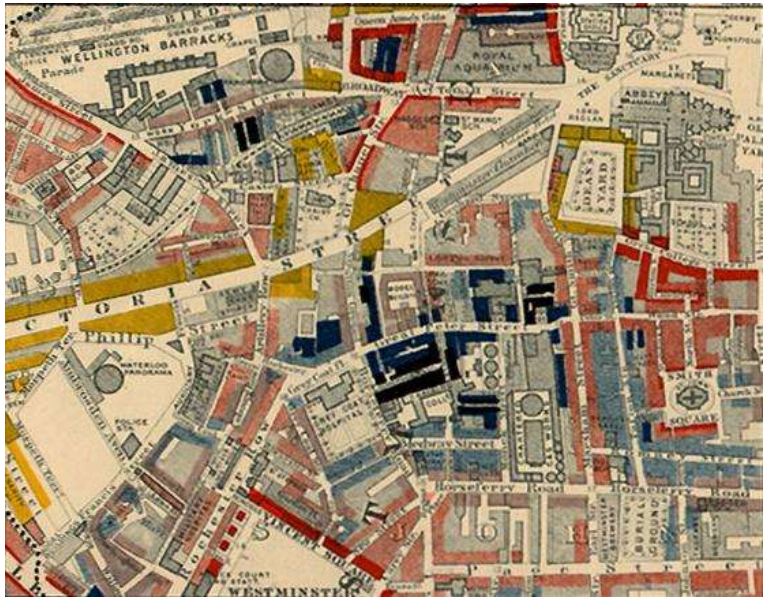
The changing geography of ill health.



Christopher Whitty
Gresham College 2020

Wide variations in ill health occur over even quite short distances.

- Sometimes a consequence of the environment itself, especially for infectious diseases.
- More often the variation points to some other major driver of disease.
- It cannot be biologically inevitable if neighbouring areas have very different experience of health and disease.
- Varies over time as well as space.
- Identifying this variation is essential to understanding disease, and tackling it.

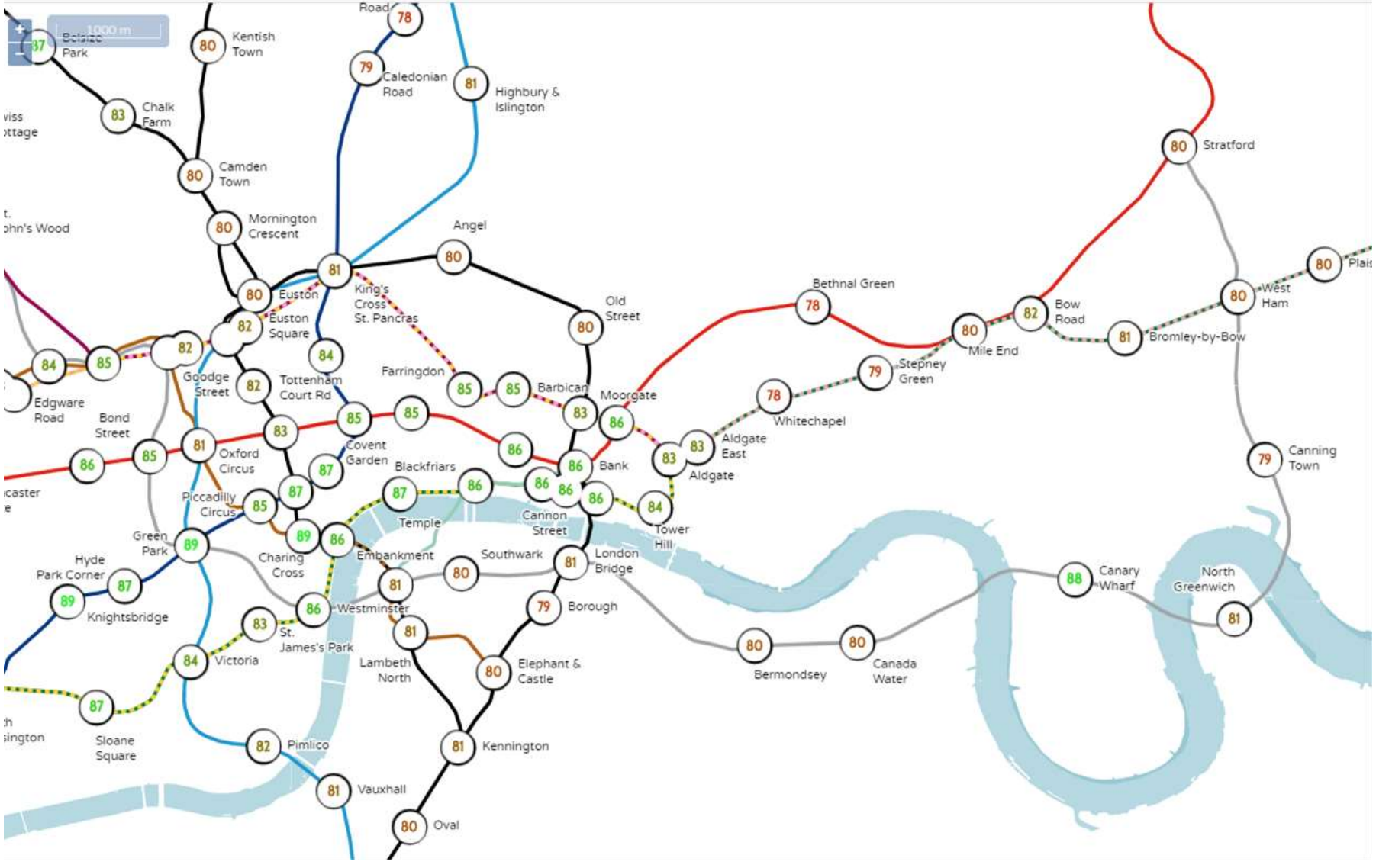
Pieter Bruegel; David Roberts

The shift from rural to urban living has brought distinct health challenges but reduces some of the impact of natural geography.

G. R Lewis *Hereford, Dynedor and the Malvern Hills* 1815

L. S Lowry. *Coming from the Mill* 1930

There is significant variation in life expectancy across London now.



Cheshire & O'Brien.
Lives on the Line site.

Four major drivers of the geography of disease.

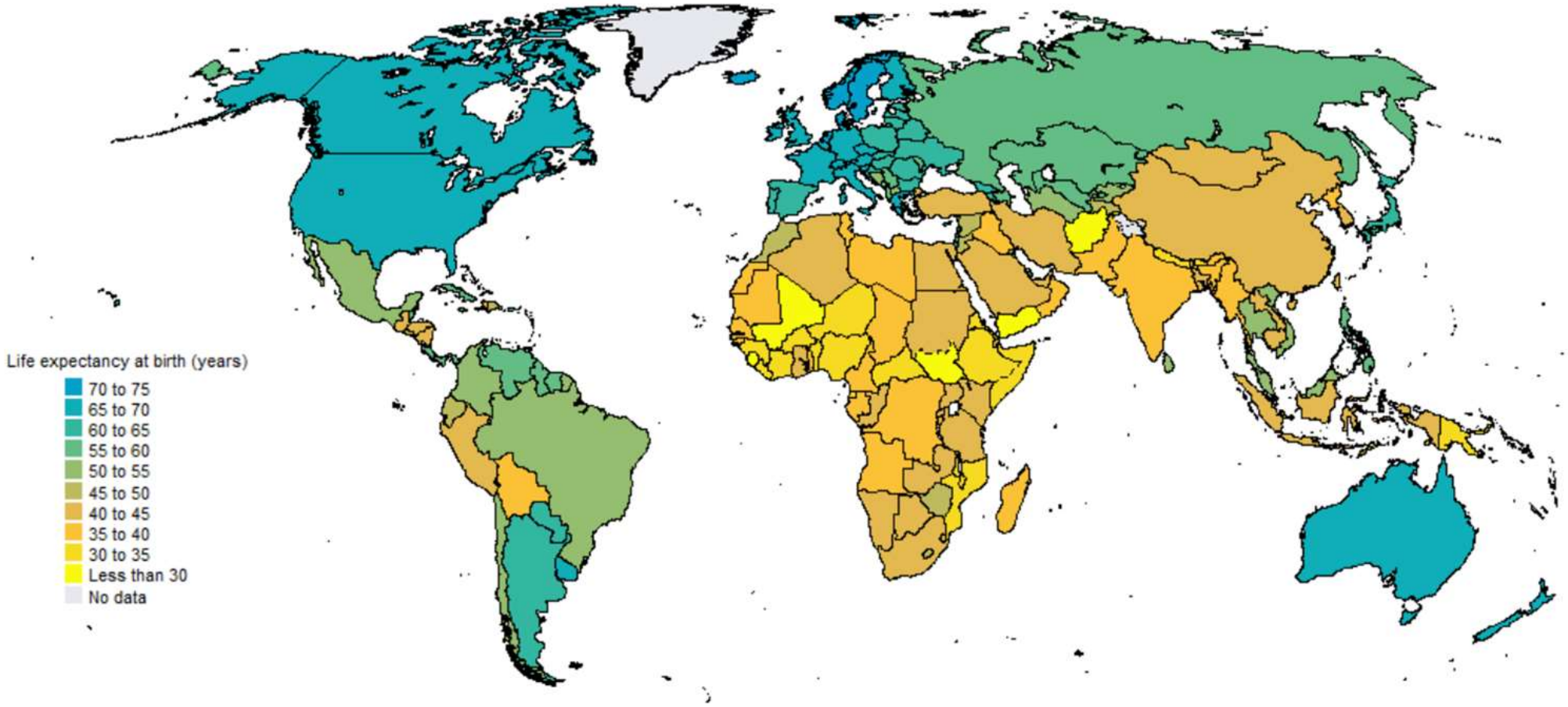
- Geography itself- water, land, climate- especially for some major infectious diseases.
- Deprivation and poverty.
- Age structure.
- Cultural and behavioural.

William Hogarth. *Beer Street* and *Gin Lane*. 1751.

Massive change in the geography of ill health over the last 70 years.

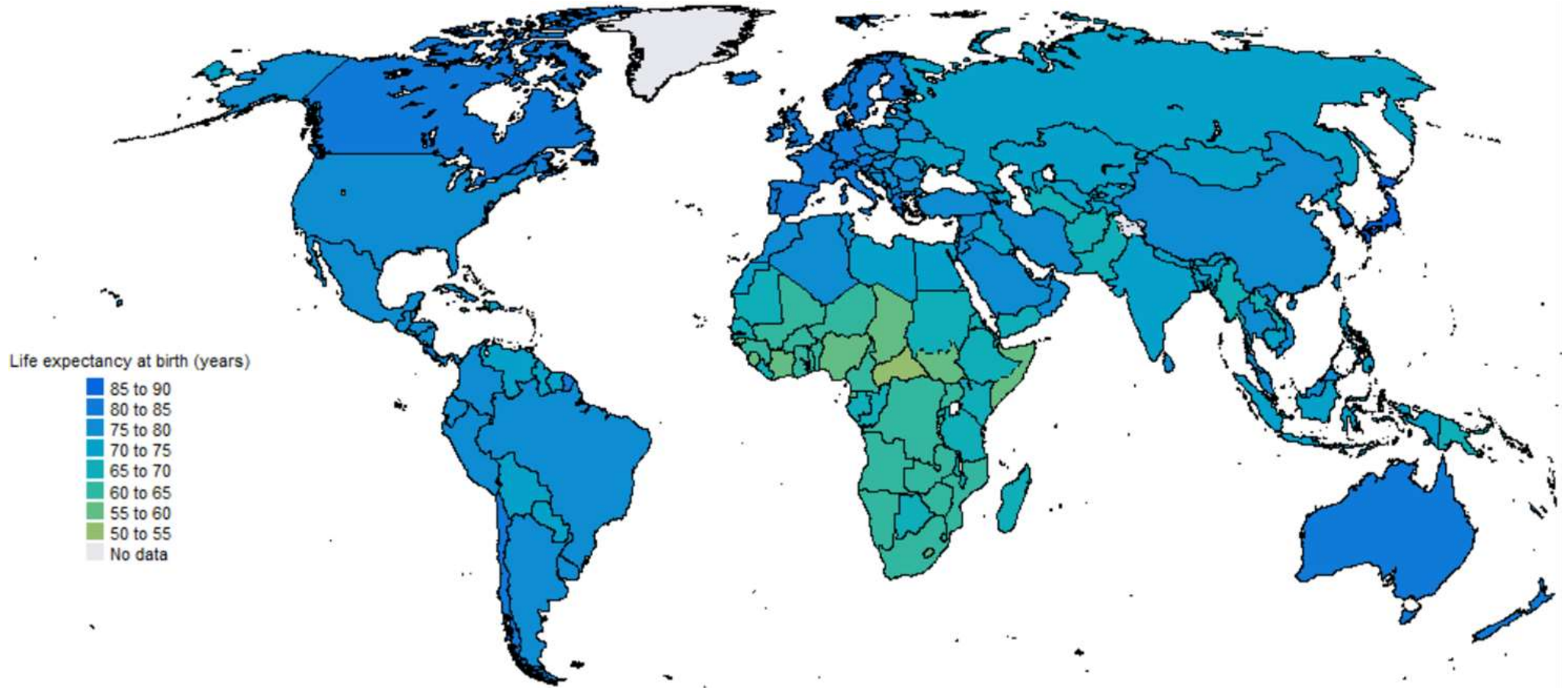
Life expectancy at birth 1950. A combination of poverty and geography.

UN 2019.



Life expectancy at birth, 2020. Reducing poverty and improving medical science can reduce many of the geographical effects.

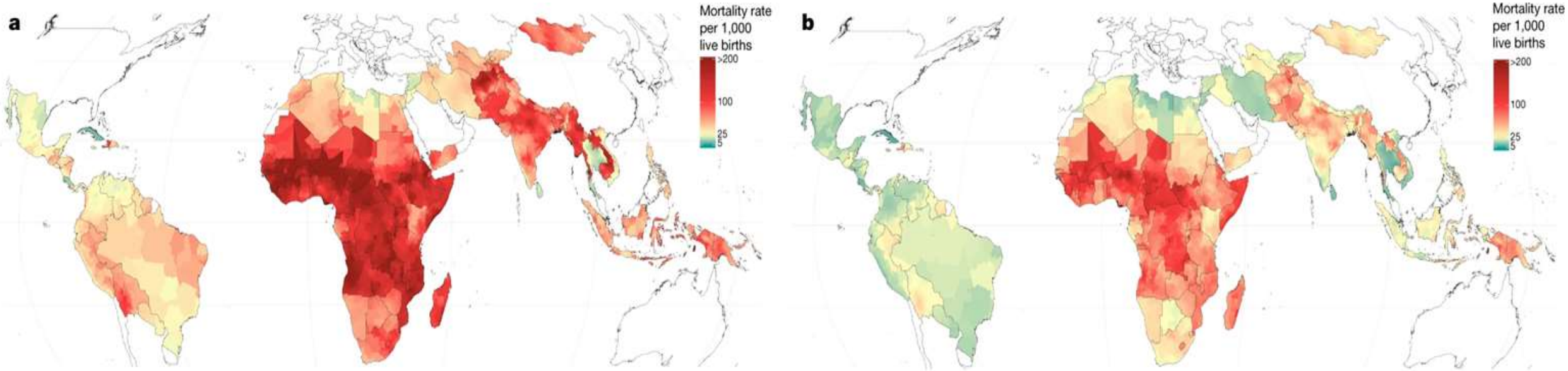
UN 2019.



Under 5 mortality 2000 (a) -2017 (b). *Burstein et al 2019, Nature*.

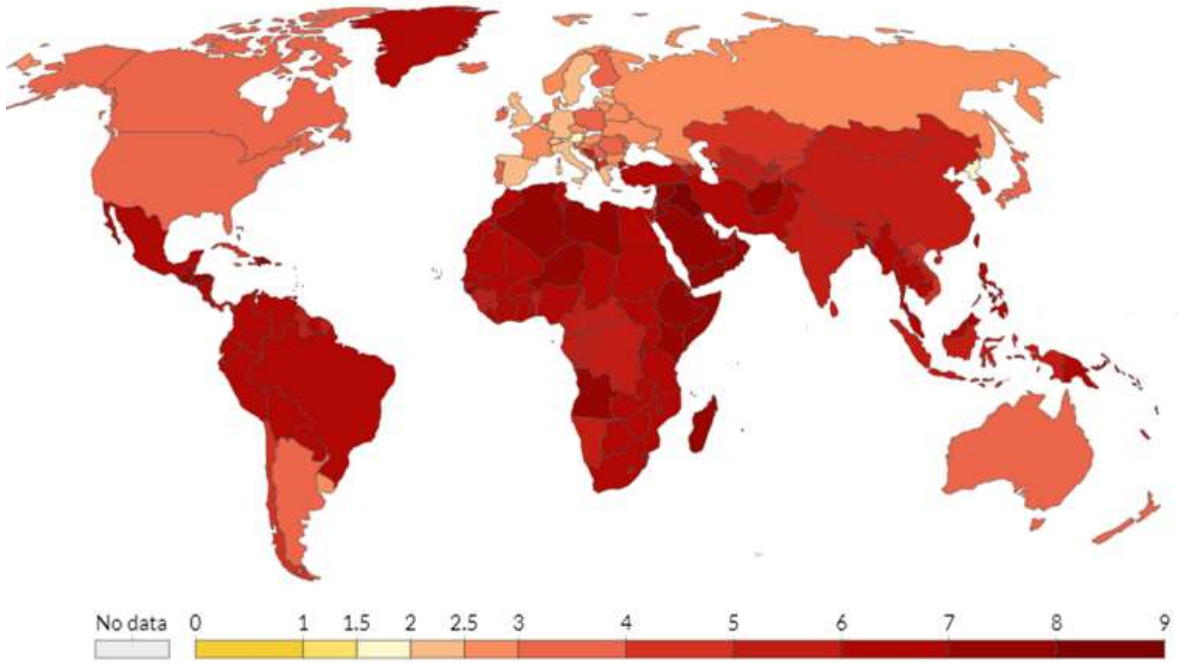
Reduced poverty, better diet, clean water, vaccine preventable diseases, malaria prevention and treatment, antibiotics.

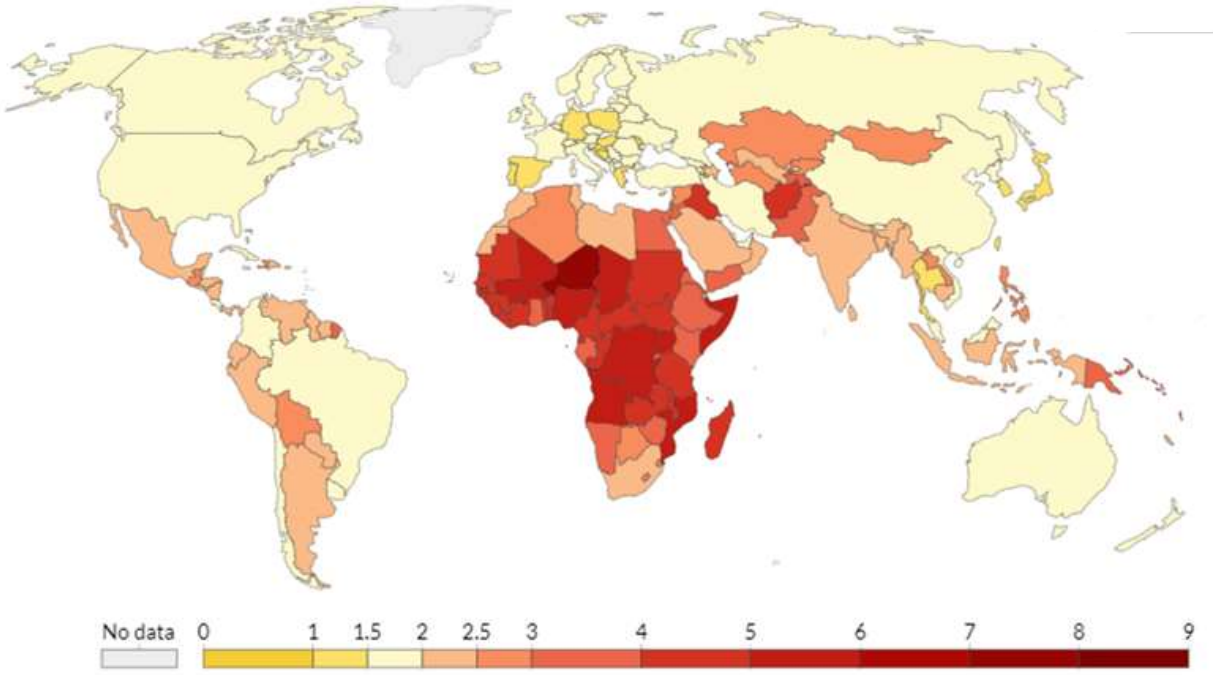
I am confident when people look back at these decades, this will dwarf most events we currently think important.



