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Climate and Health

Health and climate change

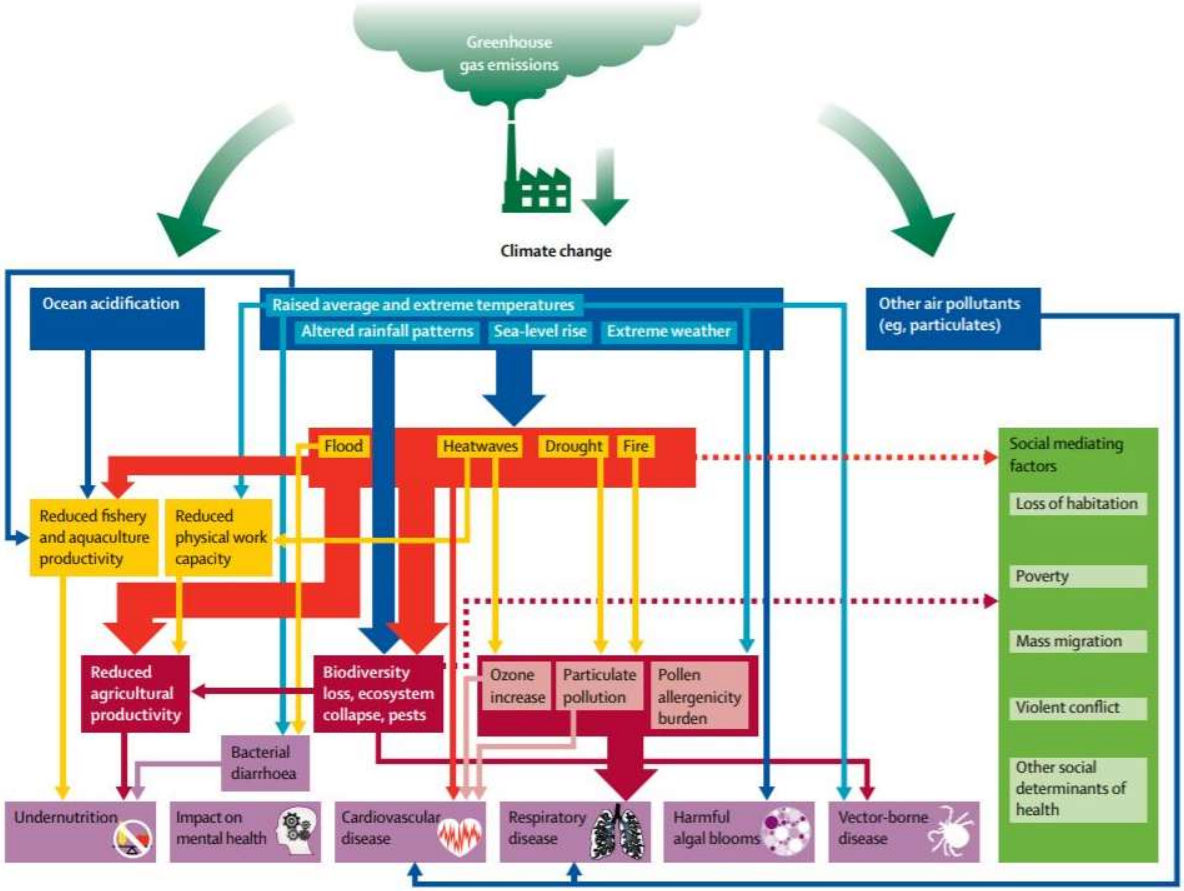
David Vernez

Climate and Health

Overview

Health determinants

- Complex relationships
- Indirect health effects
- Socioeconomic impacts



Lancet countdown 2018

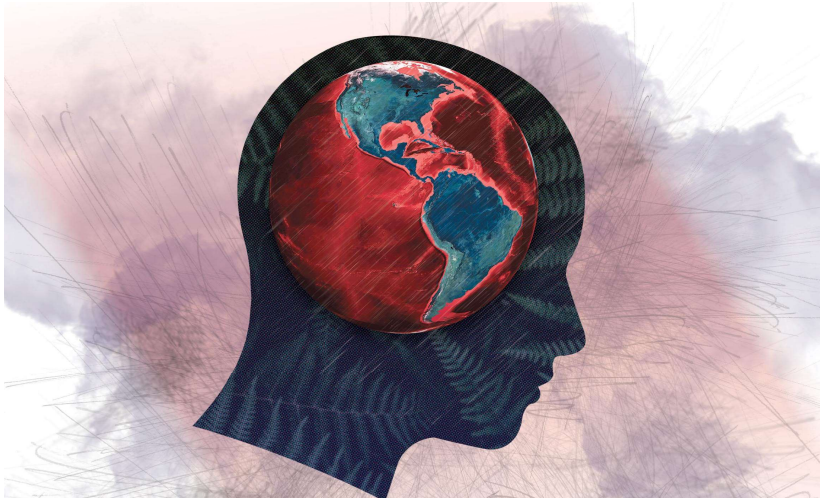
Case study

Mental health and climate

Mental health problems are one of the possible consequences of climate change.

Question (5.a)

What phenomenon(s) do you think could explain this hypothesis?



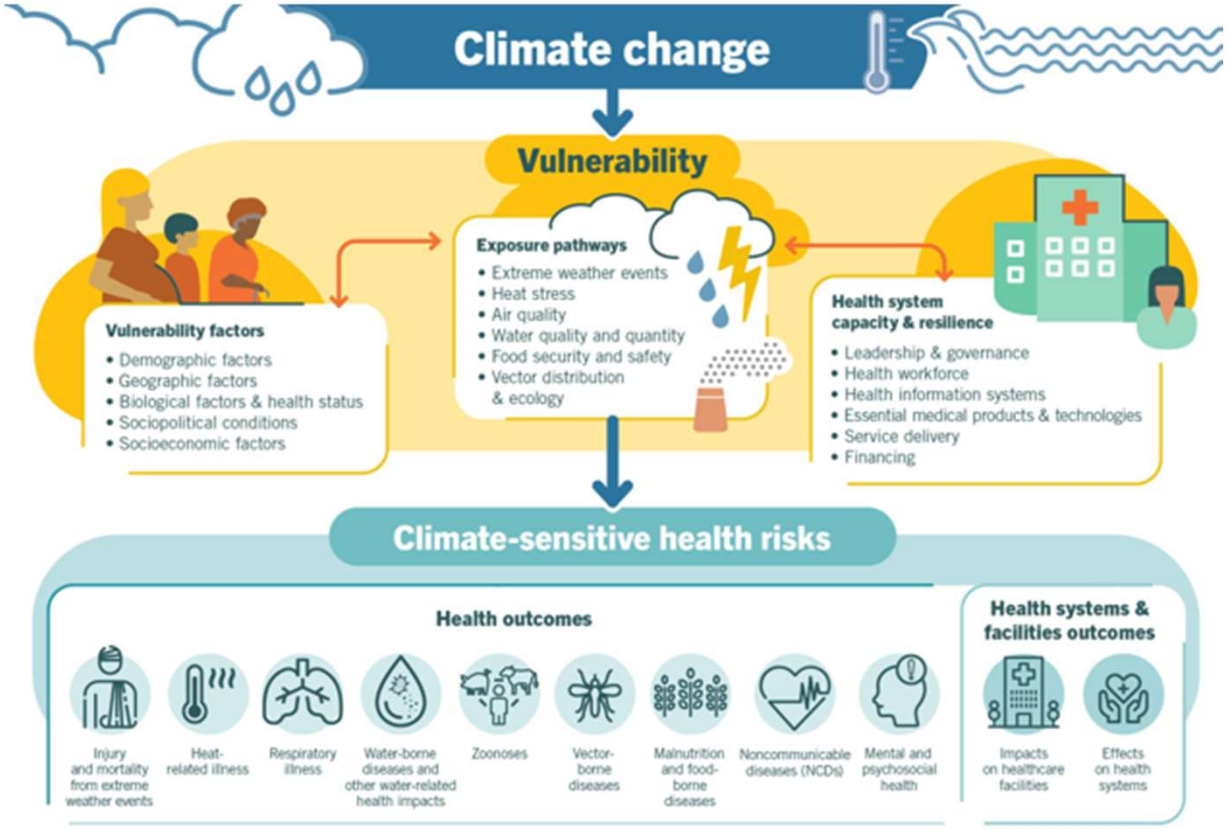
Hopkins Bloomberg Public Health

Climate and Health

Overview

Pathways and mediating factors

- Vulnerabilities
- Systemic factors
- Impact on (and from) the healthcare system



