che si sono distinte per la loro produzione scientifica
- Corsi per studentesse liceali per avvicinarsi alle STEM



<https://ondaosservatorio.it/it/>

<https://ondaosservatorio.it/it/progetto/tiws-top-italian-women-scientists/>

# Gender gap

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Con "Gender gap" si indica il divario esistente tra uomini e donne in tanti ambiti diversi, ma che impattano profondamente sulla vita quotidiana e il suo svolgimento, come la salute, l'educazione, il lavoro, l'accesso alle attività economiche e così via



# Barriers

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# To have a better control and management of Infectious Diseases what we need

<https://www.paho.org/en/documents/brochure-disease-elimination-initiative>



Health



Governments



Academia



Private sector



Civil society



Local communities



Ending these diseases  
is within our reach



The time is now!

Many thanks to...

## Translational Research Unit

Alessandra Aiello  
Tonino Alonzi  
Gilda Cuzzi  
Chiara Farroni  
Saeid Najafi Fard  
Linda Petrone  
Elisa Petruccioli  
Valentina Vanini

Anna Maria Altera  
Andrea Coppola  
Federica Repele  
Andrea Salmi  
Settimia Sbarra



# Thank you!



Fabrizio Palmieri,  
INMI



Daniela Maria Cirillo  
IRCCS San Raffaele



Tony Fauci,  
NIAID, NIH



Adriana Albini  
Università di Milano

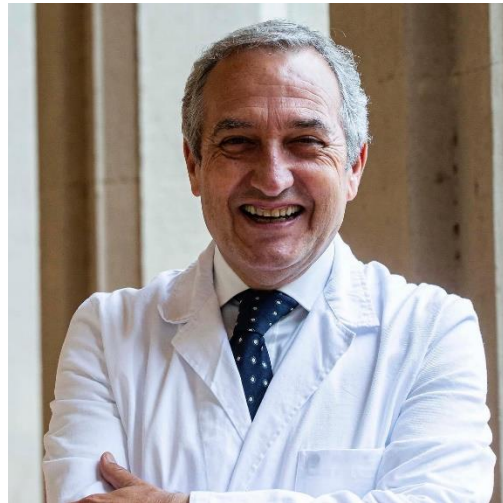


GB Migliori  
ICS Maugeri Tradate

Grazie!



Pietro Scanzano



Francesco Vaia



Enrico Girardi



Gioia Amadei