This has even wider societal and economic implications. Children born per woman (fertility rate) 1950 (L)-2019.

(Gapminder/Our World in Data)





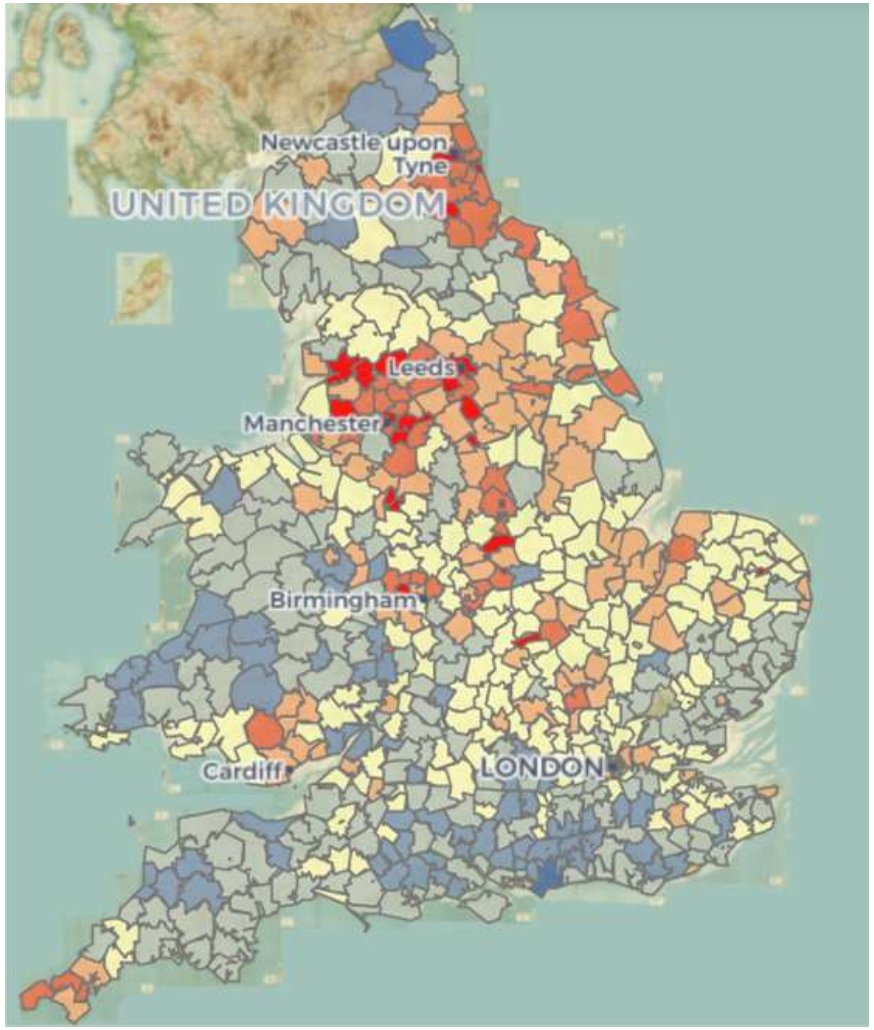
Change in infant mortality up to 1 year, 1851-1911.
Now 3.8 deaths per 1000 live births (ONS).

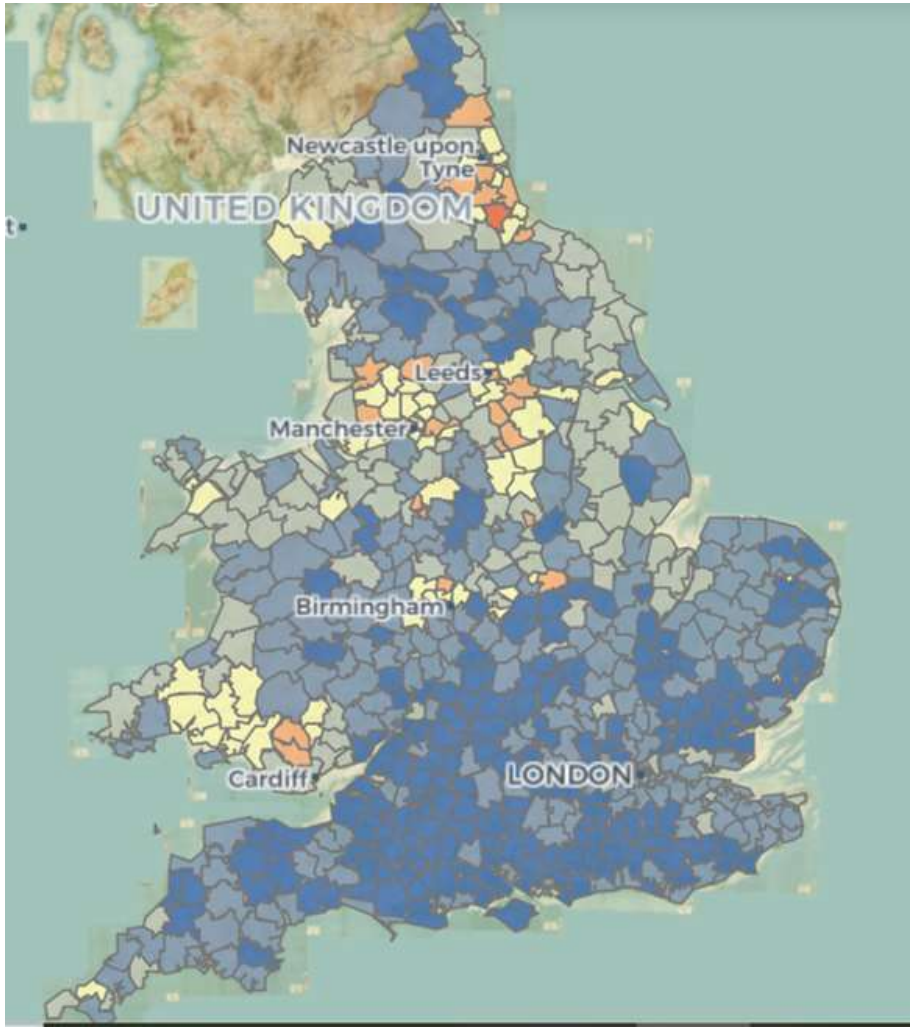
Reid A et al Populations Past 2018.

Infant Mortality Rate

The number of children out of 1,000 born who died before their first birthday

- Unknown
- ≥180
- 160 - <180
- 140 - <160
- 120 - <140
- 100 - <120
- 80 - <100
- <80





Geographic differences in infections as a direct or indirect consequence of the physical environment.

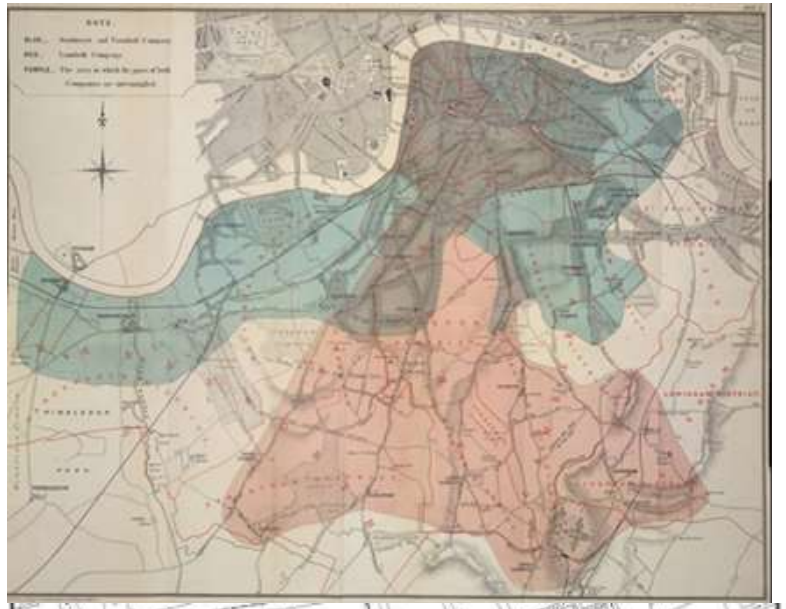
- Urban- diseases of crowding.
- Rural- vector-borne diseases and other specific habitats.
- These have changed over time.

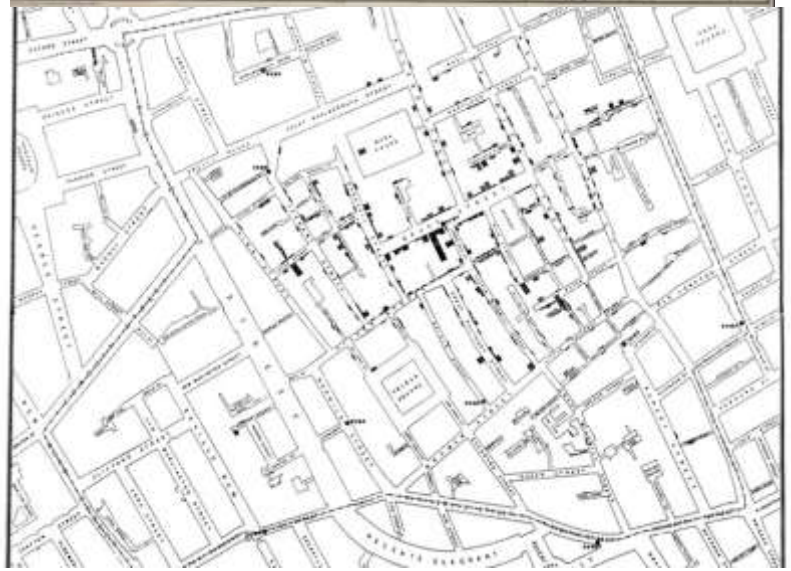
- Some diseases are self-infections. Example urinary tract infections. Geography much less important.

John Nordon 1593

Mapping disease essential to understanding it for centuries. Diseases associated with drinking water the first examined scientifically.

- John Snow's demonstration that cholera mapped onto particular water companies was central to understanding how to control it.
- The Lambeth Company 5 deaths per 1000 households. Southwark & Vauxhall Company (blue) 71/1000.
- His mapping onto the Broad Street pump is better known, but arguably less important.





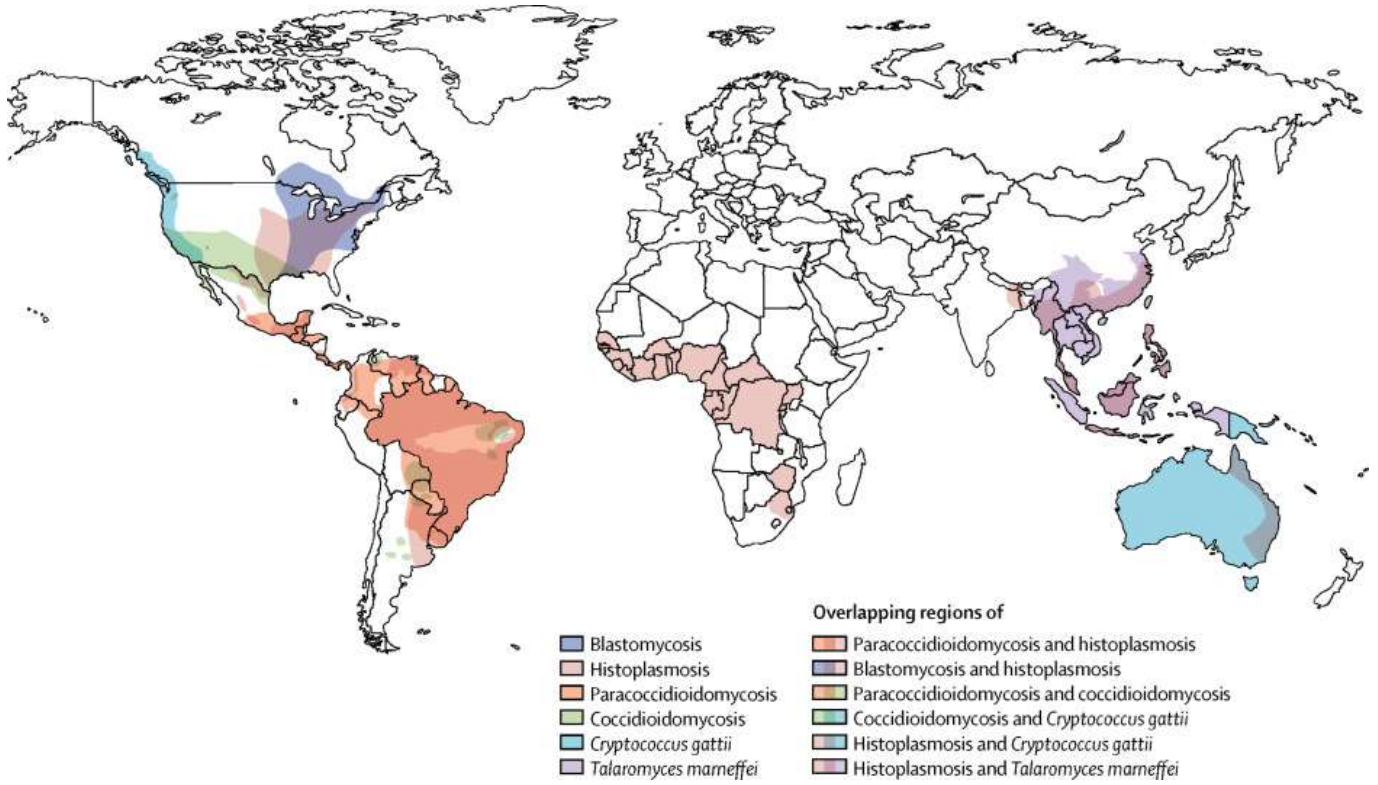
Some diseases are more common where water is scarce- ‘water-washed’.

- Diarrhoeal diseases. Insufficient water for hand washing before eating.
- Skin diseases such as scabies.
- Eye diseases such as trachoma.

Wellcome Collection

Examples of diseases due to infections from the soil.

- Tetanus. A major cause of mortality pre-vaccine. Worldwide.
- Melioidosis. Highly lethal, associated with specific rice-farming regions.
- Fungal infections. Vary by geography. Right, fungi that invade the central nervous system.



Schwartz S et al Lancet Neurology 2018.

Vector-borne diseases. Each has a geographical range.

Examples:

- Dengue, Zika, Yellow Fever (Aedes mosquitos)
- Trypanosomiasis / sleeping sickness (Tsetse fly)
- Lyme disease (tick)
- If the vector does not breed locally, you will not catch the disease.
- Often depends on the water habitat and temperature.
- Urbanisation, changes in land use, climate change, medical countermeasures.

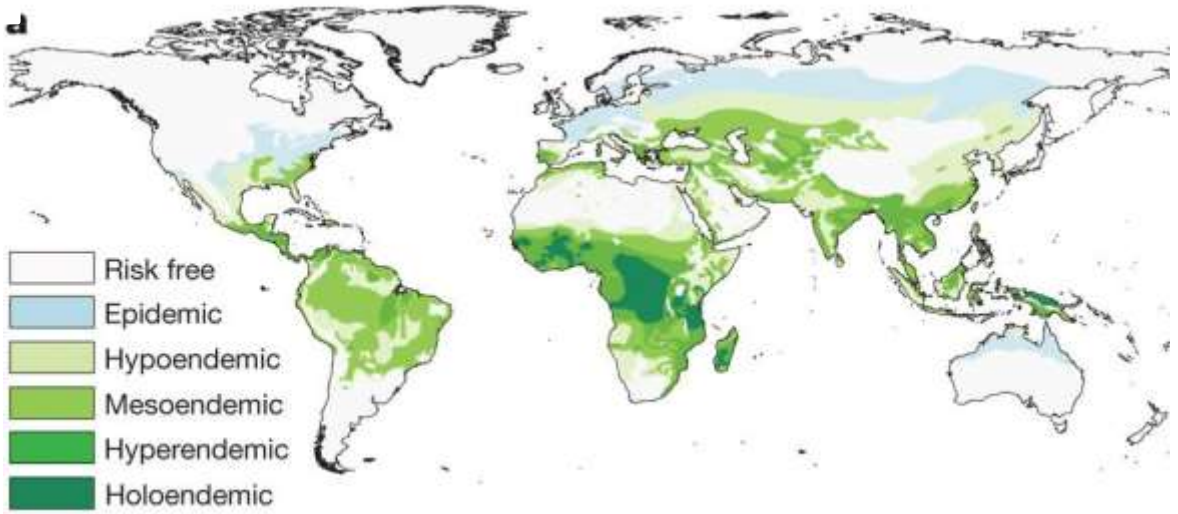
Muhammed Mahdi Karim/CDC/Scot Baur

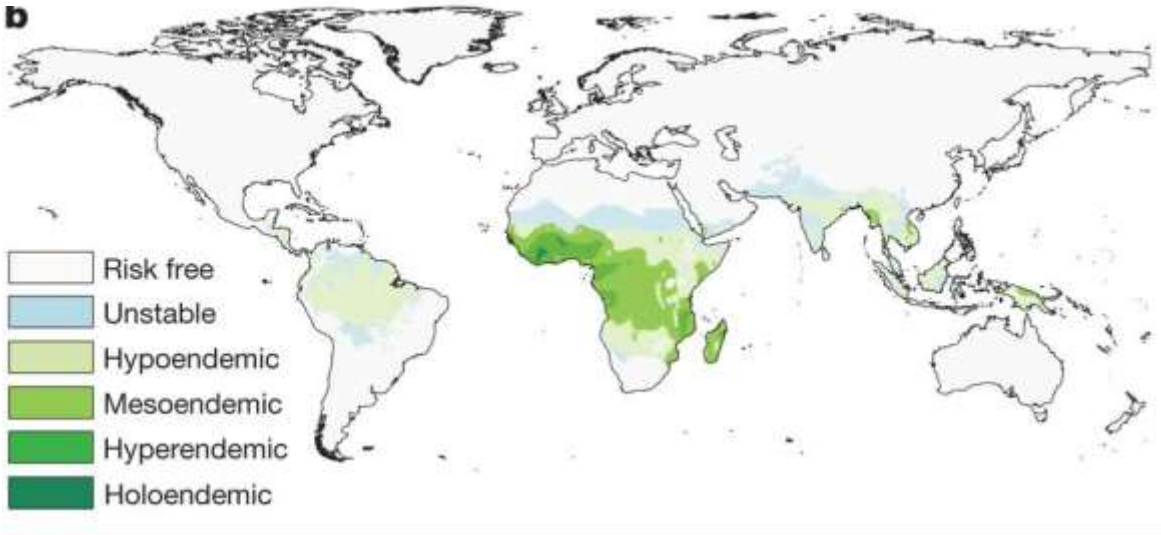
Malaria: 1900 (top) and around now. *(Gething et al, Nature 2010)*

Changing geography, mortality.

Around 400,000 deaths a year.

Over halved since 2000 (WHO).