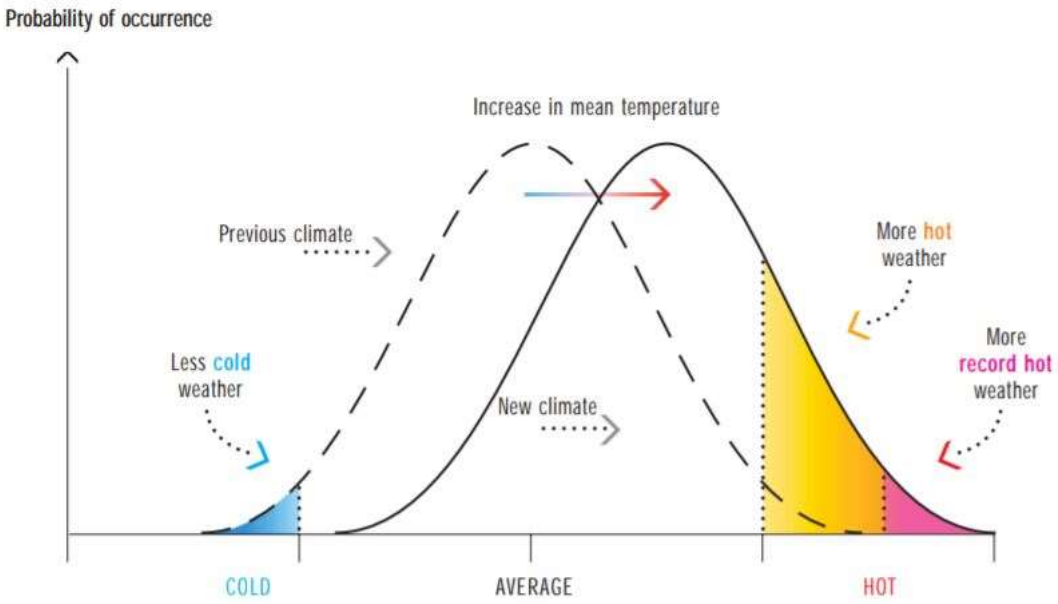
WHO 2022

Climate and health – heat

Extreme weather events

Displacement of the weather distribution

- Average increase in temperature
- Increase in frequency of extreme weather conditions



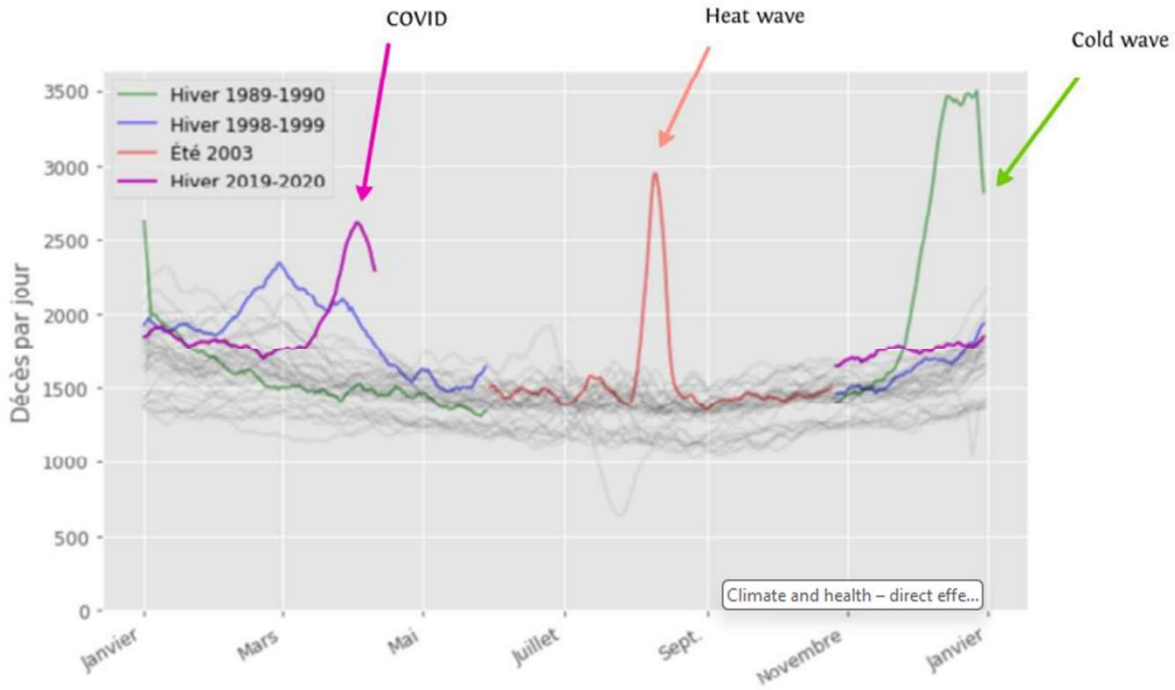
Houghton 2001

Climate and health – heat

Extreme weather events

Thermal events and excess mortality

- Seasonal mortality in France
- Influence of extreme events



Climate and health – heat

Heat Waves and Heat stress

General population

Situation
- Lasting elevated temperatures

Effects
- Exhaustion, deshydratation
- Overmortality in vulnerable populations

Criteria
- Elevated daily and nocturnal temperature
- Several days
- Ambient temperature

Workers

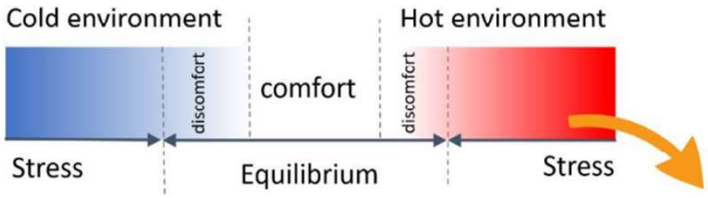
Situation
- Acute elvated temperature
- At risk activities

Effects
- Heat stroke, exhaustion, deshydratation
- Exhaustion, heat stroke
- At risk workplaces

Criteria
- Heat strain (WBGT Temp.)
- Metabolic activity
- clothing..

Climate and health – heat

Assessing the global impact of heat stress



Energy unbalance

Risk of hyperthermia, cardiac arrest

Health outcomes

Heat Stress at Work Warning \ Physical Workload	Light	Moderate	Heavy	Very Heavy
Amber		45 mins work 15 mins rest in each hour (75% work; 25% rest)	30 mins work 30 mins rest in each hour (50% work; 50% rest)	15 mins work 45 mins rest in each hour (25% work; 75% rest)
Red	45 mins work 15 mins rest in each hour (75% work; 25% rest)	30 mins work 30 mins rest in each hour (50% work; 50% rest)	15 mins work 45 mins rest in each hour (25% work; 75% rest)	Suspension of work
Black	30 mins work 30 mins rest in each hour (50% work; 50% rest)	15 mins work 45 mins rest in each hour (25% work; 75% rest)	Suspension of work	Suspension of work

Requirements and preventive measures (exposure time)