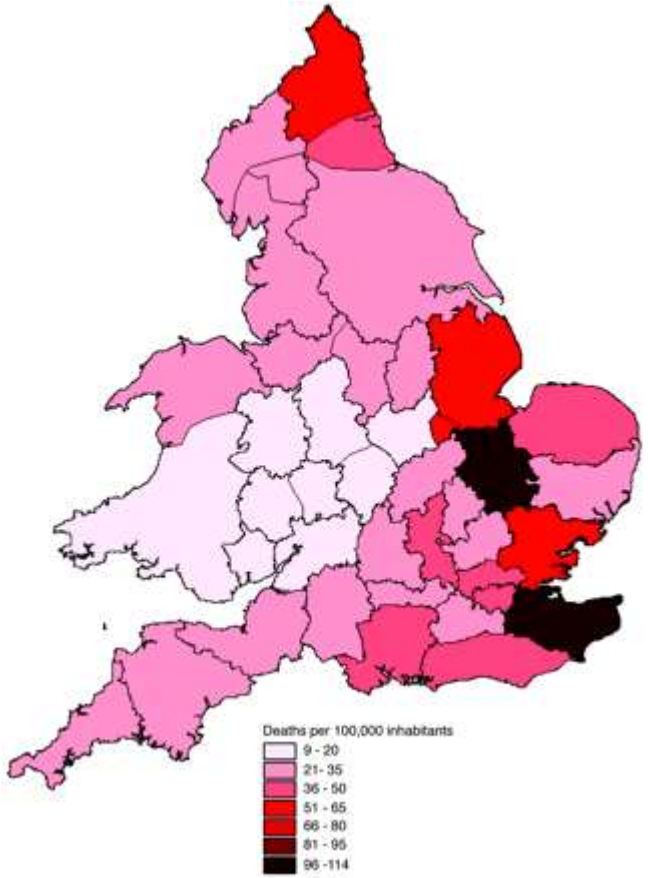




Change in land use and agricultural practice leads to may diseases associated with agricultural land changing or disappearing.

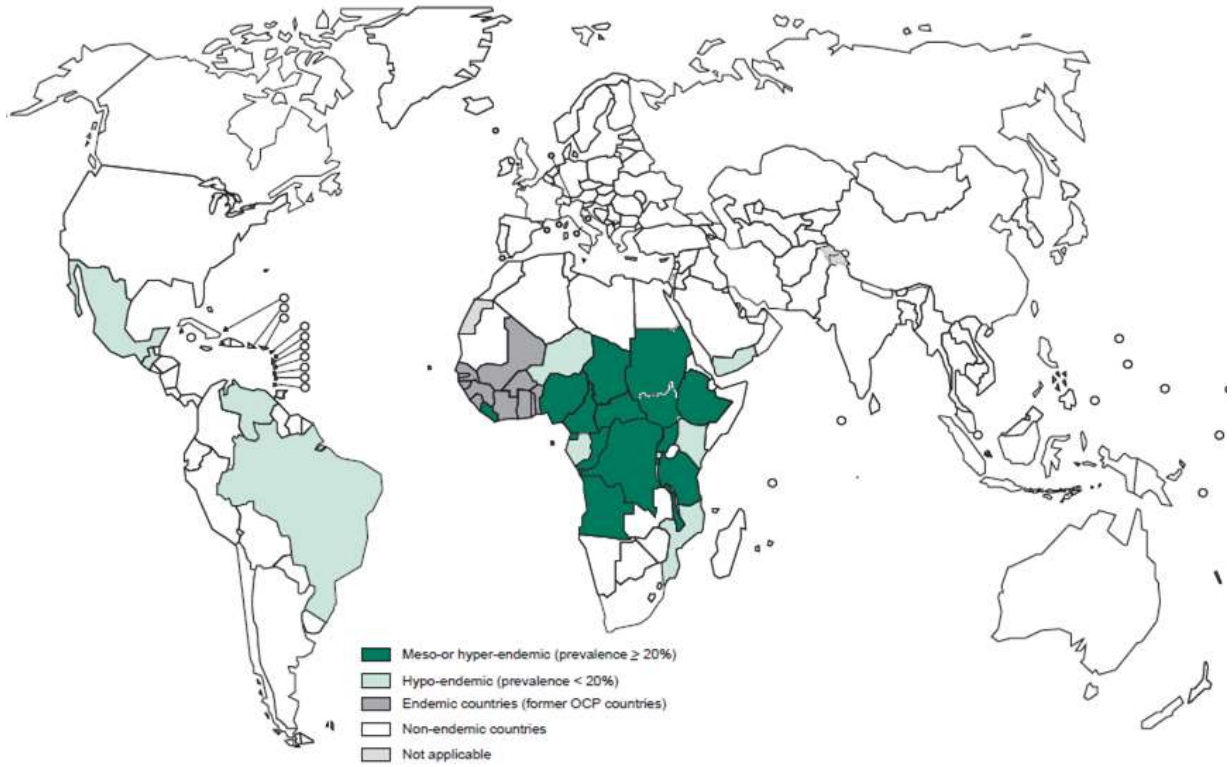
- Malaria in UK. Once fairly common in parts of England (map to R argue fever deaths 1830-1910) eliminated from UK 1920s.

- Mainly wetland drainage and reduced cattle density.



Kuhn KG et al PNAS 2003

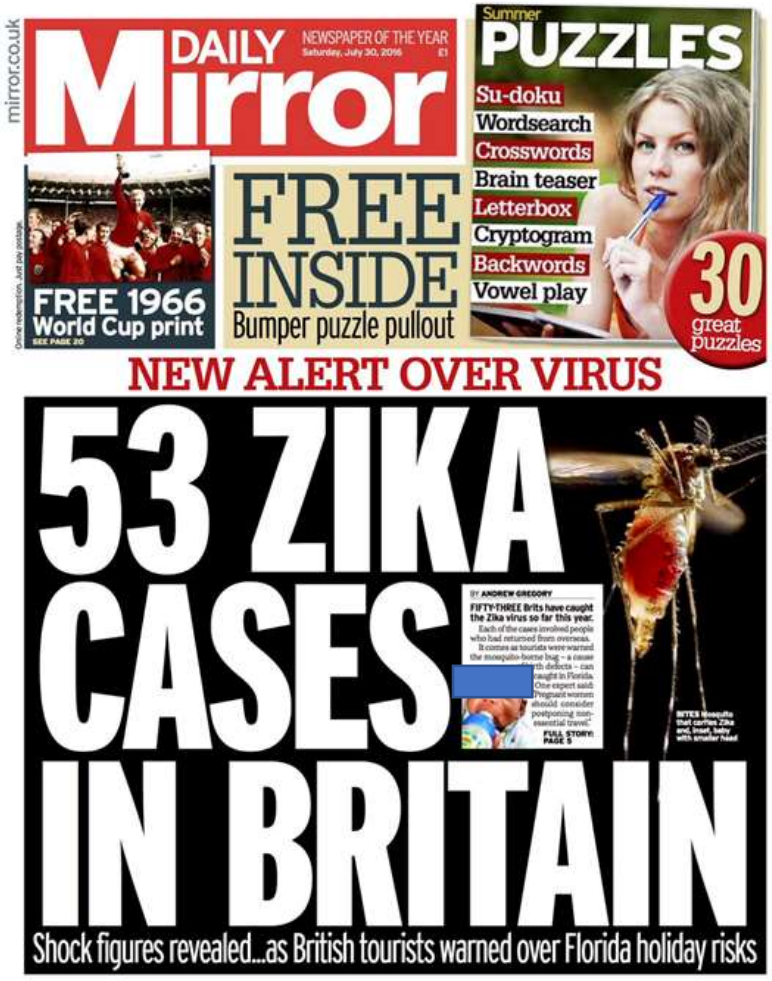
Some vector-borne diseases much more geographically concentrated. Onchocerciasis / river blindness.

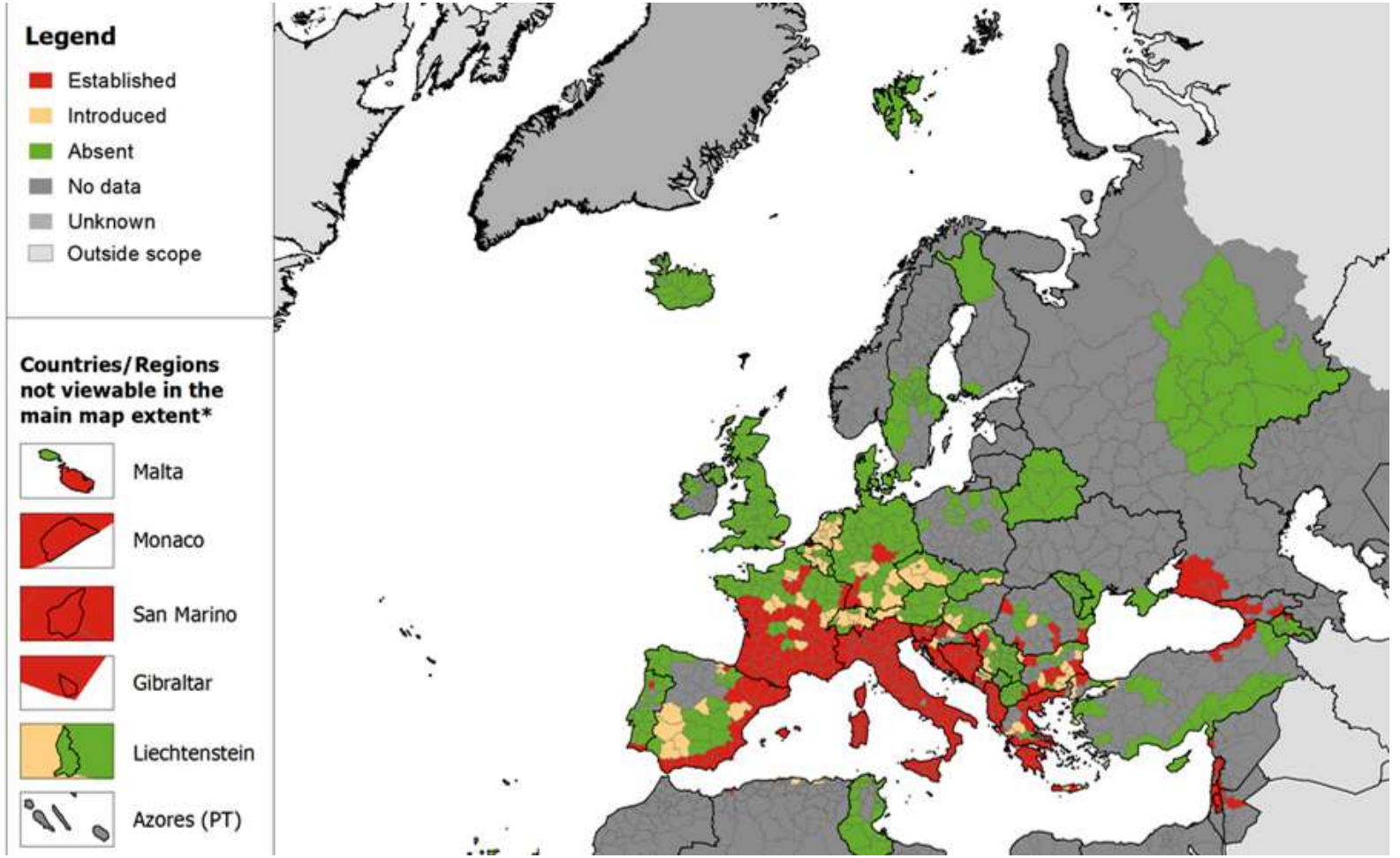


WHO

Zika an example of a disease where the absence of the Aedes vector key to risk assessment in 2015.

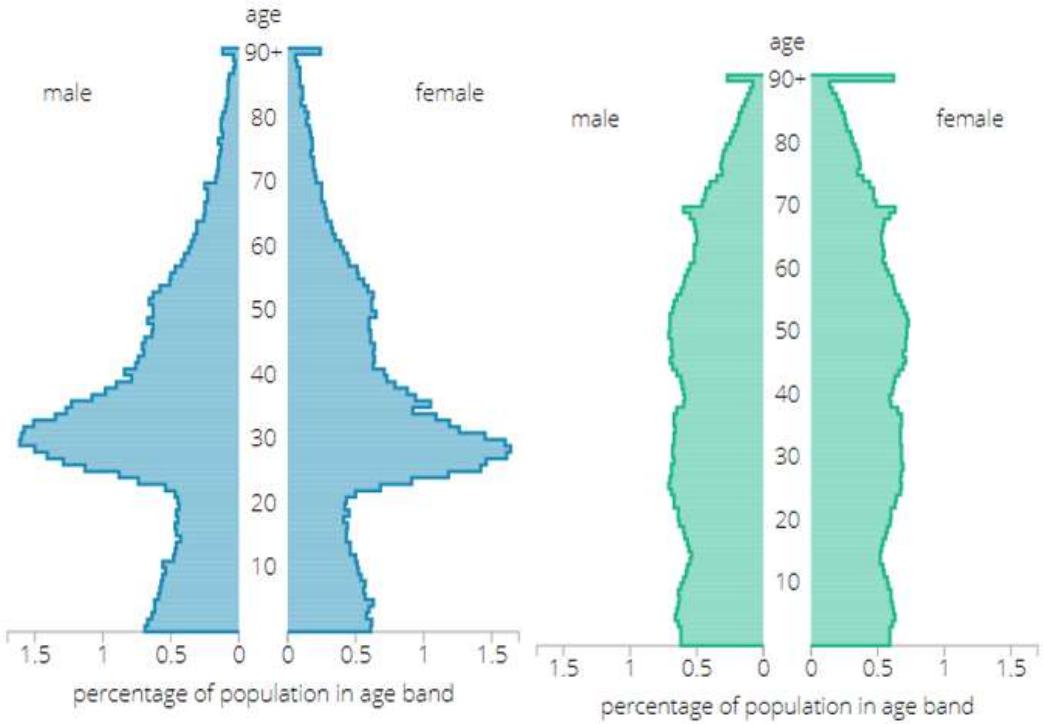
Aedes albopictus mosquitos Europe, ECDC 2020. Climate change may alter this.



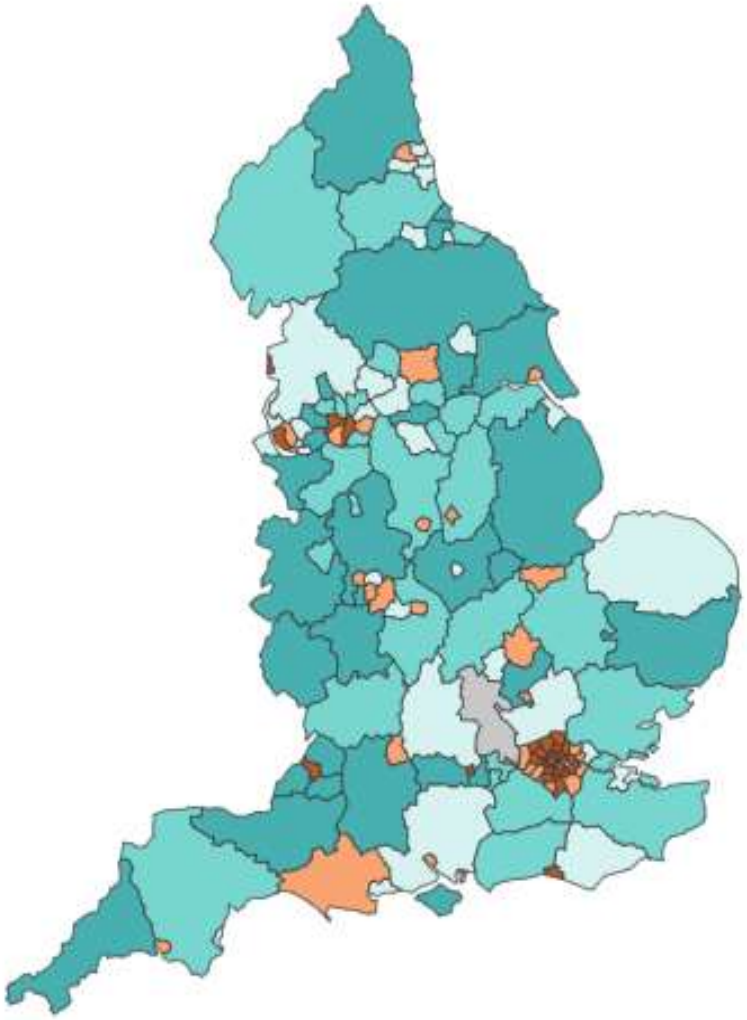


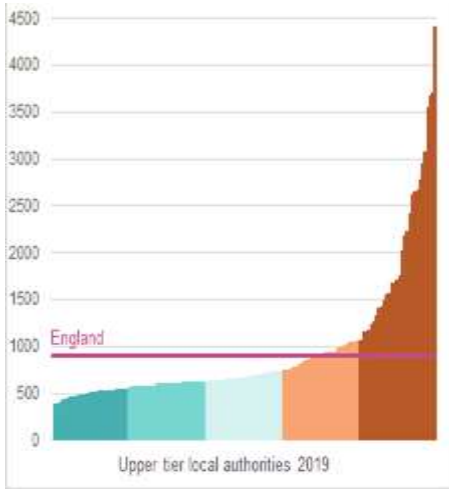
‘And then the lover sighing like furnace…’

Rate /100,000 of new sexually transmitted infection diagnoses age 15-64 2019 (PHE, excludes chlamydia).

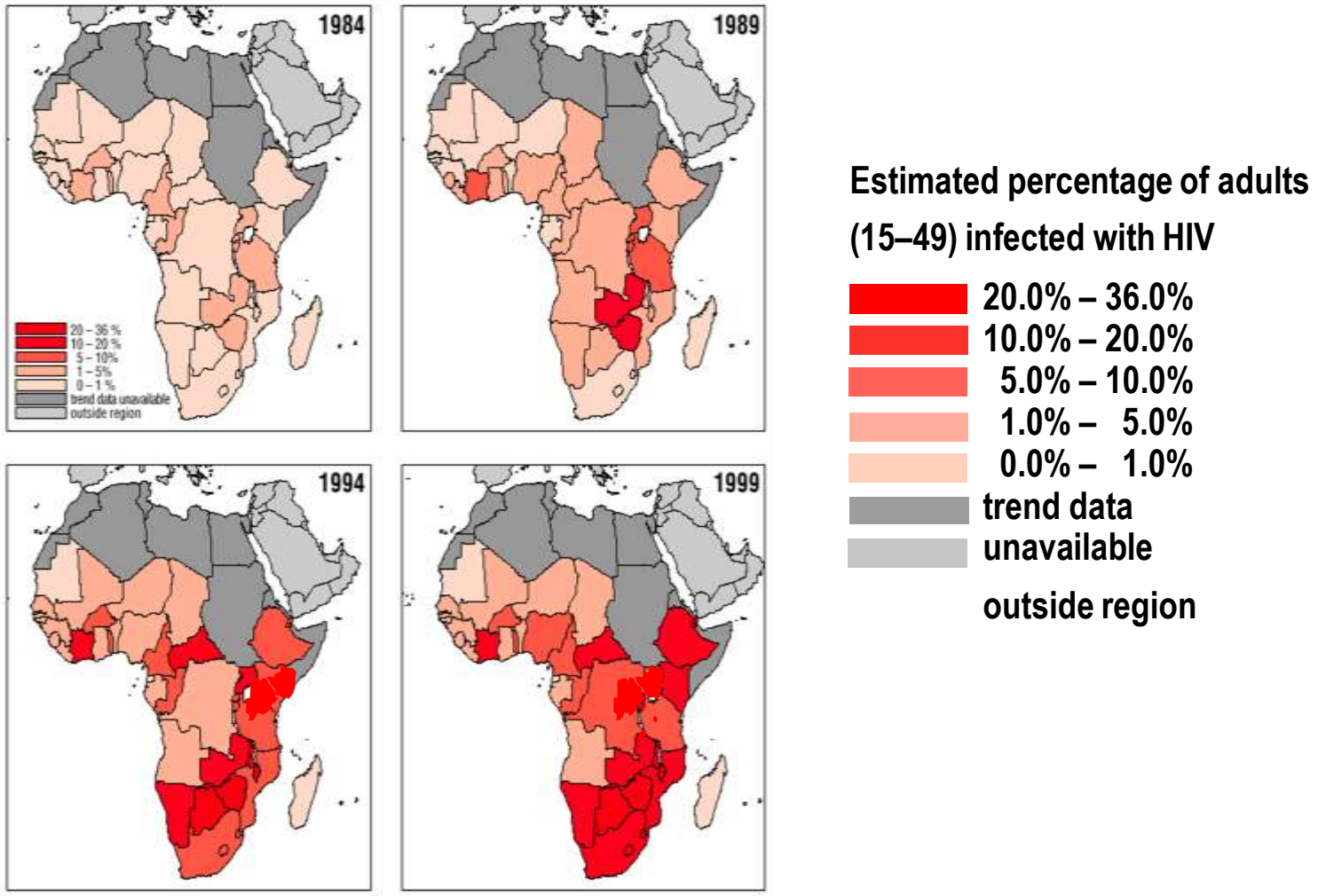


Population pyramid Lambeth (L) and England & Wales (R).