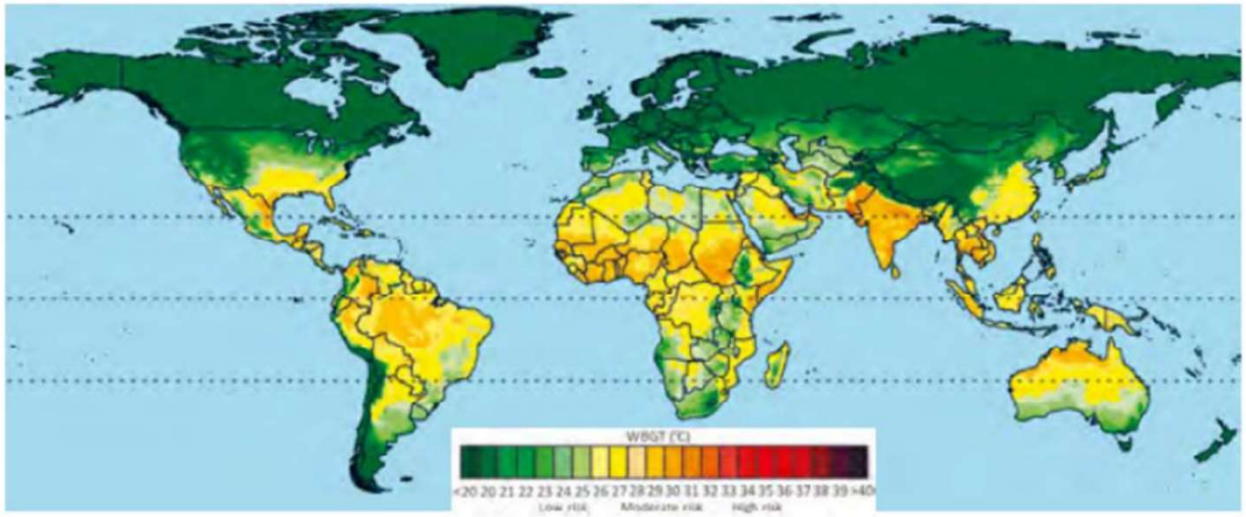
- Rare extreme outcomes
- Statistics are not reliable (causality)
- Indirect metric (requested rest time)

Climate and health – heat

WBGT climatology

Maximum daily WBGT values

- 30 yr average
- 1981-2010
- Heat stress in 1996

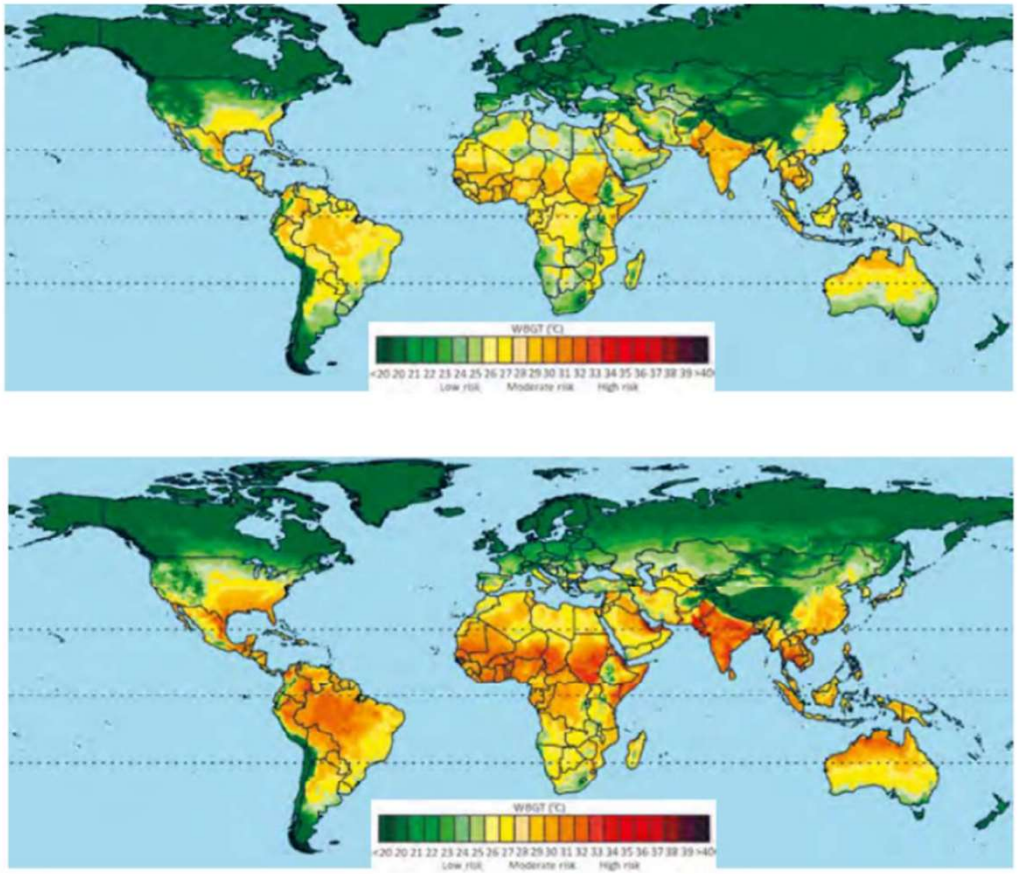


Climate and health – heat

WBGT forecast

Maximum daily WBGT values

- situation 1996 vs
- Forecast 2085



ILO 2019

Climate and health – heat

WBGT – Forecast in Europe

Weak effect on productivity loss

- Low % of workers in primary sectors
- Low global increase in WBGT

Increased direct effects for:

- Populations and work organization poorly acclimatized
- Particularly exposed work situations

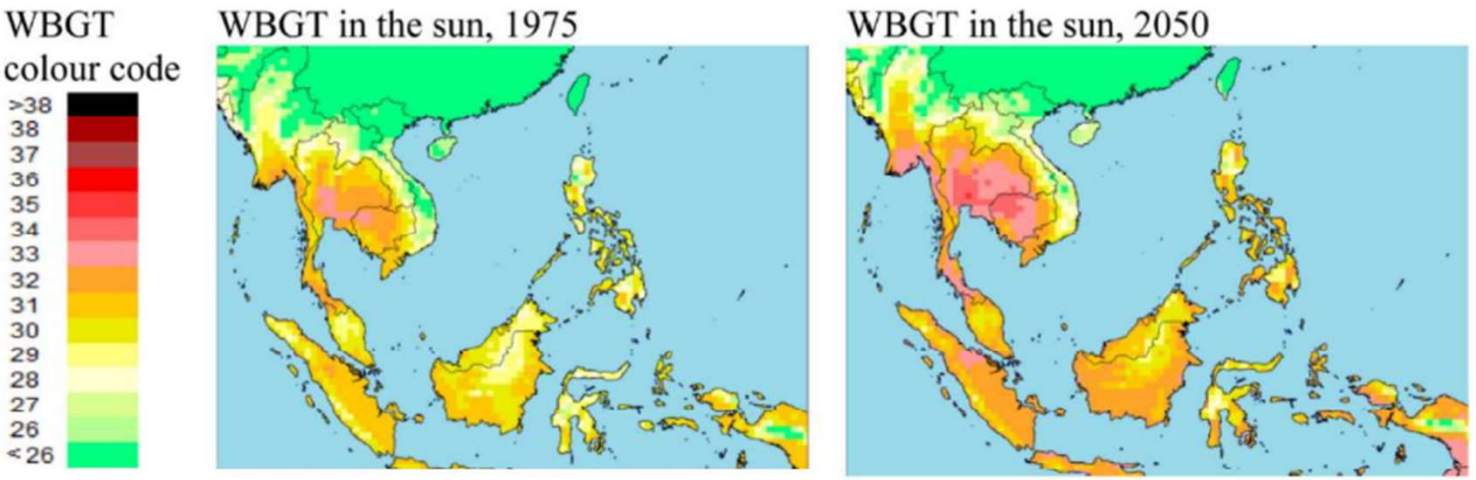
«Workers: the Climate Canaries». Am J. of Pubic Health 2014

Climate and health – heat

Extreme situations in south-east Asia

Progressive increase of WBGT with climate

- Worker productivity drops by 2–3% for every degree above 20°C.