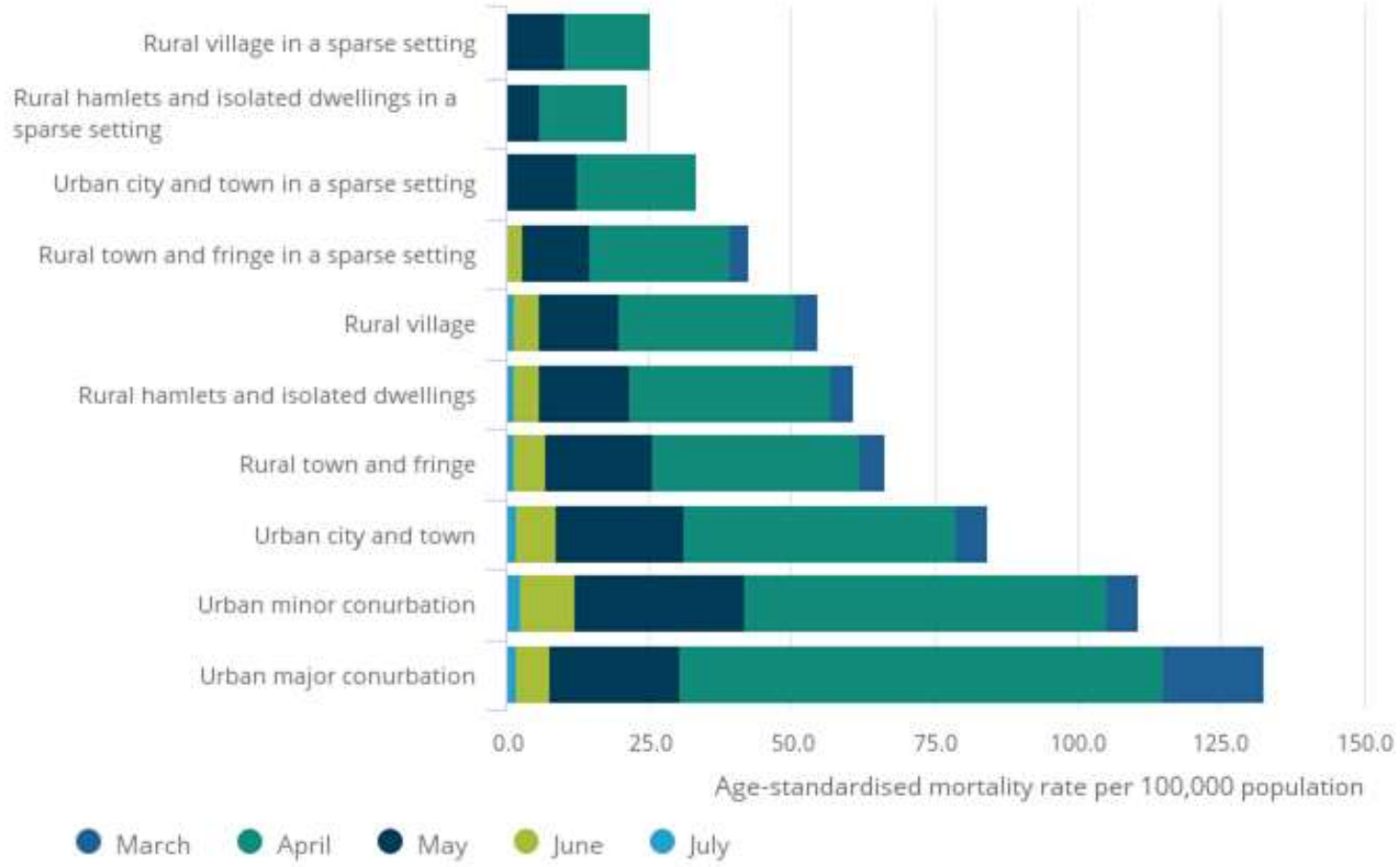


Infectious diseases spread geographically. The last really serious global pandemic: HIV sub-Saharan Africa, 1984-2000.



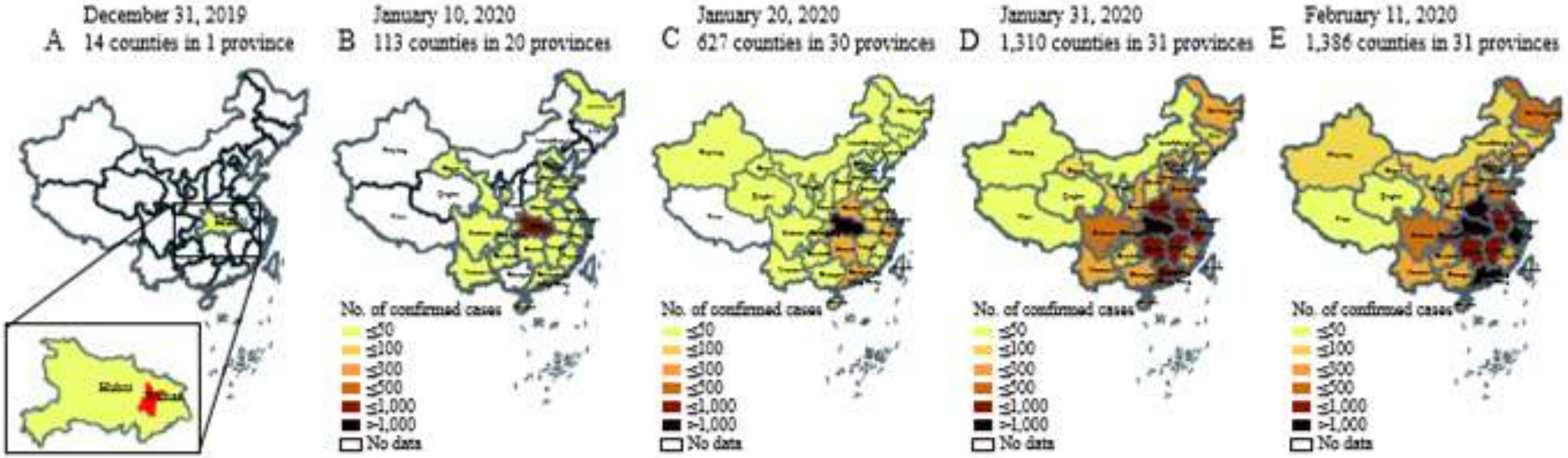
Some diseases, especially respiratory, more likely in crowded, and therefore urban, environments.

Age-standardised mortality/100,000 from COVID, UK, first wave. ONS.

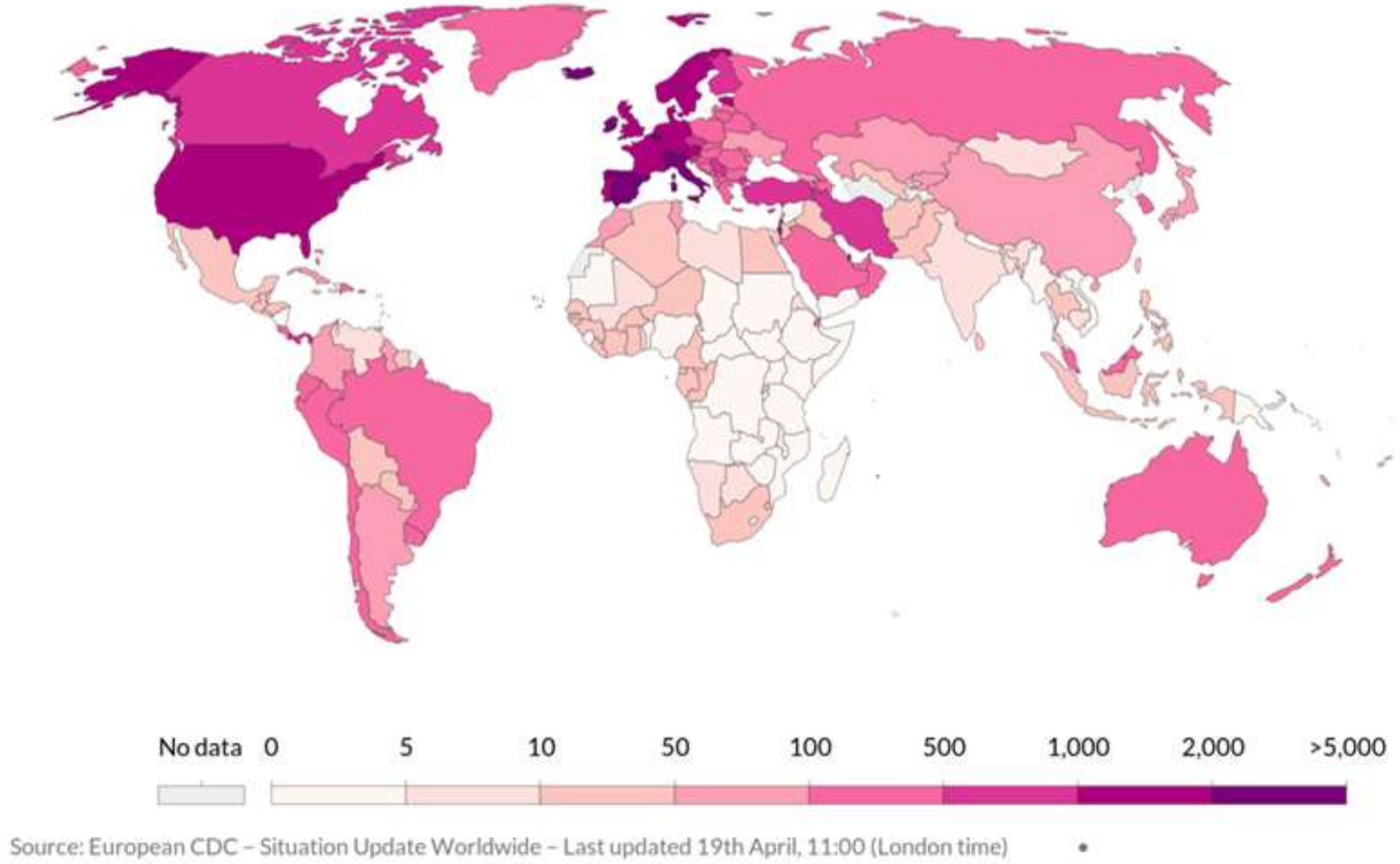


Stuart Wilding/

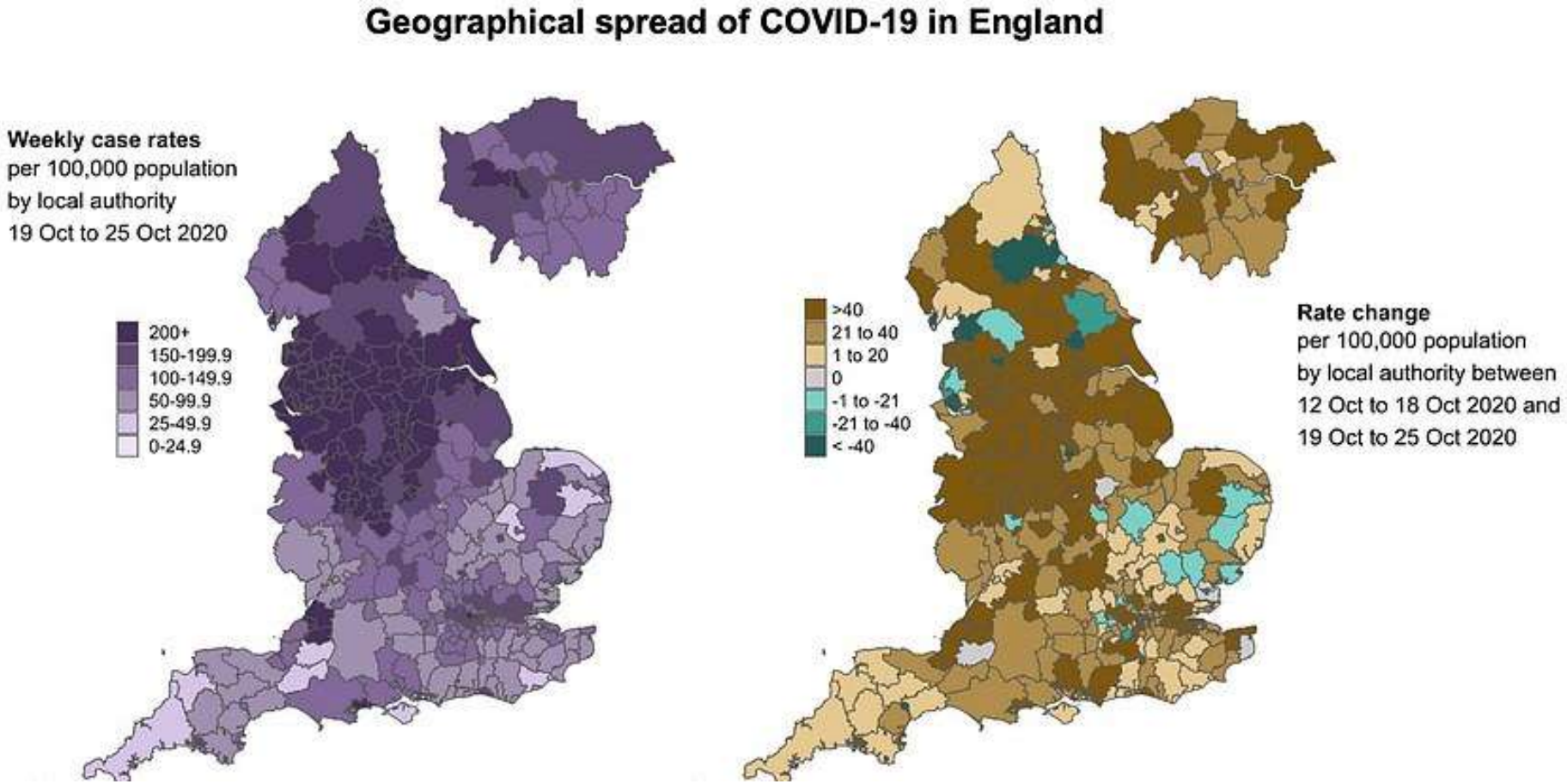
Respiratory infections can spread very fast. Initial spread of COVID-19 in China Dec 31st-Feb 11th. (China CDC)



Spread of COVID-19 around the world.
Confirmed COVID-19 cases April 2020 (ECDC/Our World in Data).

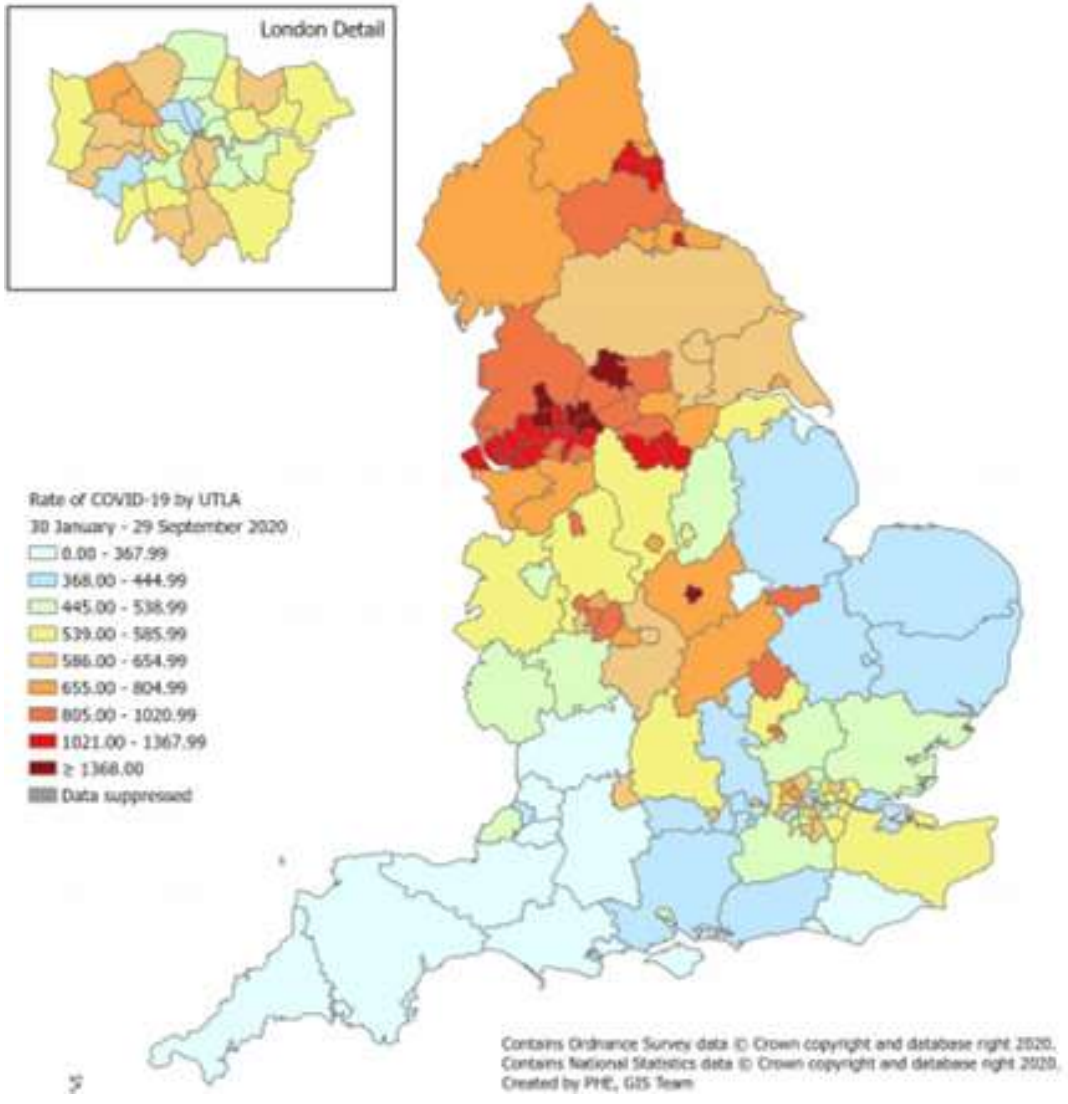


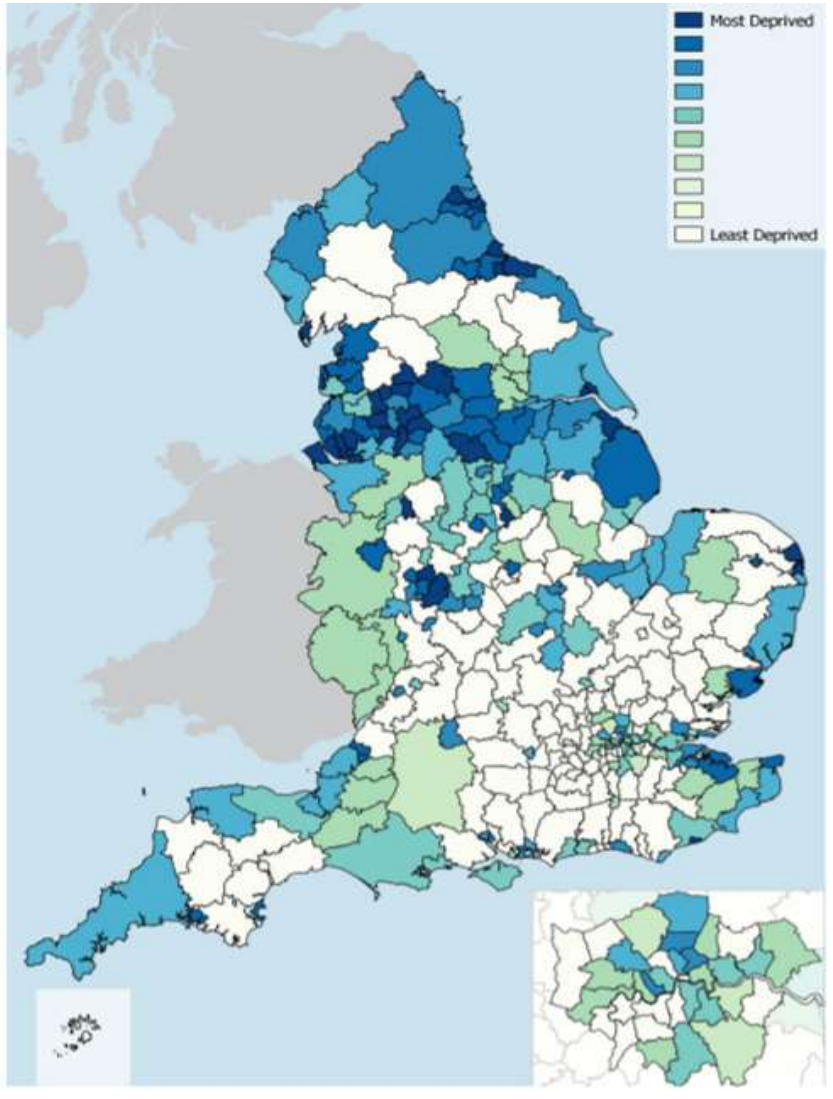
Infectious diseases spread- but areas of deprivation where they tend to hit hardest. UK COVID-19 end Oct 2020 (ONS/PHE).