Climate and health – heat

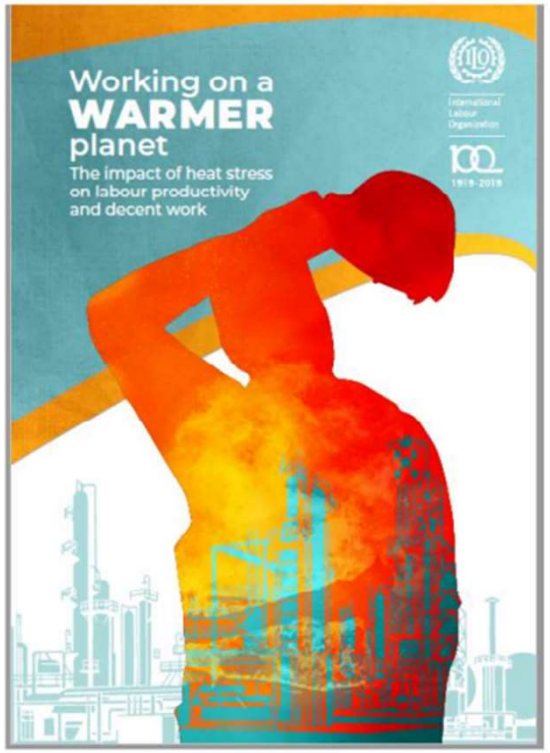
Extreme weather events – indirect effects

Loss of productivity

- Slower pace of work
- Need to increase rest time

Increased risk of accidents

- Fatigue, decrease in reasoning ability, difficulties in wearing protective equipment



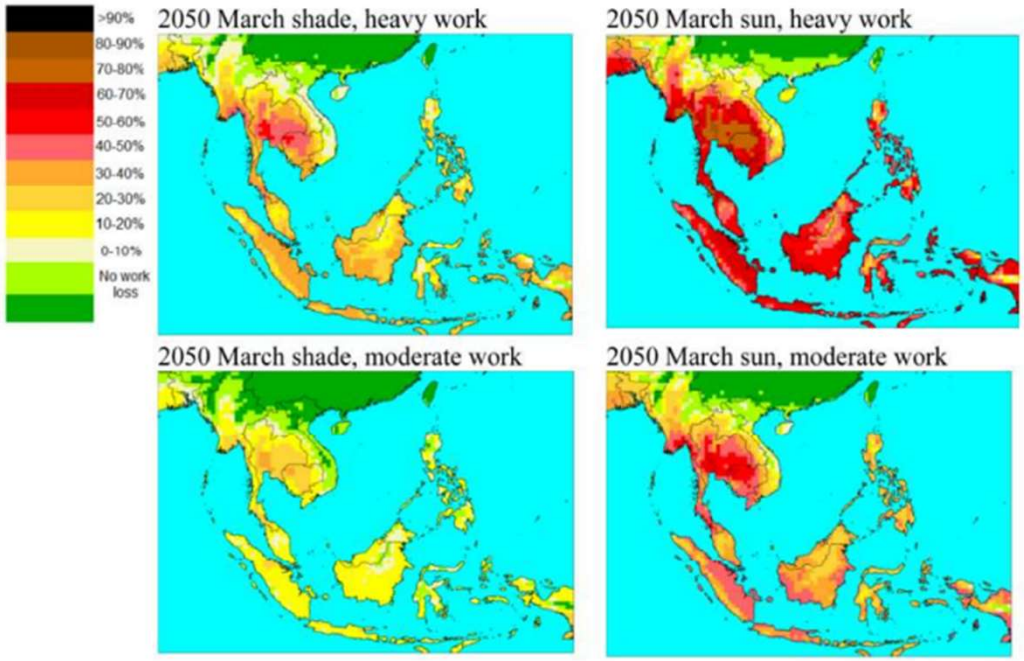
ILO, 2019

Climate and health – heat

Loss of working time

Loss of work related to the need for rest time

- [%] of afternoon time lost
- Projection 2050
- Highly sensitive to the work performed

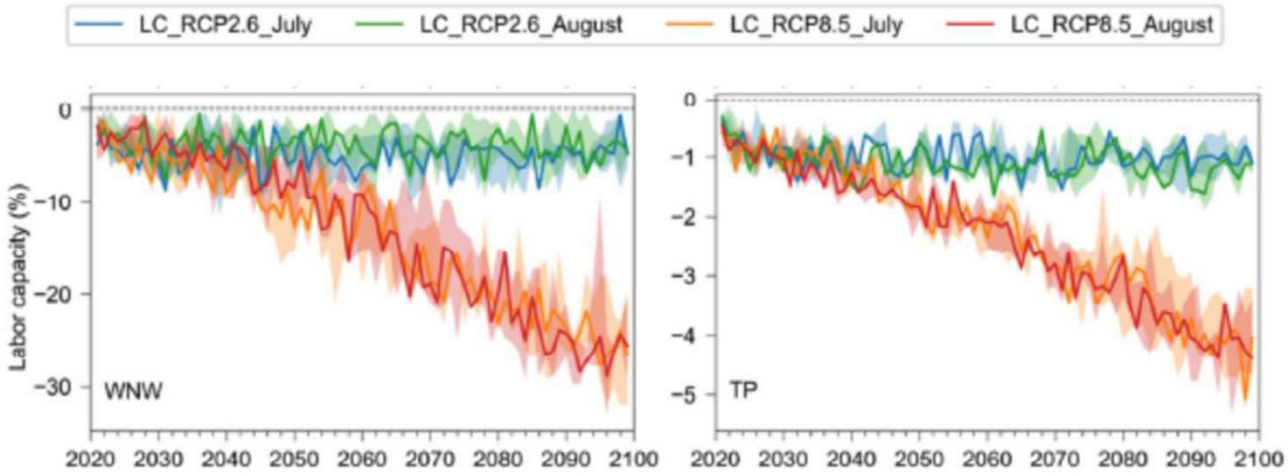


Climate and health – heat

Loss of working time

Loss of work in two provinces in China

- Labor capacity [%]
- Projection 2099
- High sensitivity to climate change scenario



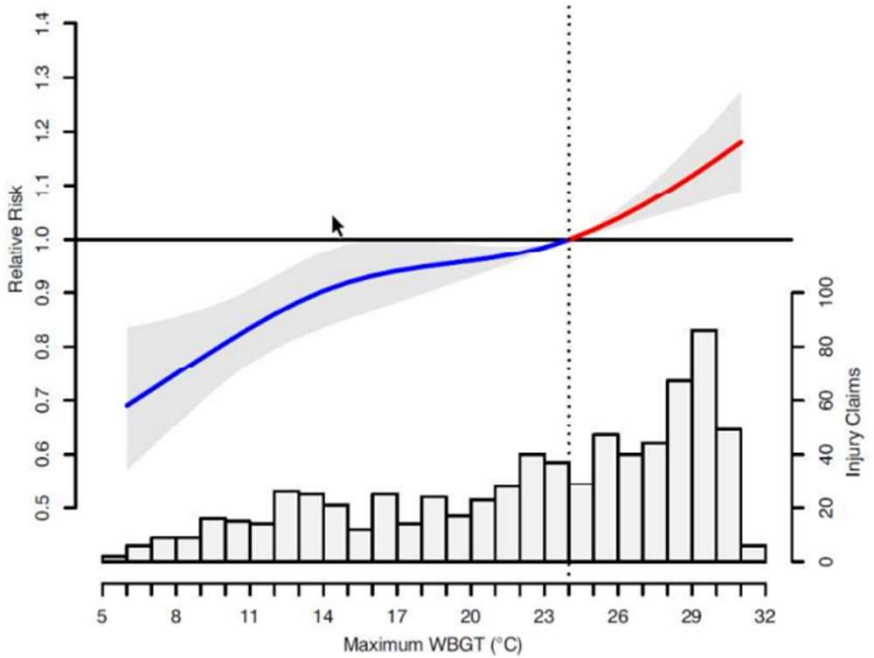
Xincai, IJERPH, 2020

Climate and health – heat

Thermal stress and work accidents

Effects other than heat stroke: work accidents, absenteeism

- Correlation between the increase in daily WBGT max and accident cases reported
- 4.8% of occupational injuries attributable to heat stress

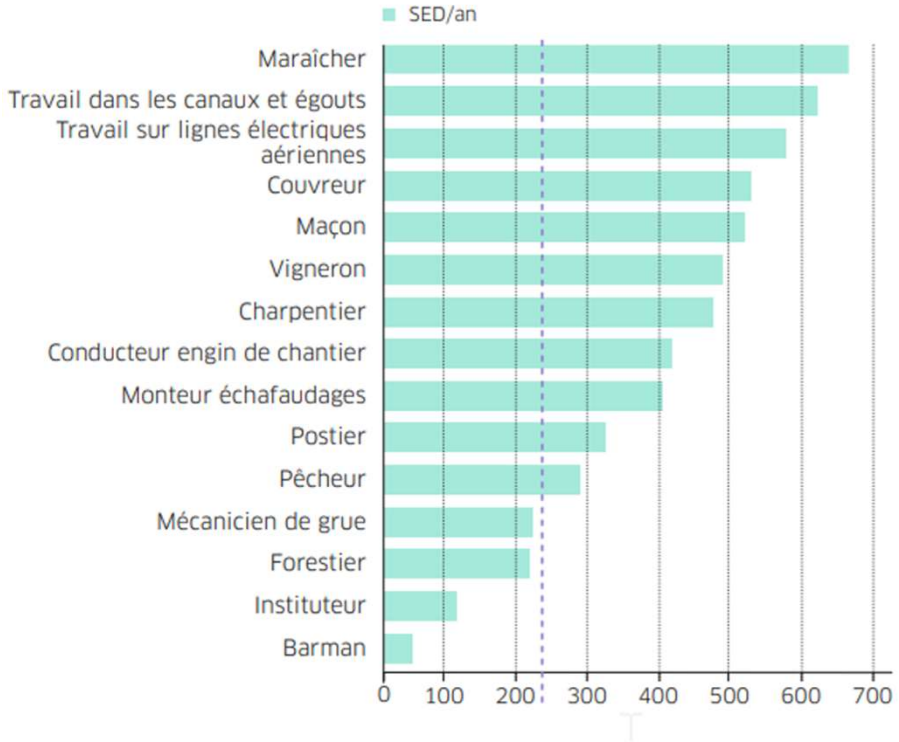


Ma et al. Science of the Tot. Env. 2019

Climate and health – UV light

More sunny days

- Increase in UV light exposure
- Incidence of skin cancer
- Average UV doses in outdoor occupations



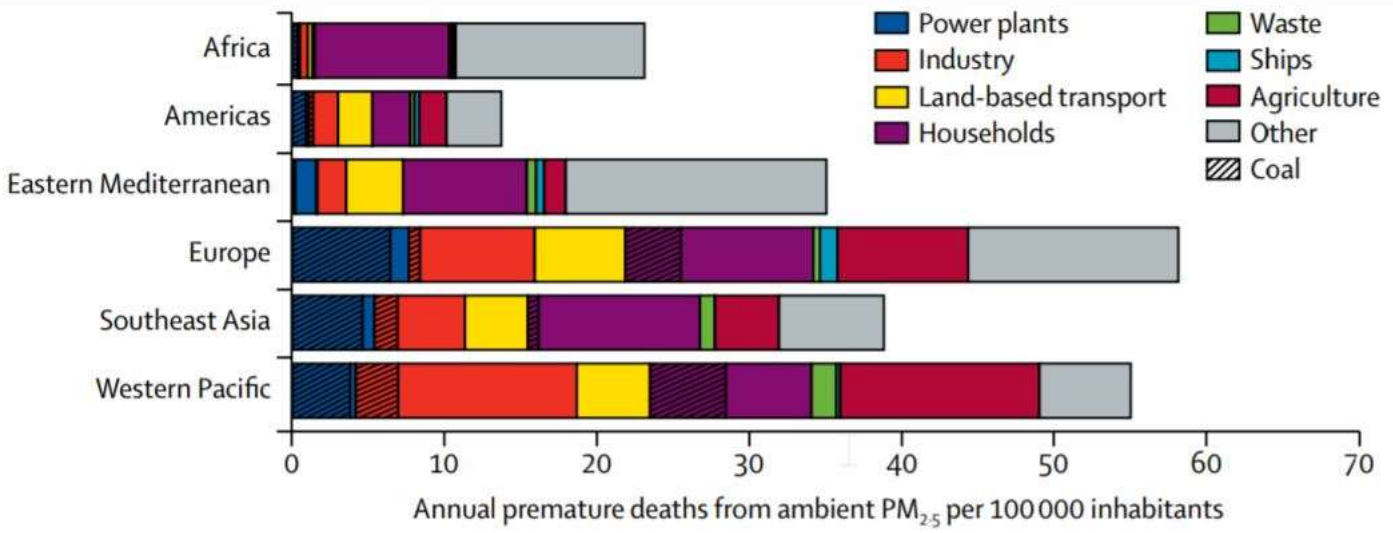
Genesis, 2022

Climate and health – Air pollution

Particulate pollution, ozone pollens

Increase in atmospheric pollution

- Cardiovascular risks, chronic respiratory diseases, asthma
- 4.2 Mio death/year due to environmental pollution



Climate and health – Air pollution

Particulate pollution, ozone pollens

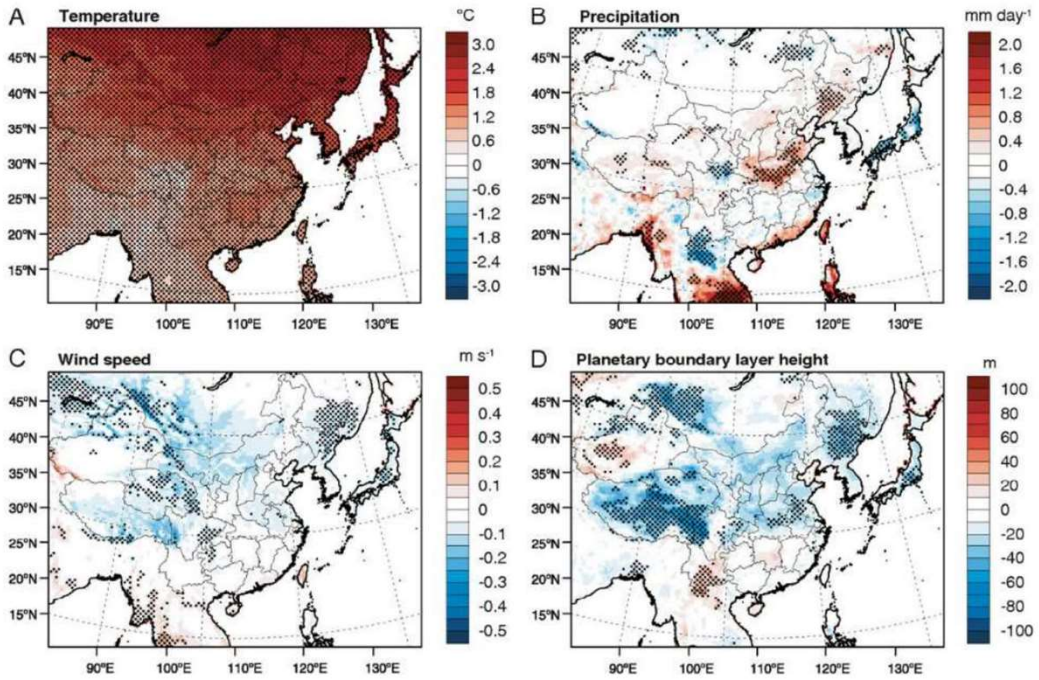
- 3% of cardiopulmonary death and 5% of lung cancers are attributable to PM
- Particulate pollution causes 3.1 Mio death/year (2010)
- PM_{10} and $PM_{2.5}$ penetrate the thoracic and respiratory zone, respectively
  - Evidence of health effects from short-term exposures to PM_{10}
  - Evidence of effects on respiratory health and mortality from chronic exposure to $PM_{2.5}$
  - Mortality increases by 6-13% per 10 $\mu g/m^3$ of $PM_{2.5}$
- Vulnerable groups: pre-existing lung or heart disease, elderly, children
- 90% of cities have particulate concentrations > WHO recommendation (10 $\mu g/m^3$ of $PM_{2.5}$)