COVID-19 rates/100,000 (L) to end September 2020 and distribution of deprivation by local authority (R).

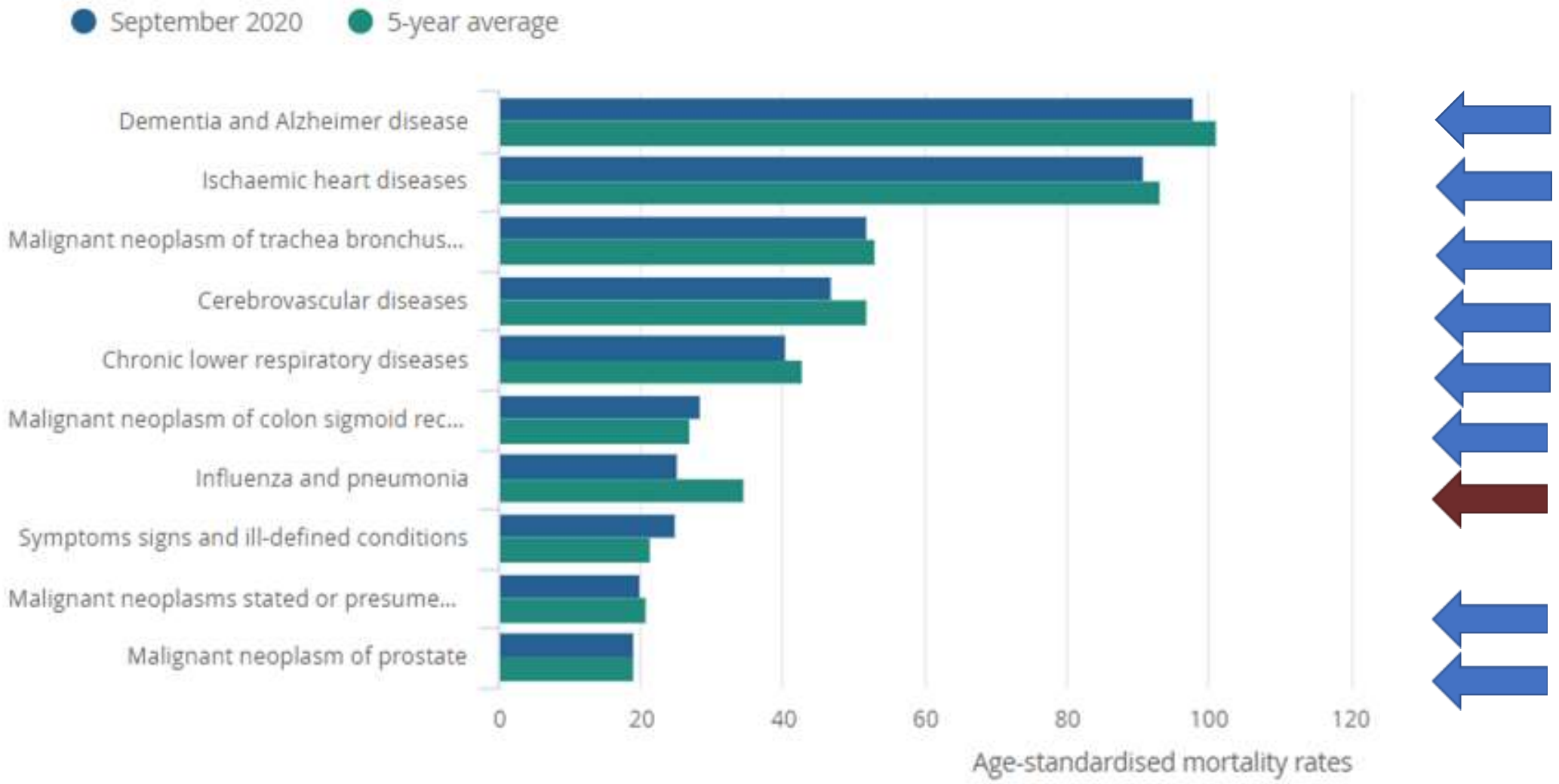
Urban deprivation highly predictive. (PHE)





Non-communicable diseases dominate in high-income countries. Causes of death in England, Sept 2020 and last 5 years.

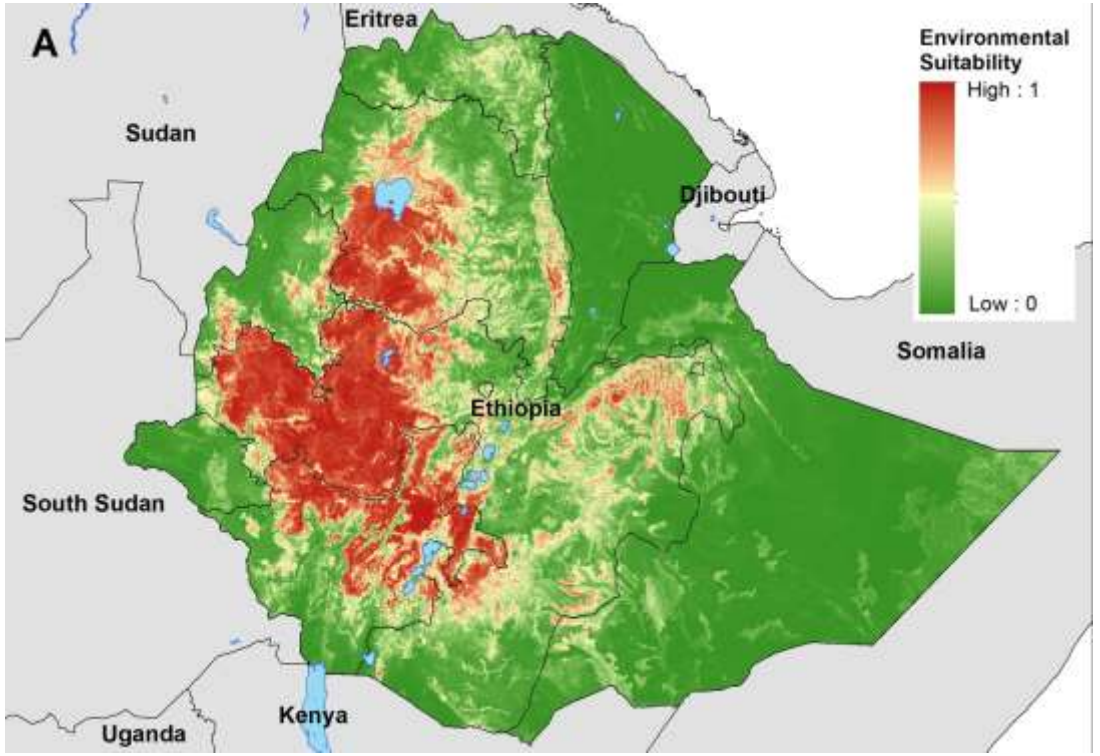
(ONS, age-standardised mortality/100,000)



Occasionally the land itself can cause non-communicable disease.

An example- podoconiosis, a disease in Africa, Latin America and India caused by a particular red clay.

Fasil Ayele , NIH/Wiki

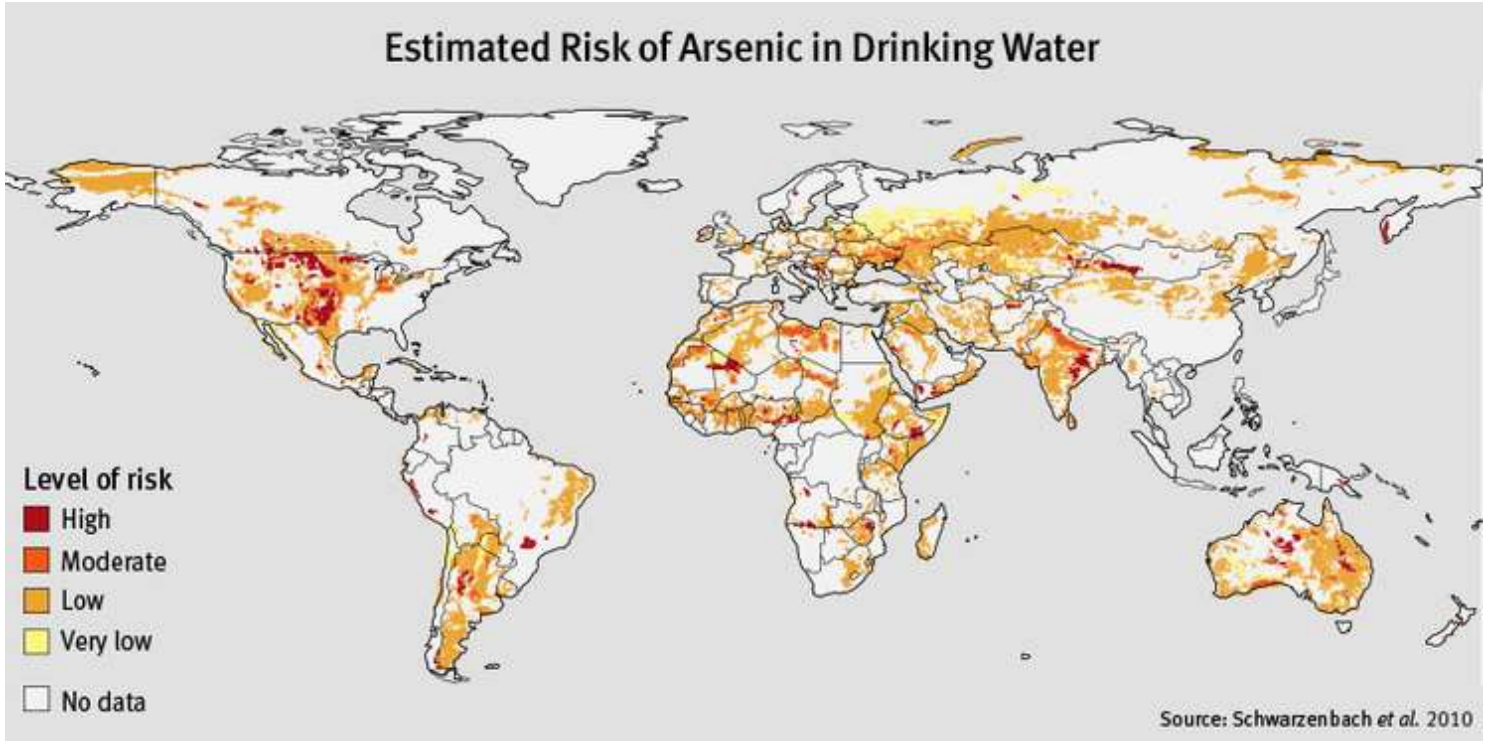


Global Atlas of Podoconiosis

Water minerals can affect health. Fluoride (teeth, L), arsenic (cancer R).

Not trivial- the most common operation on children in UK is tooth extraction.

Discoverwater.co.uk

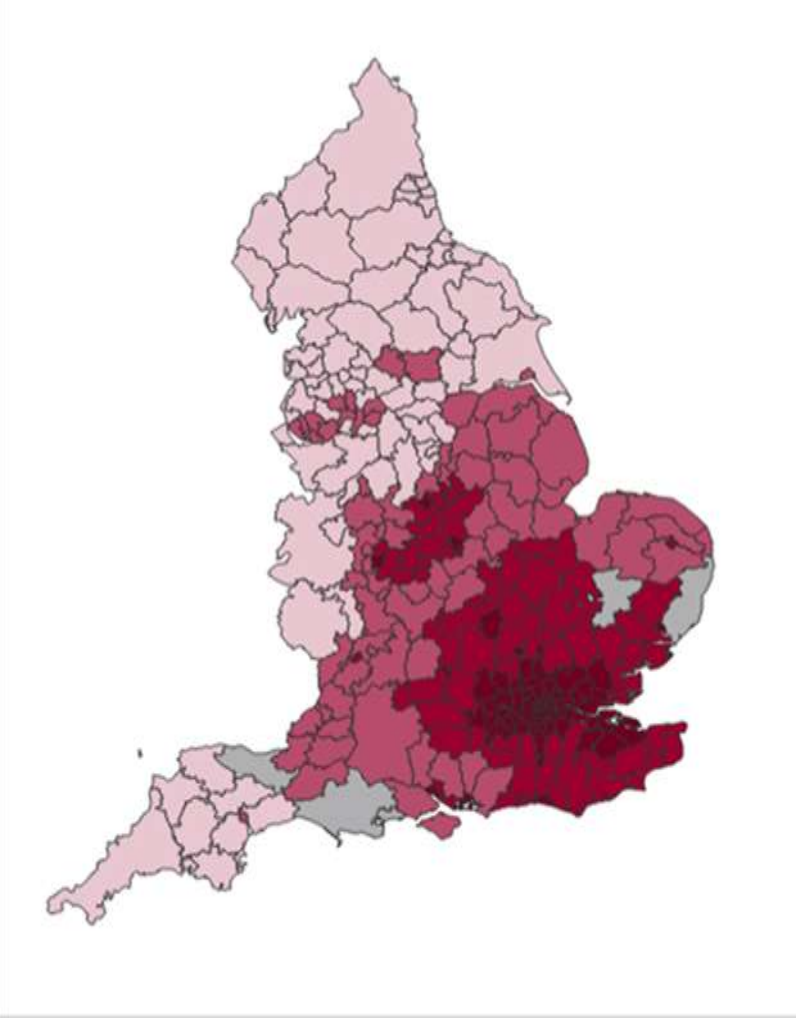


United Nations Environmental Programme.

Air pollution is geographically variable, and contributes to multiple diseases including stroke, heart disease and lung disease.

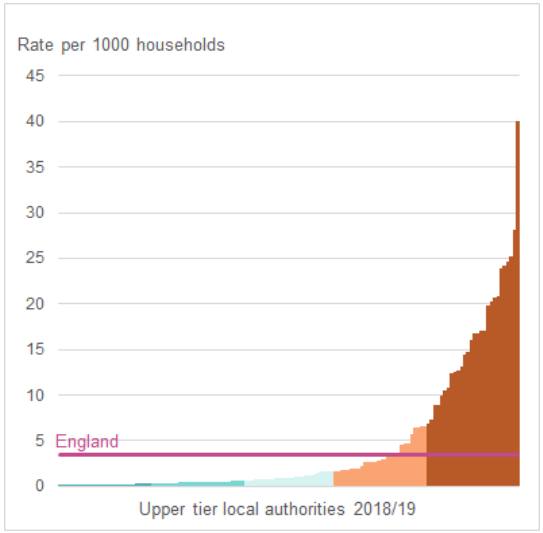
Fraction of mortality attributable to air pollution (2017).

Mariordo/Wiki



PHE

Statutory homelessness. (PHE)

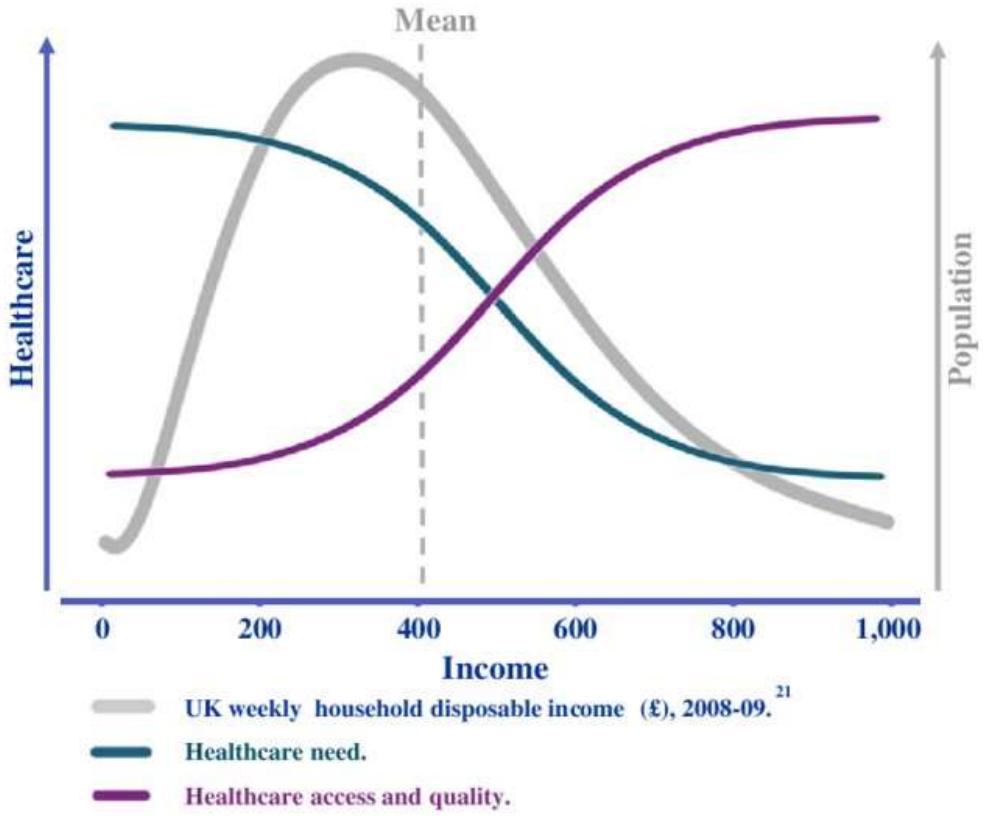


Benjamin Brock Wiki

Deprivation is a risk for many non-communicable diseases, including in high income countries.