Climate and health – Air pollution

Particulate pollution, ozone pollens

Climate forecast in China

- Increased temperature and ozone
- Variation in average conditions (precipitation, humidity)
- Increase of extreme events (heat waves, atmospheric stagnation…)



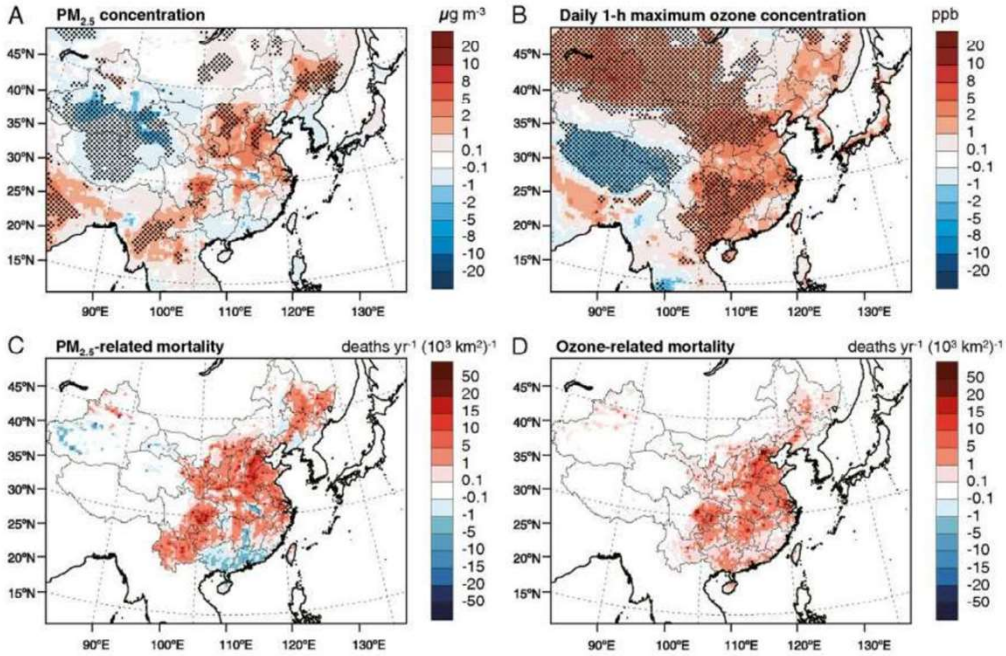
Expected changes between 2010 and 2050 (RCP4.5), Hong 2019

Climate and health – Air pollution

Particulate pollution, ozone pollens

Health forecast in China

- Increased ozone-related mortality
- Average PM2.5 increases to μg/m^3
- Pollution-related death increase in almost all provinces



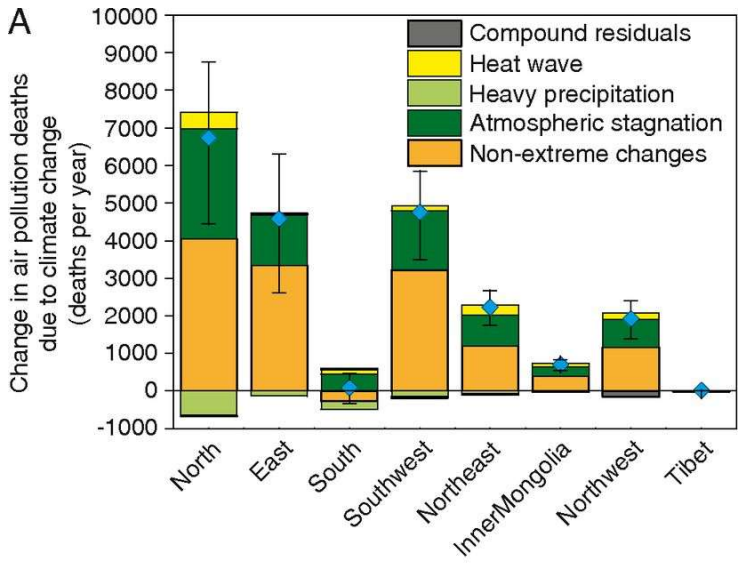
Expected changes in air pollutants and mortality between 2010 and 2050 (RCP4.5)

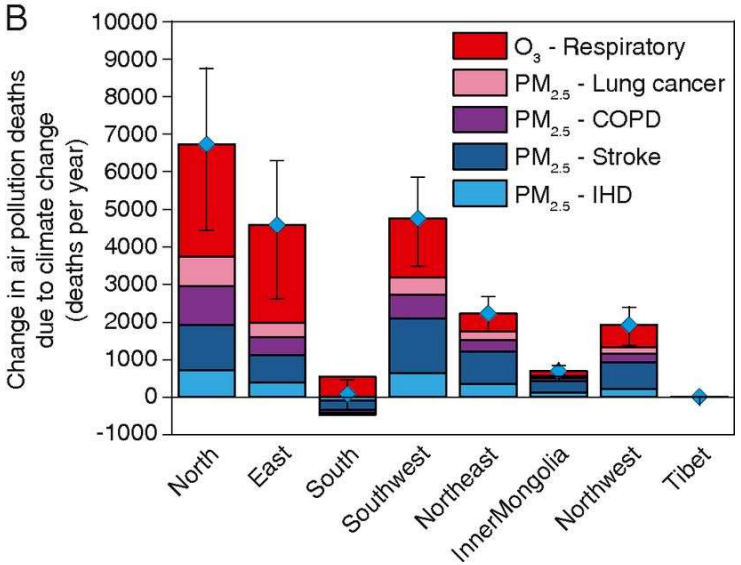
Climate and health – Air pollution

Expected mortality

Health forecast in China, variation in health outcomes

- By factor (A)
- By pathology (B)

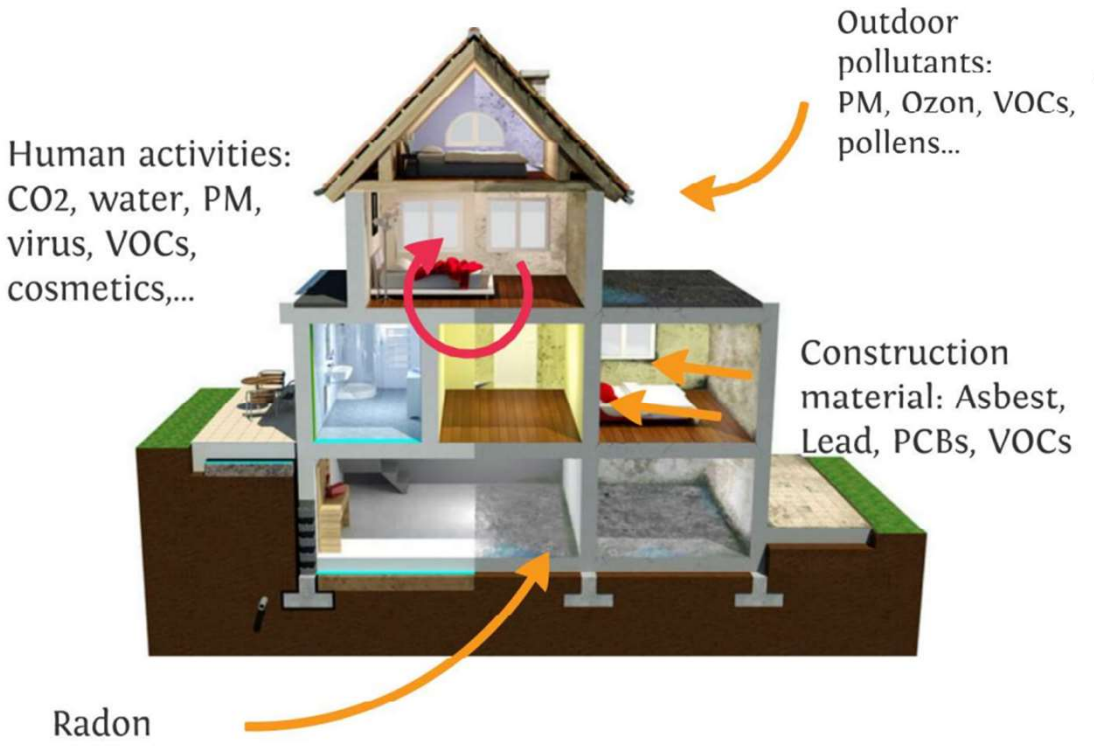




Climate and health –IAQ

Indoor air quality (IAQ)