From pregnancy all the way through to old age. Includes less good:

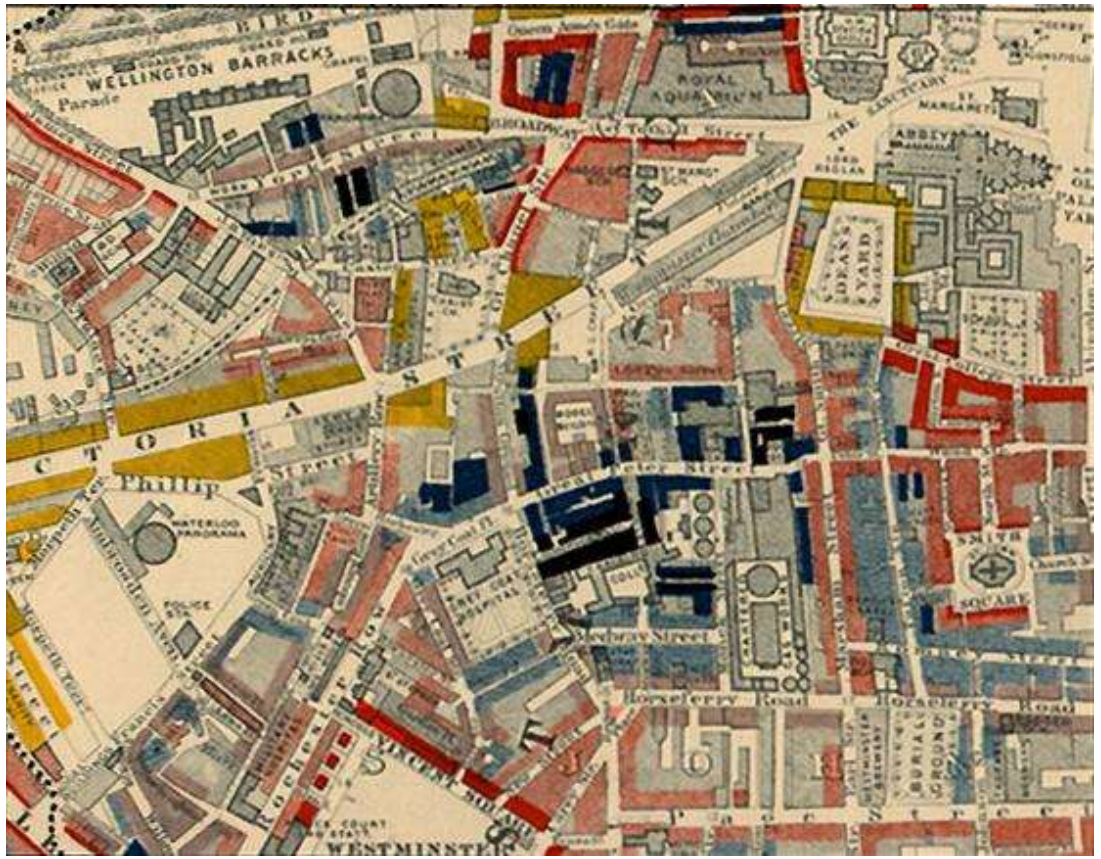
- Diet
- Housing
- Work
- Often education
- Smoking.
- Inverse care law (Julian Tudor Hart).



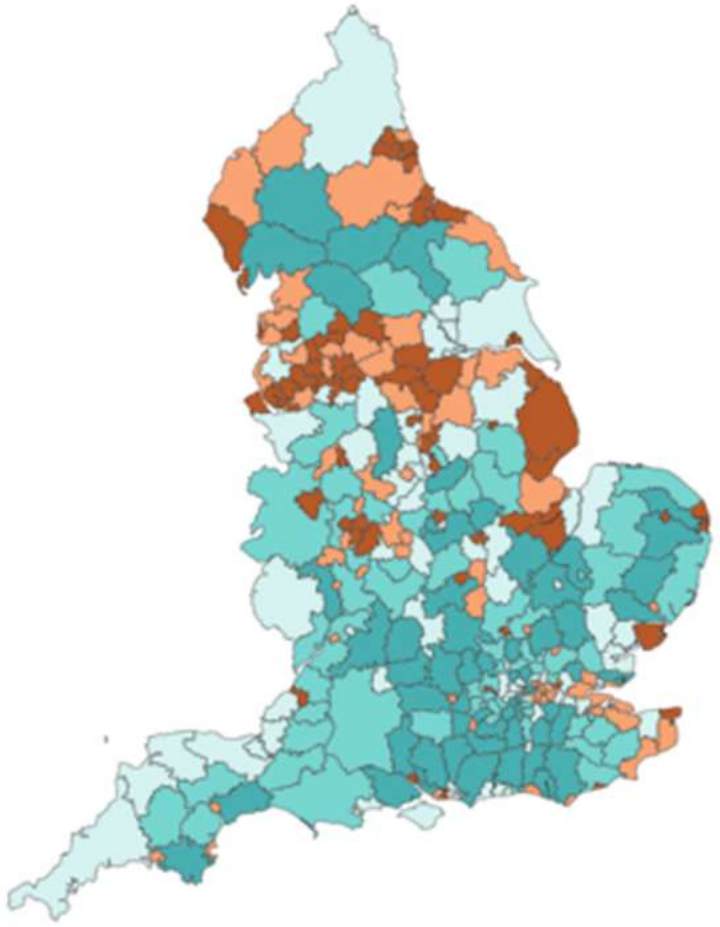
Jack James 2014 (schematic)

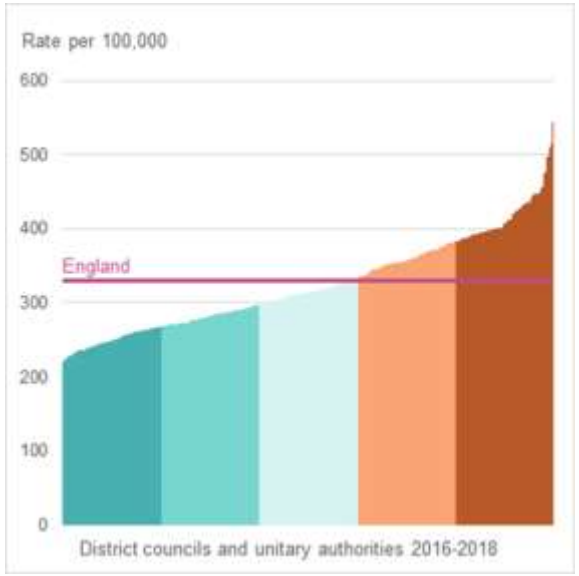
The map of London by Charles Booth demonstrates how close high and low risk areas can be- and how things can change.

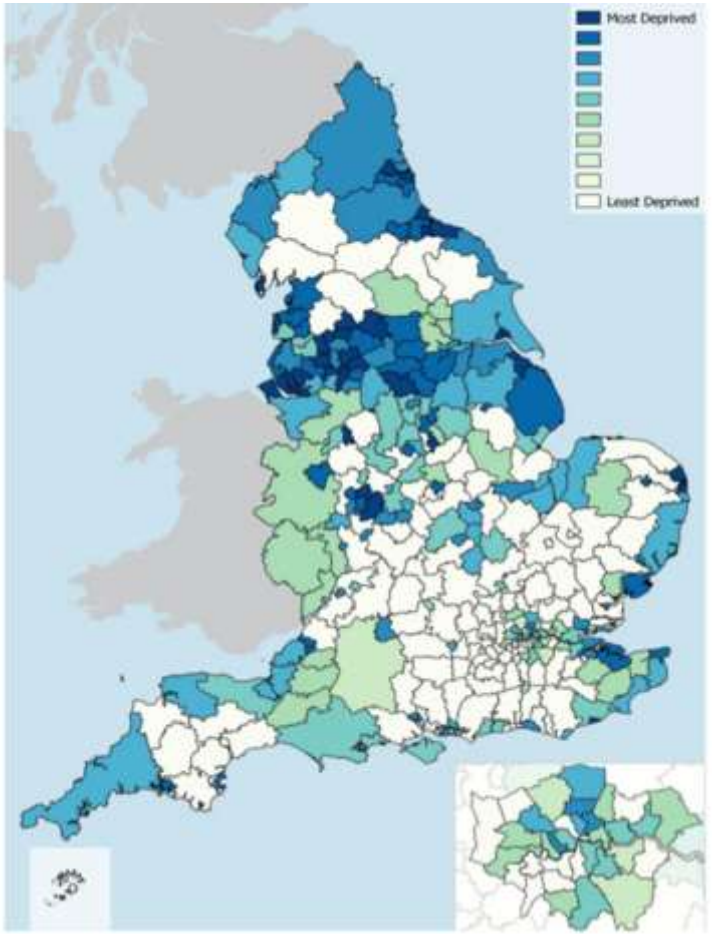
- ‘Close under the Abbey of Westminster there lie concealed labyrinths of lanes and courts, and alleys and slums, nests of ignorance… [and] squalor, wretchedness, and disease; whose atmosphere is typhus, whose ventilation is cholera;…., which no sewage committee can reach’. Cardinal Wiseman 1850.



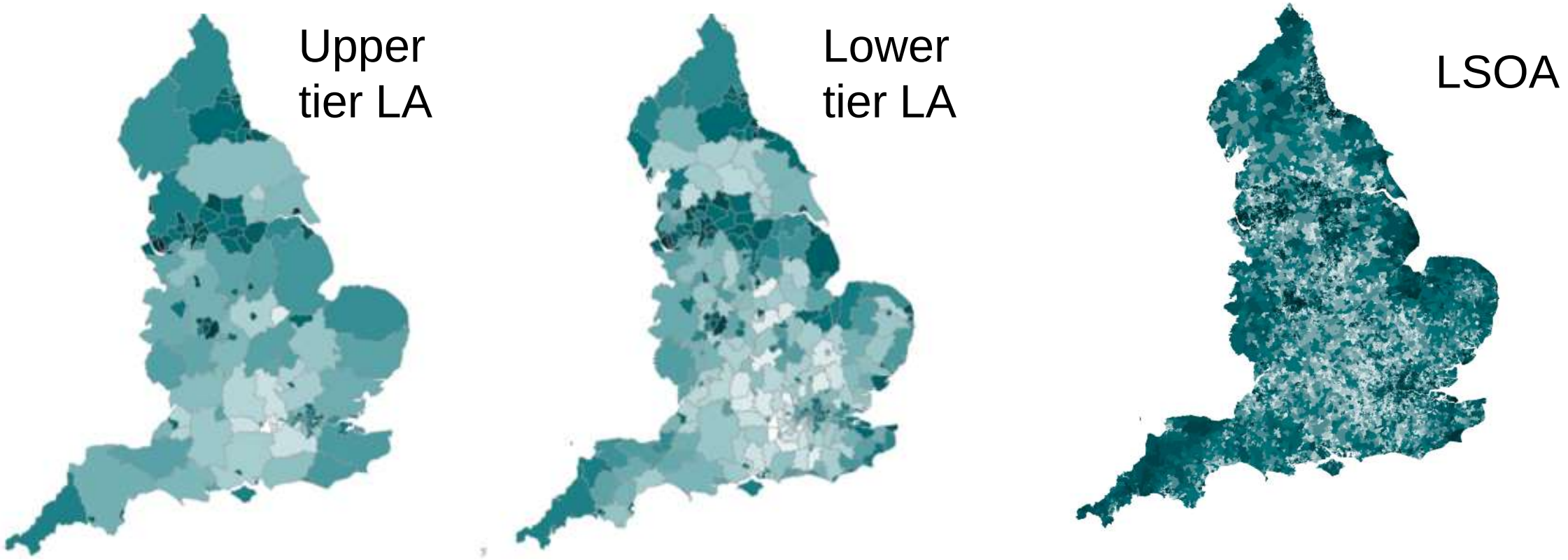
Under 75 year mortality (L 2016-18); relative deprivation (R).





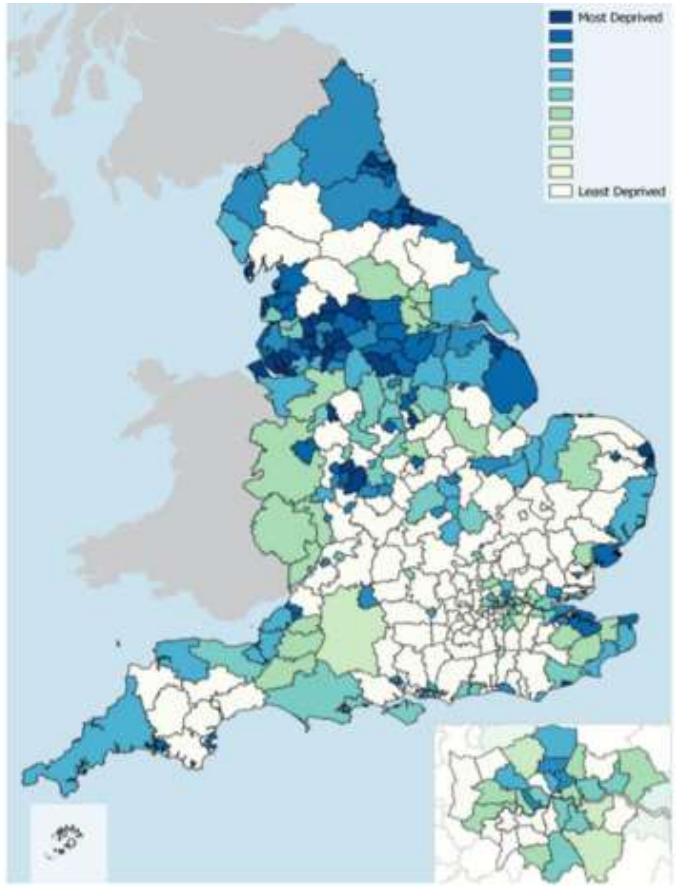


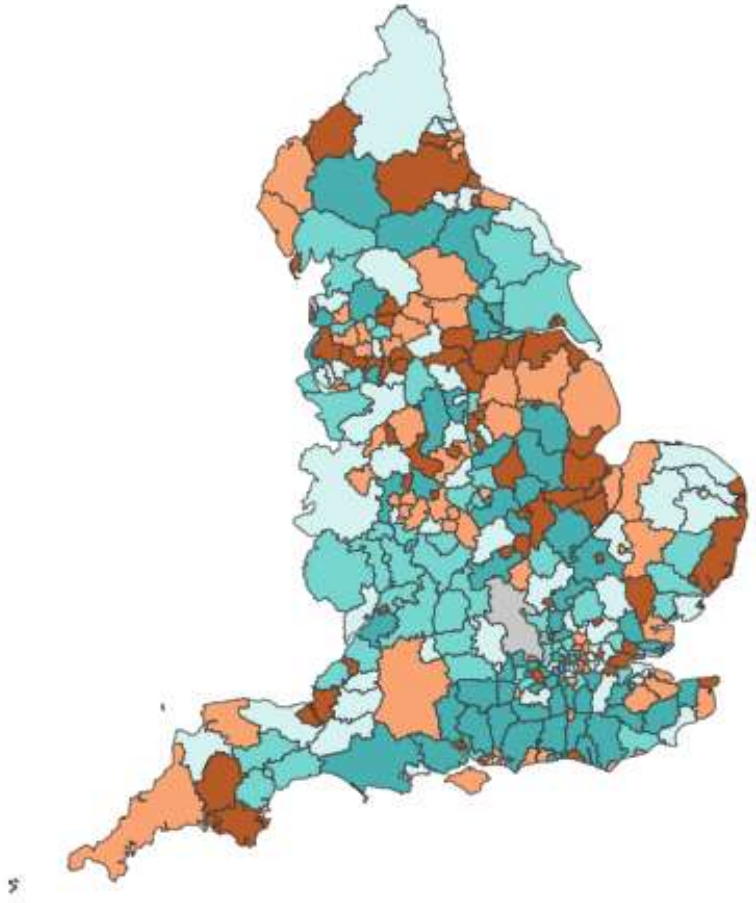
The more granular the data the more concentrated the deprivation, and therefore avoidable ill health.



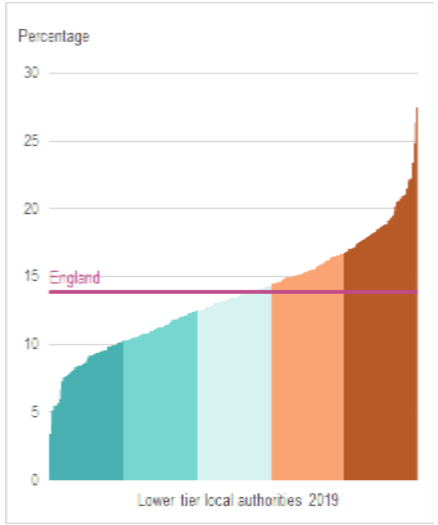
Socioeconomic deprivation (measured using IMD 2019) at different geographic levels
Source: Department of Health and Social Care, analysis of ONS data

Relative deprivation (L) smoking prevalence (R) 2019 data. The cigarette industry goes to the least wealthy areas to take their profits.

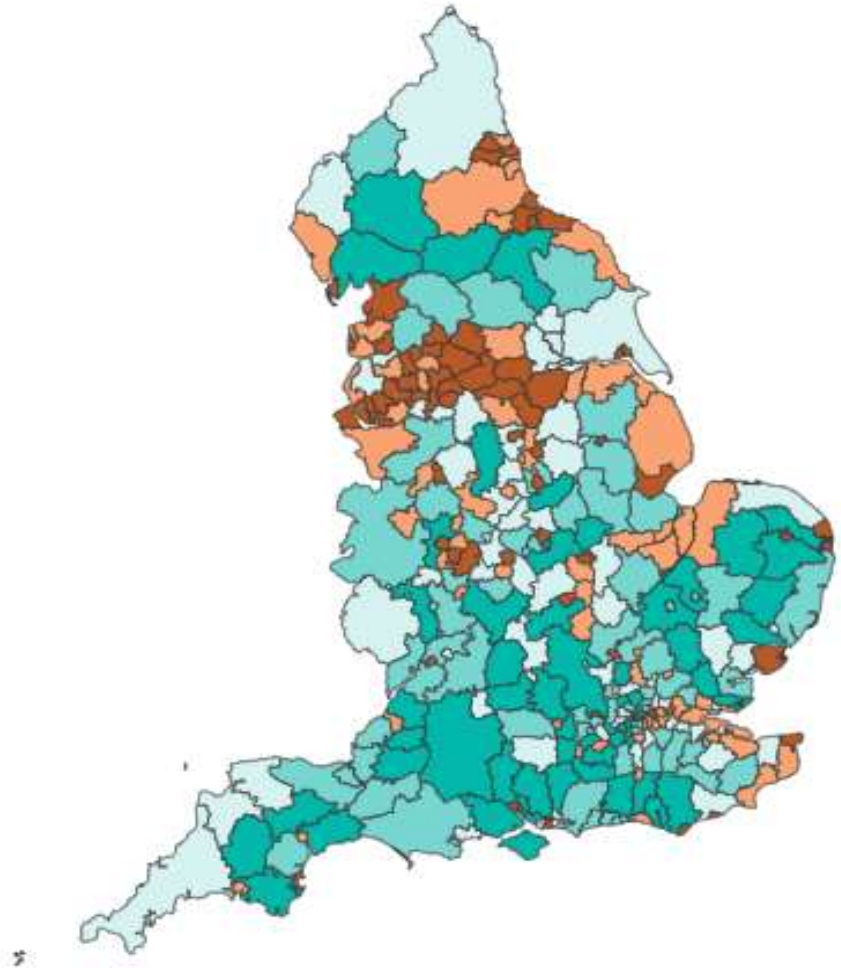


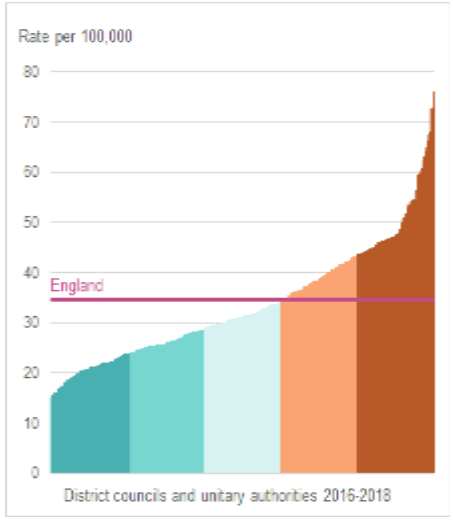


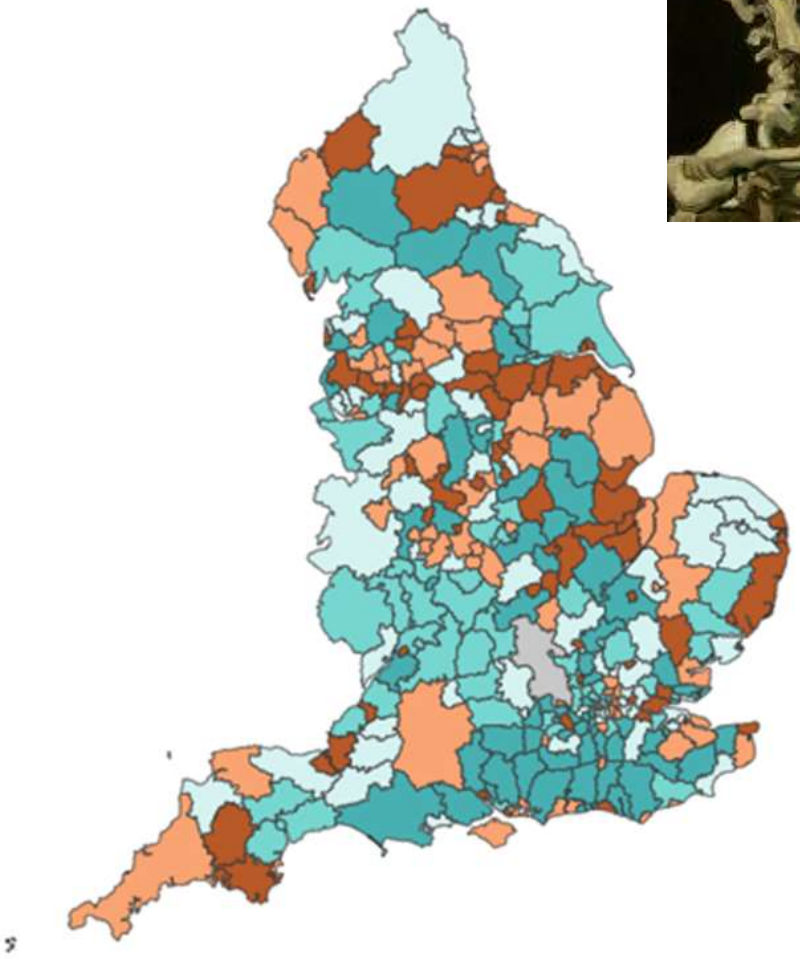
Vincent Van Gogh



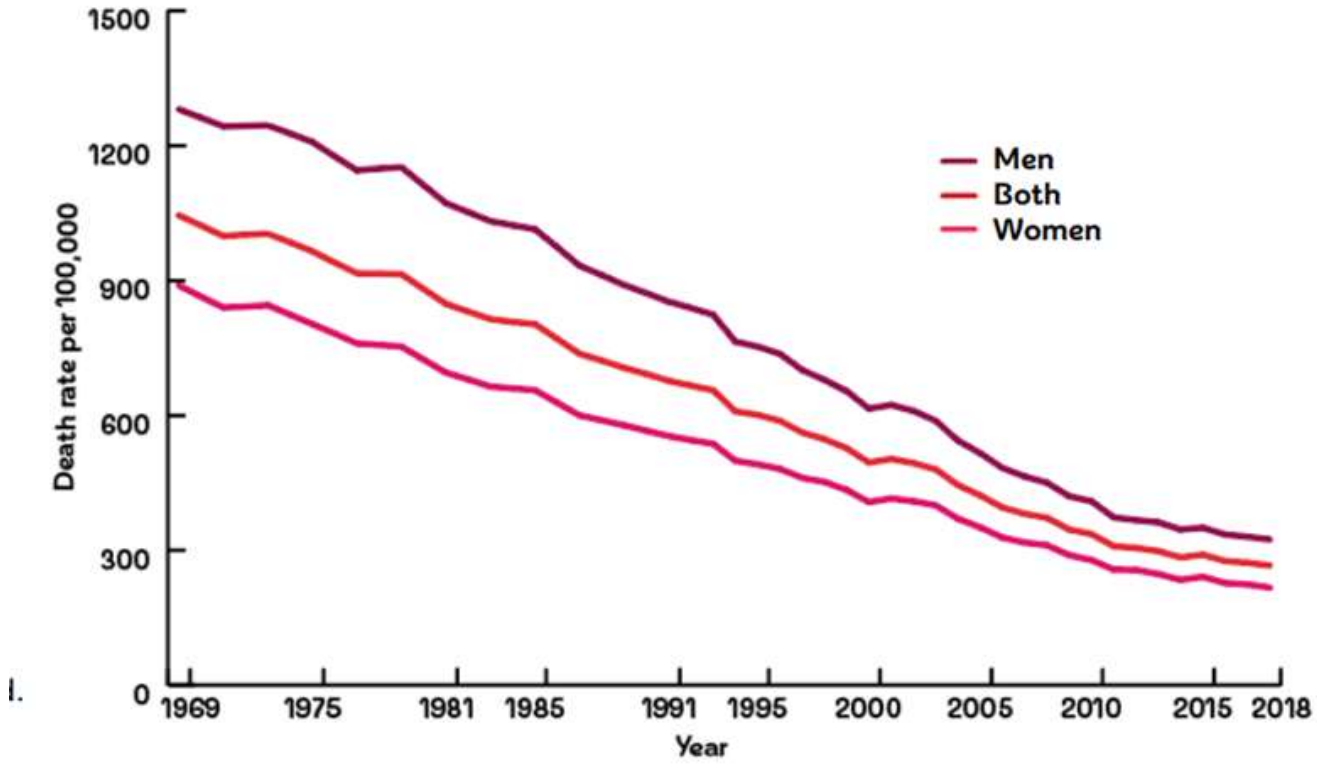
Deaths due to respiratory disease under the age of 75 years (L), cigarette smoking (R).

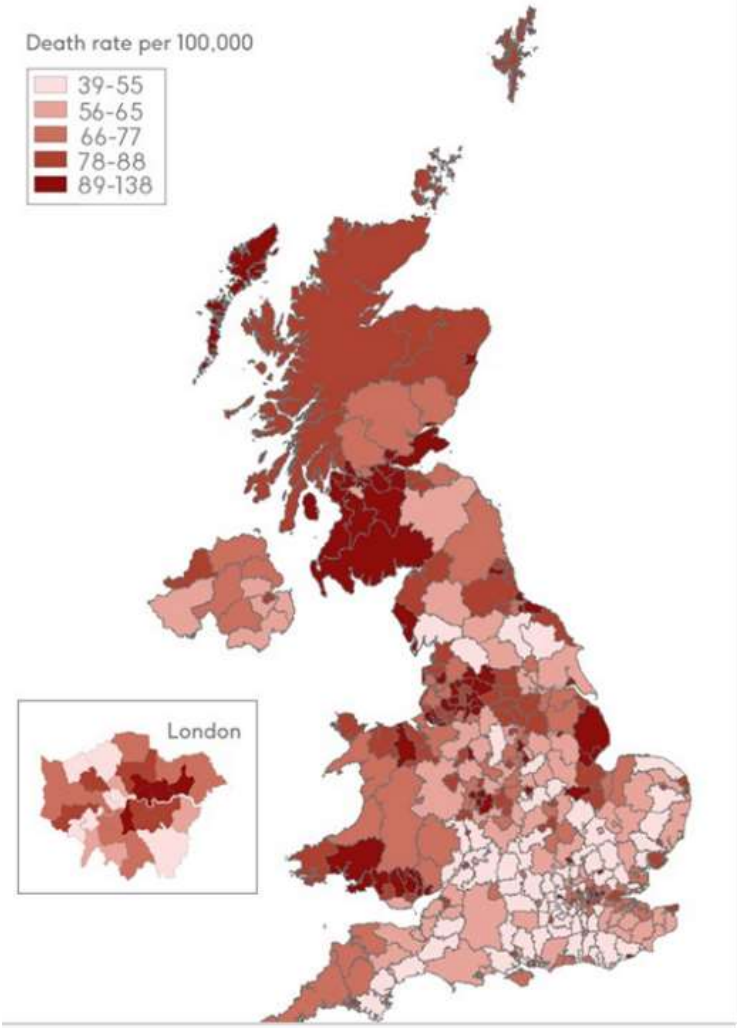




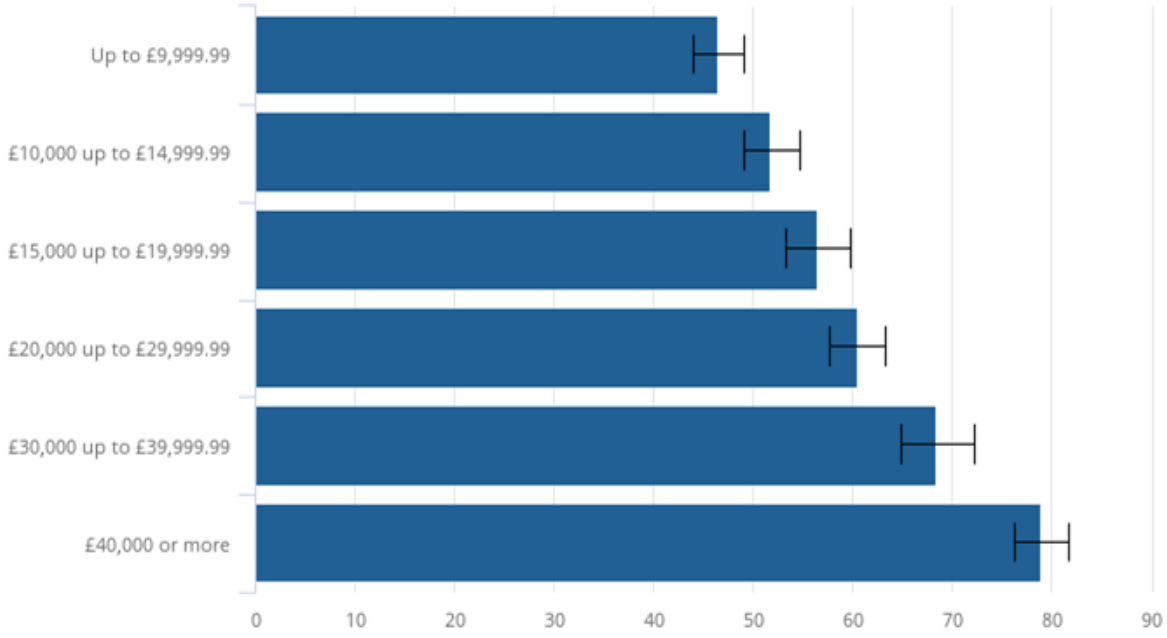


Premature (<75) cardiovascular disease strongly linked to deprivation and smoking. Heart and circulatory.
Rate in Glasgow 138/100,000; Hart, Hampshire 39/100,000 (BHF).

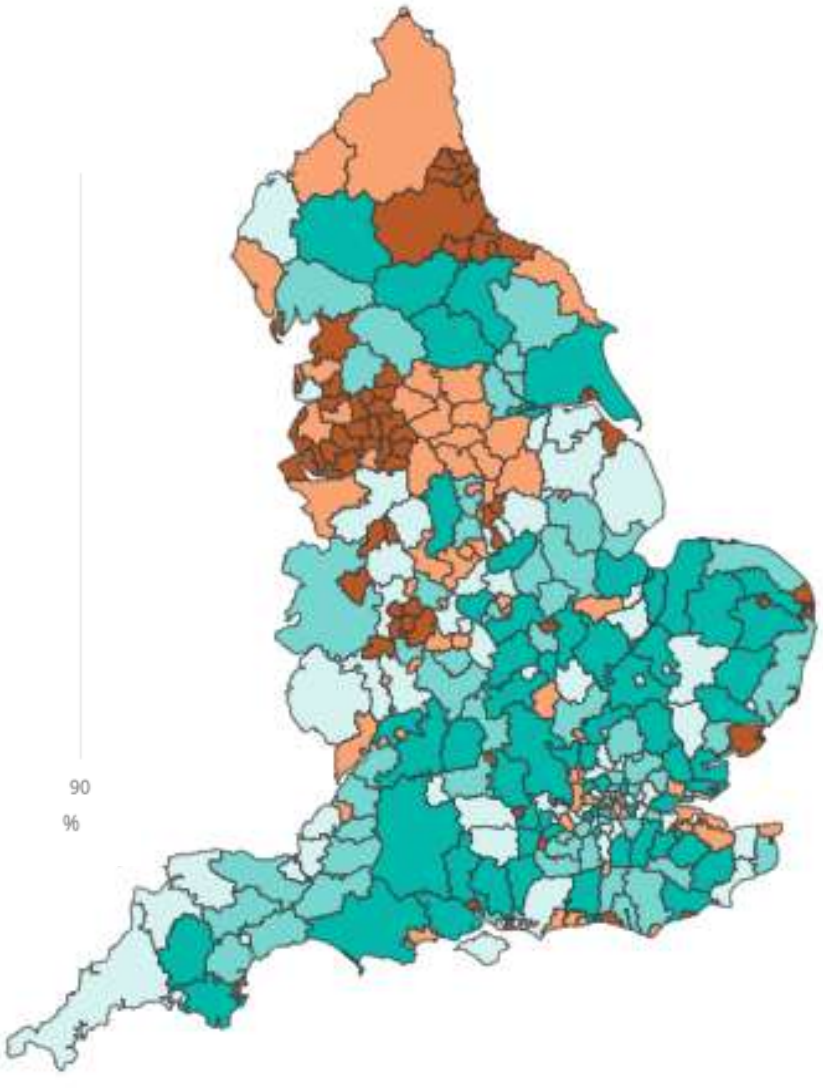


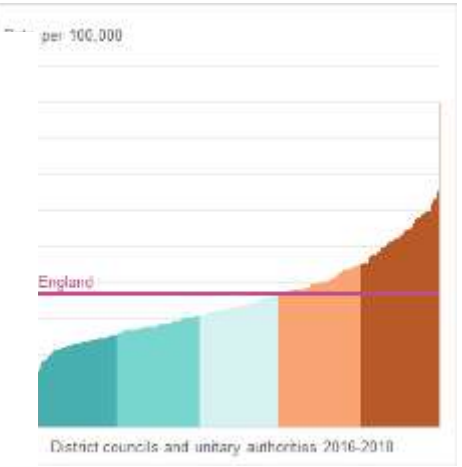


Deaths due to liver disease under the age of 75 years 2016-18, proportion who drink by income.



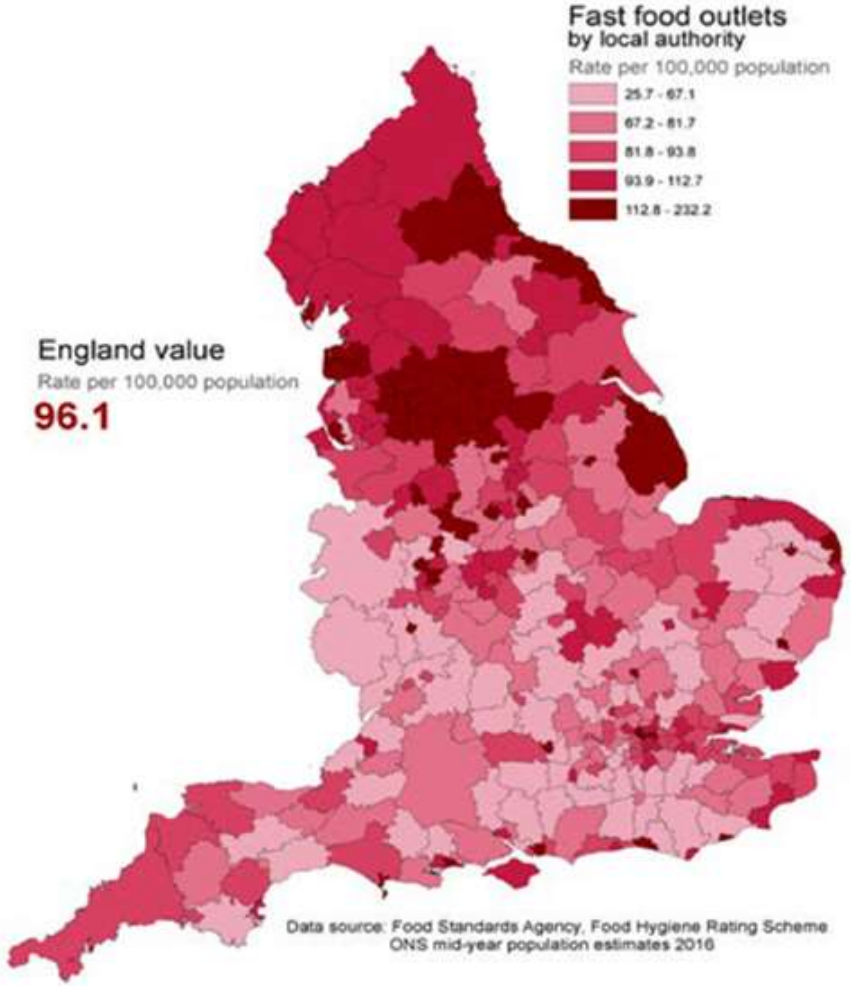
ONS, 2017

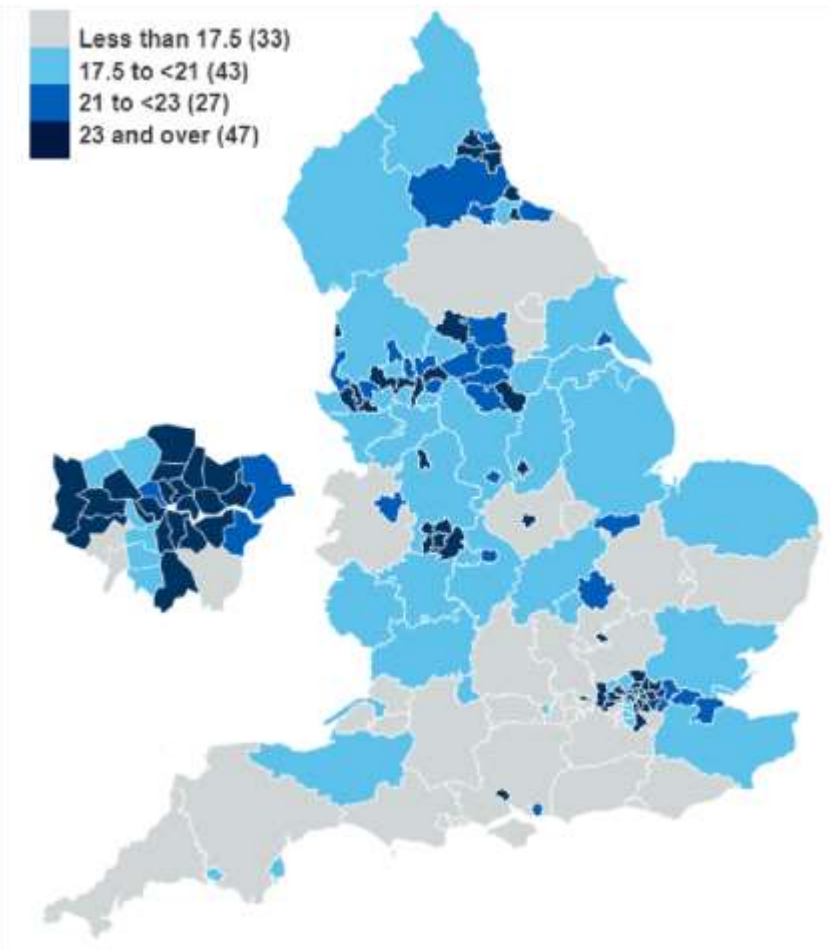




PHE

Child obesity prevalence Year 6 (R) and fast food outlets (L).