- 85-90% of our time spent in indoor spaces
- IAQ is a strong health determinant
- Multiple sources of pollution
- Increase in pollution [ ] favored by low air renewal



Climate and health –IAQ

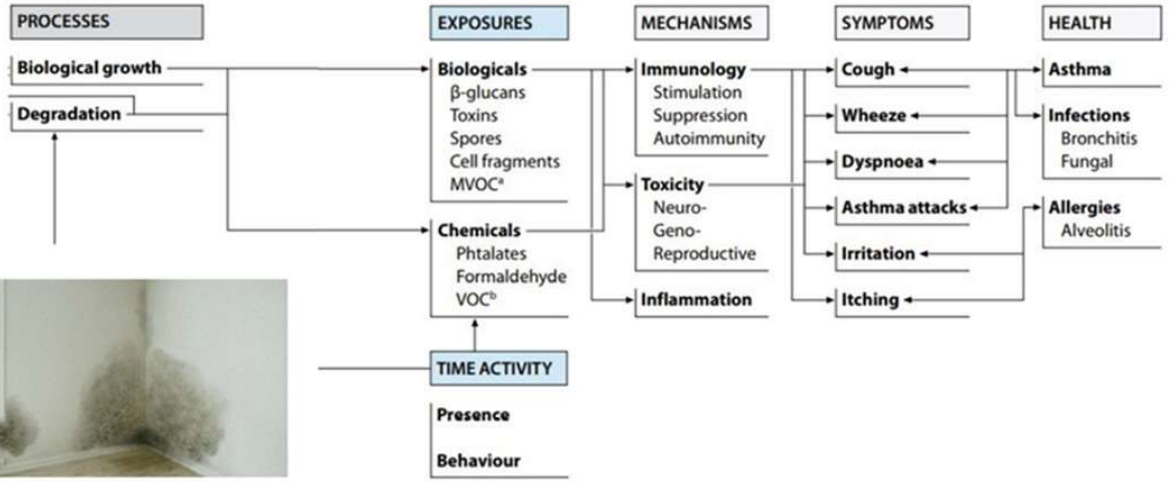
Indoor air quality (IAQ)

Molds in buildings

- Natural origin, growth promoted by humidity and temperature
- Risk factor for asthma, lung infections, and allergies

Mesqualair study (French-speaking Switzerland)

- Mold measurement in 149 homes
- Visible mold in 18% of homes



Case study

Molds in housing

Molds in housing are associated with a number of respiratory problem, most particularly in children.

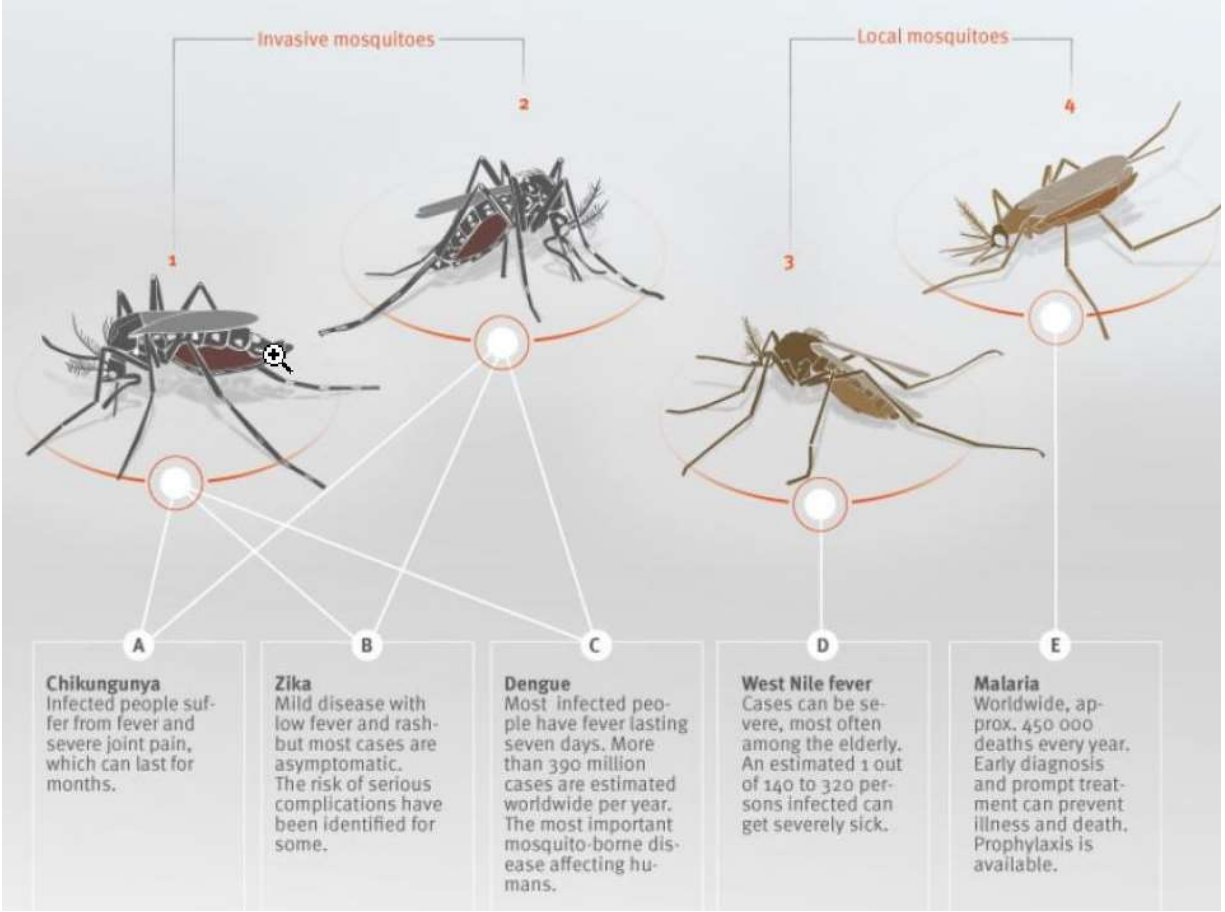
Question (5.b)

What are the argument (pros and cons) for an increase of molds issues in buildings due to climate change ?

Climate and health – infectious diseases

Movement and proliferation of vectors

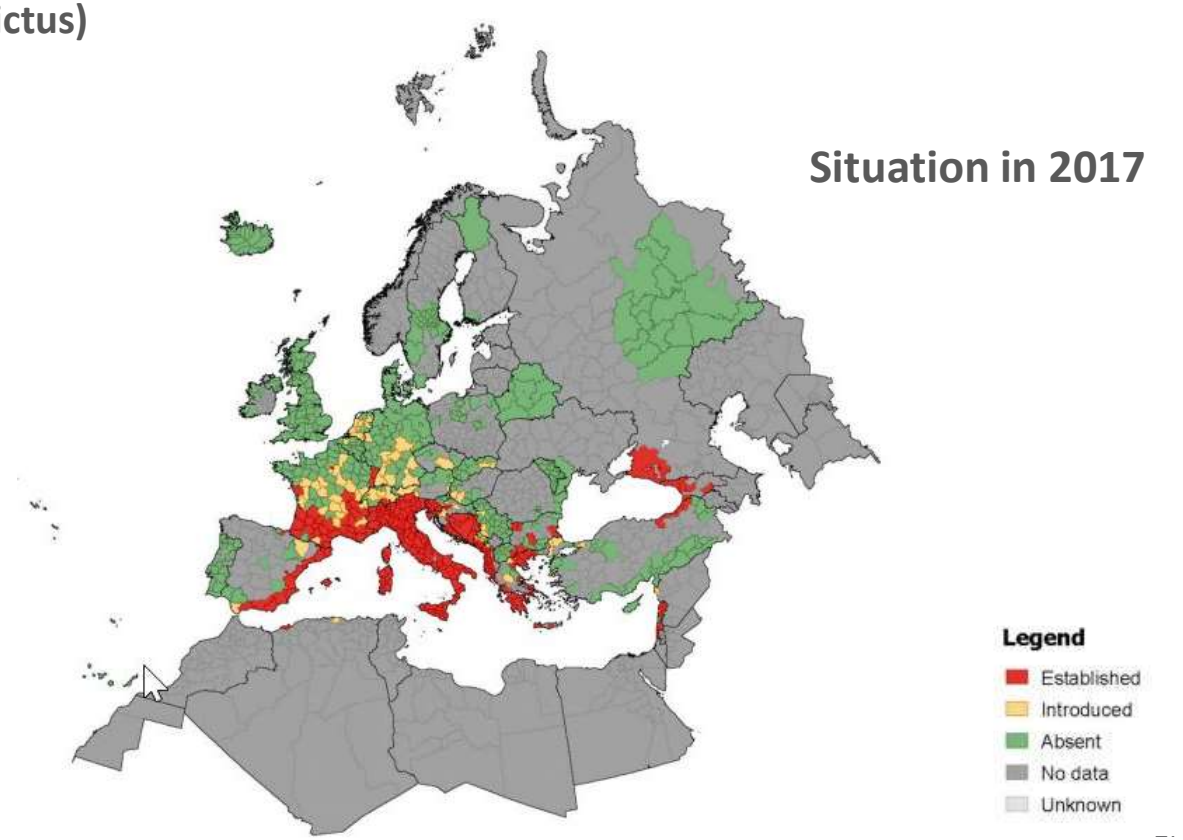
- Favorable environmental conditions, proliferation in northern or altitude regions



Climate and health – infectious diseases

Tiger Mosquito (Aedes Albopictus)

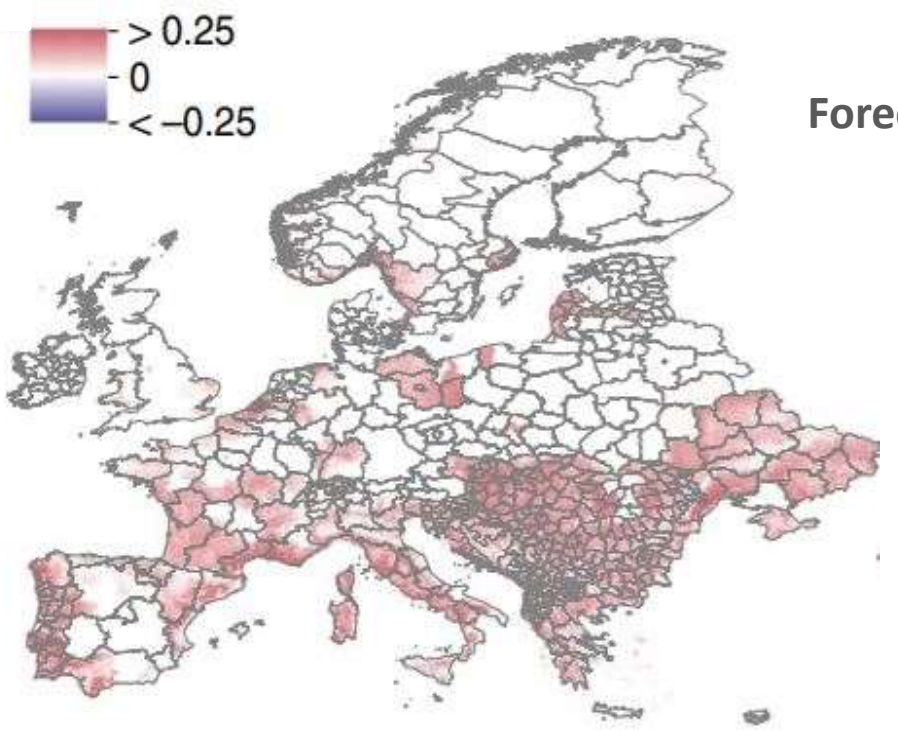
- Vector of Dengue, Zika and Chikungunya
- Arrival in Italy in 1990
- Appearance of Chikungunya and Dengue clusters in Europe



Climate and health – infectious diseases

Tiger Mosquito (Aedes Albopictus)

- Predicted increase/decrease by 2080
- Medium climate scenario RCP 6.0

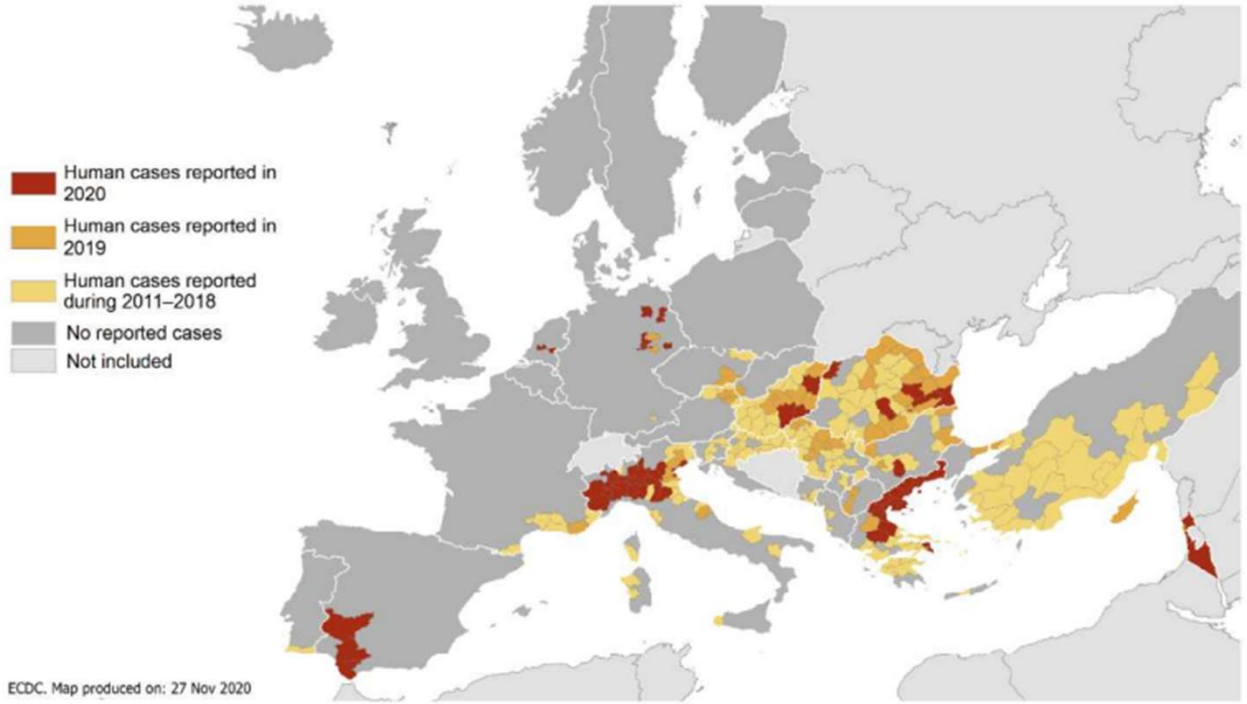


Forecast 2080

Climate and health – infectious diseases

West Niles virus

- 316 cases (including 37 death) EU 2020



Climate and health – infectious diseases

Ticks

Tick in EU in 2017

- Lyme disease 65’000 cases/year EU
- Tick-borne encephalitis 2’000 cases/year
- 400% increase in 30 years
- 3.8% increase in habitat projected for 2030-2060