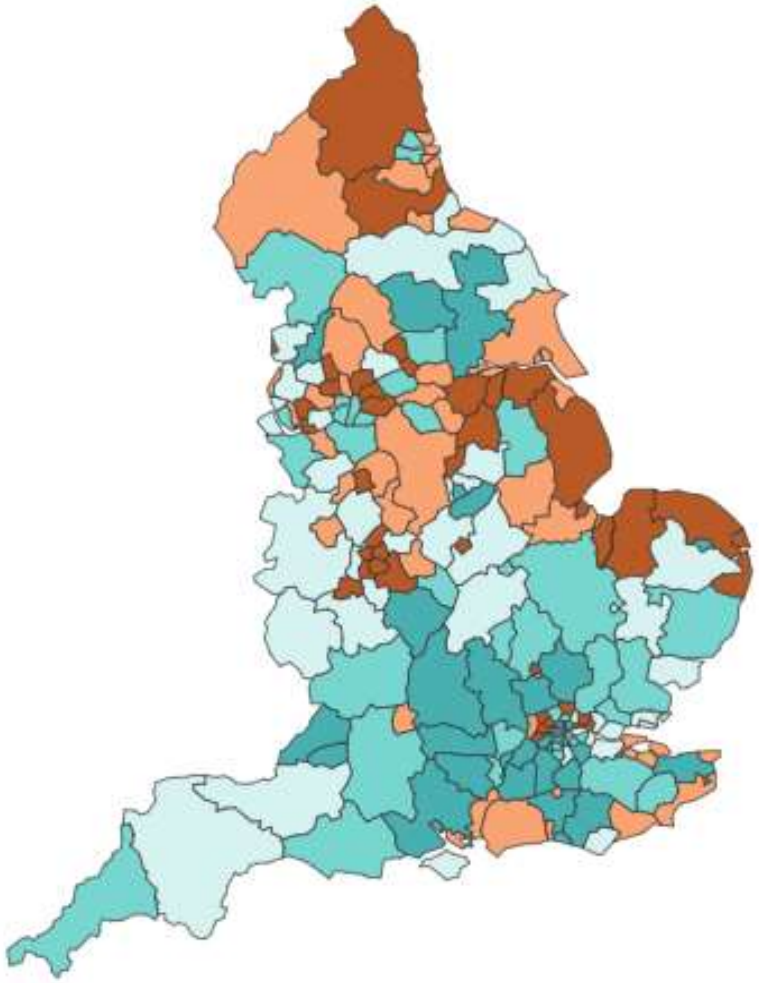


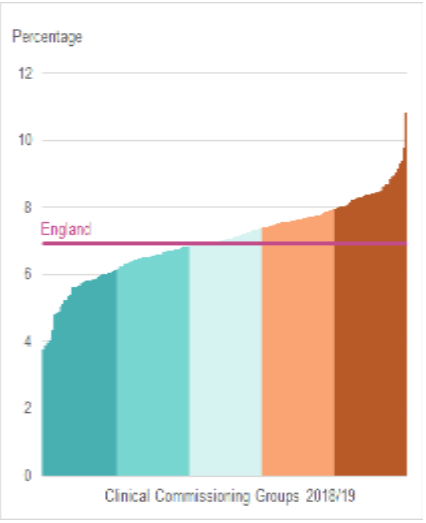
Diabetes prevalence.

PHE/National GP profiles 2018/19.

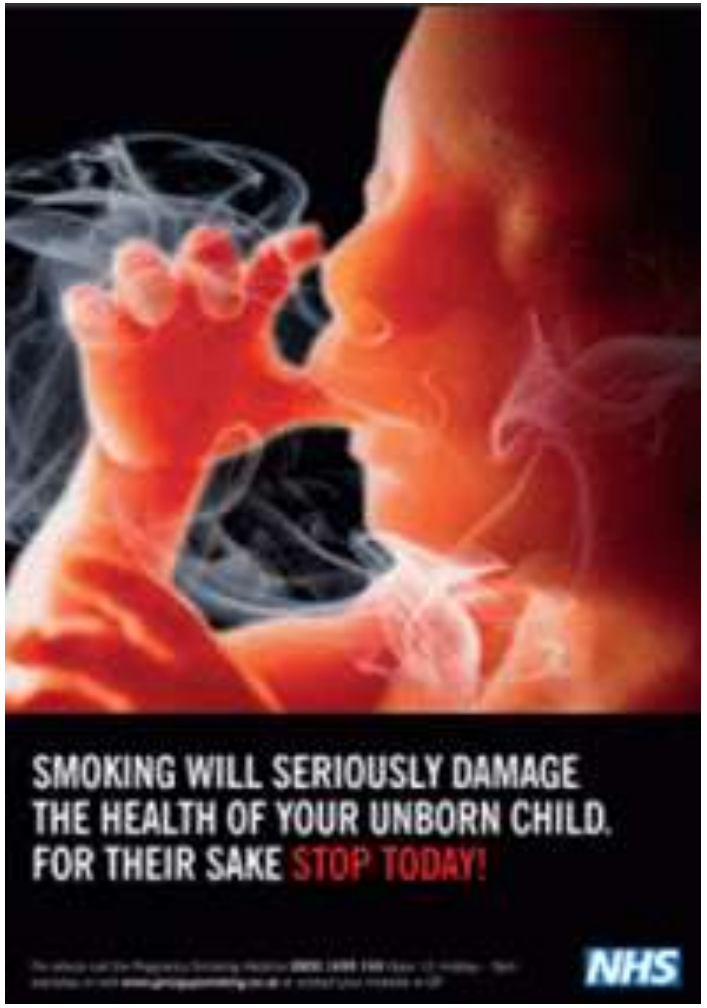
Type 2 diabetes strongly linked to obesity.

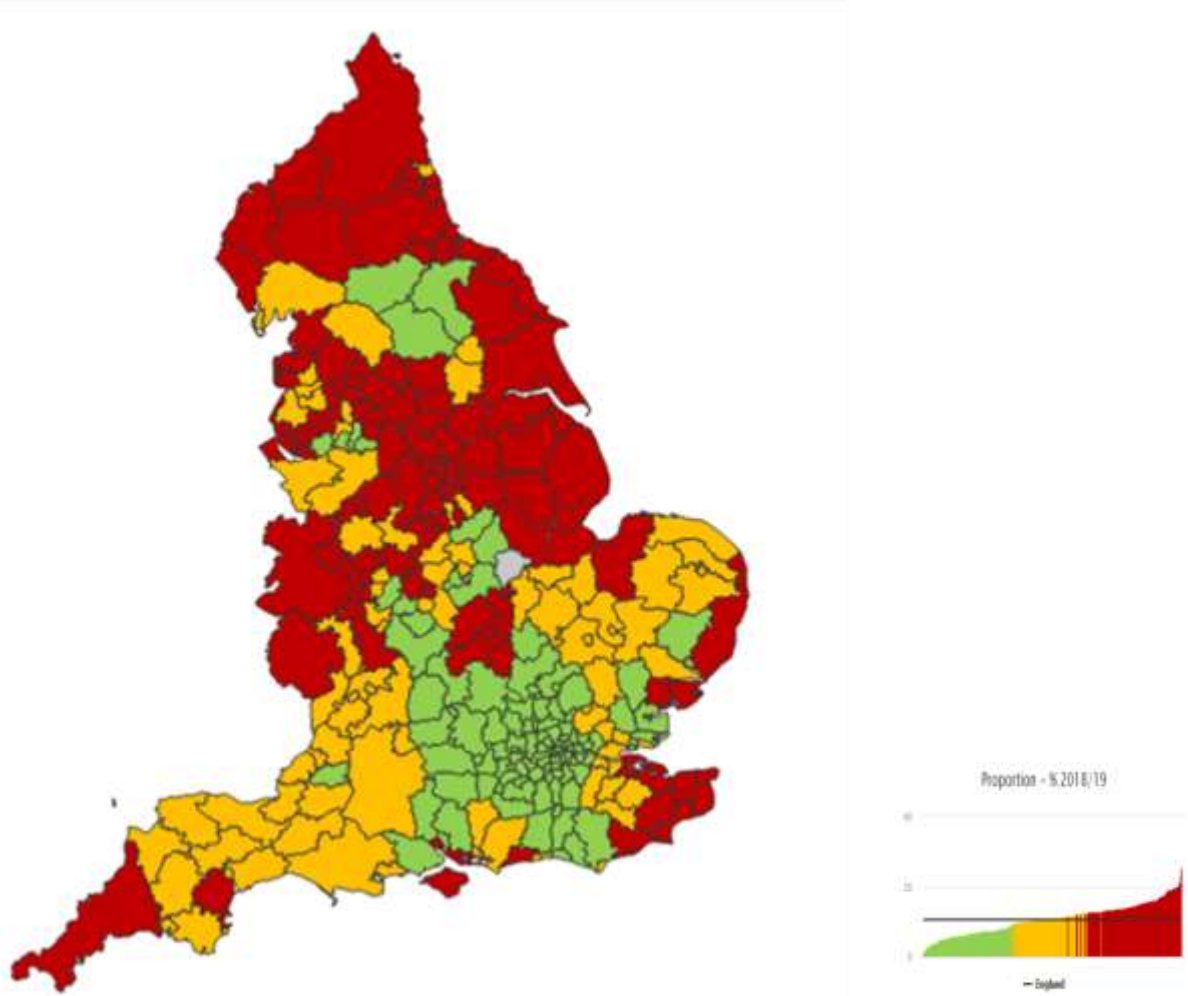
FatM1ke Wiki





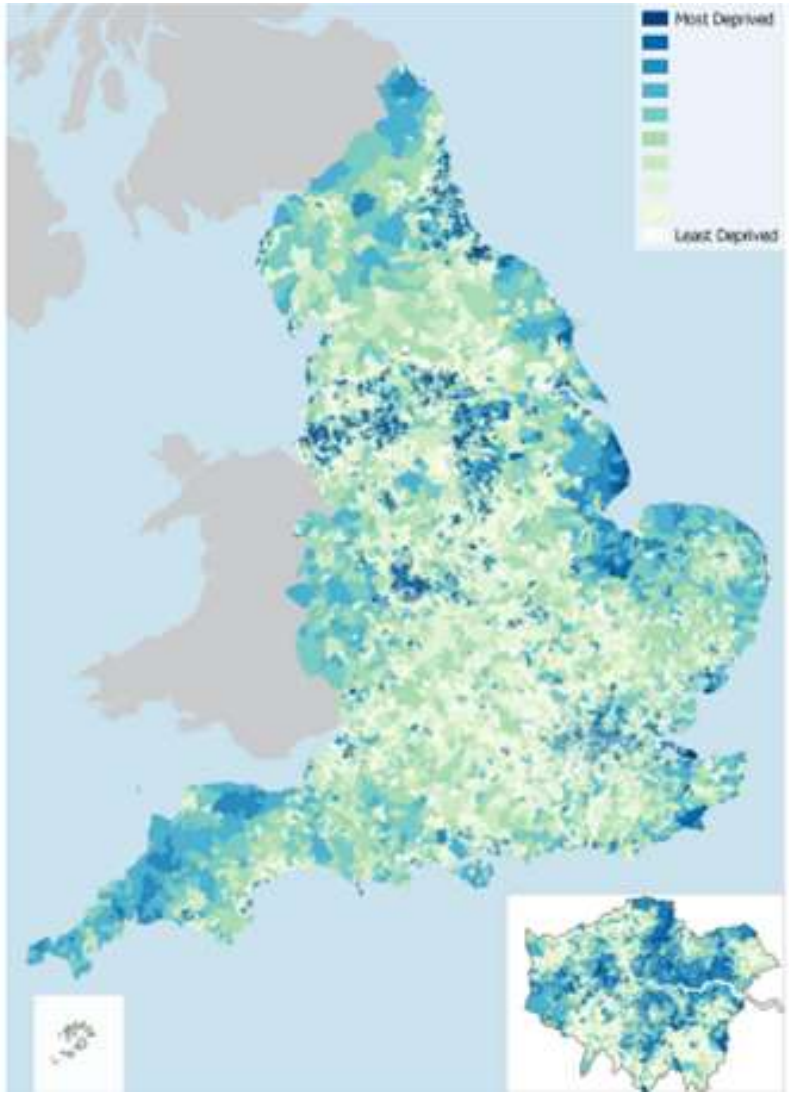
Smoking in pregnancy- one of the most avoidable causes of stillbirth, prematurity, birth defects.





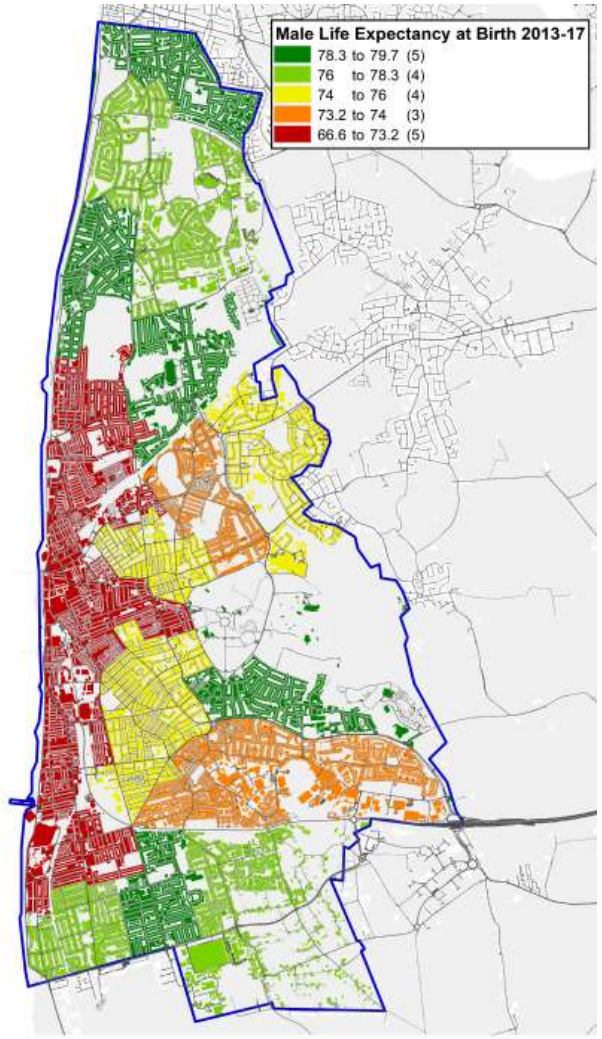
Socioeconomic deprivation not all post-industrial. Includes coastal, rural.

Index of multiple deprivation 2019.

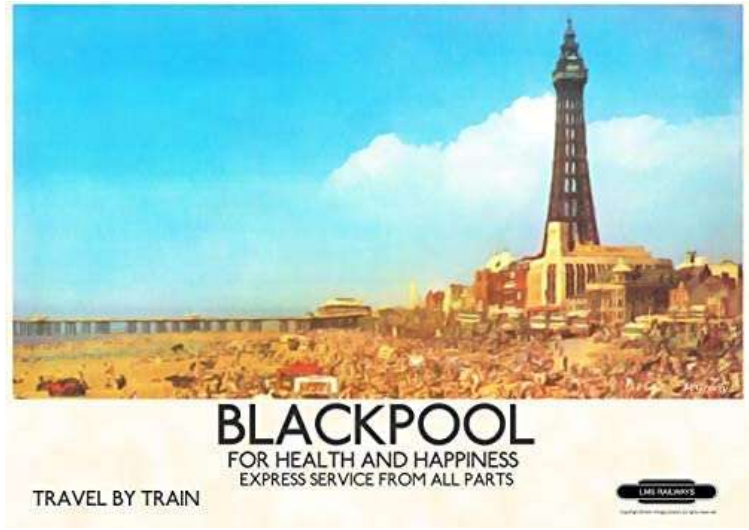


Blackpool. Lowest life expectancy at birth E&W- although improving.

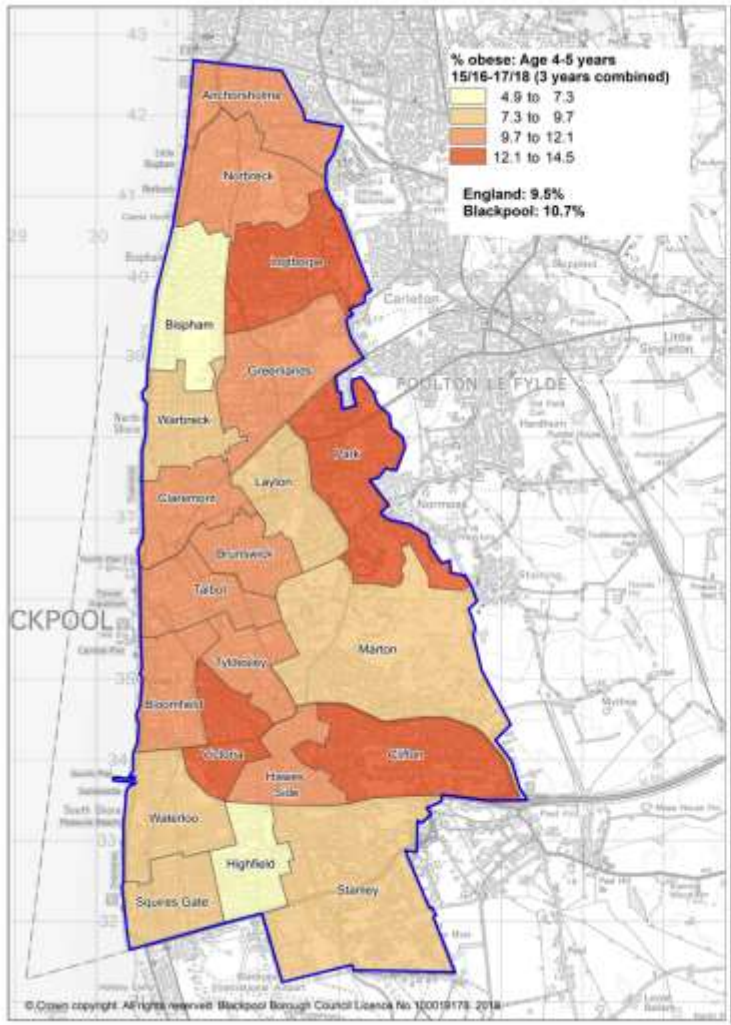
- Within Blackpool very wide differences. Male mortality R.
- Some of the lowest life expectancy behind the justly famous seafront.
- House of multiple occupation (HMO) from old guest houses attract a transient population.

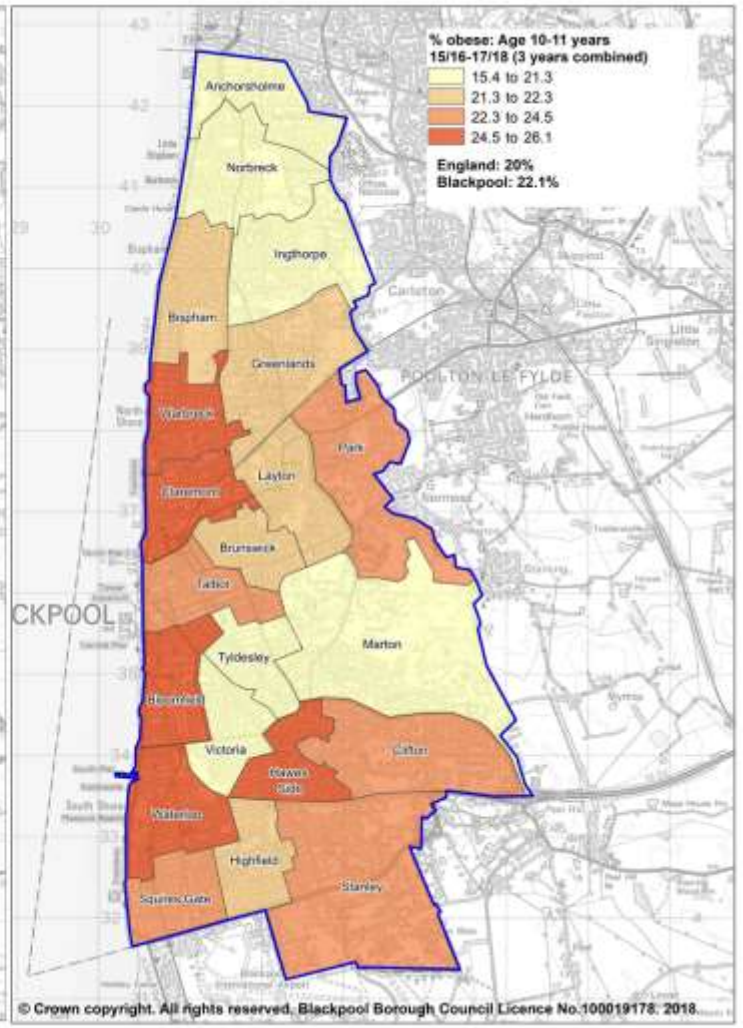


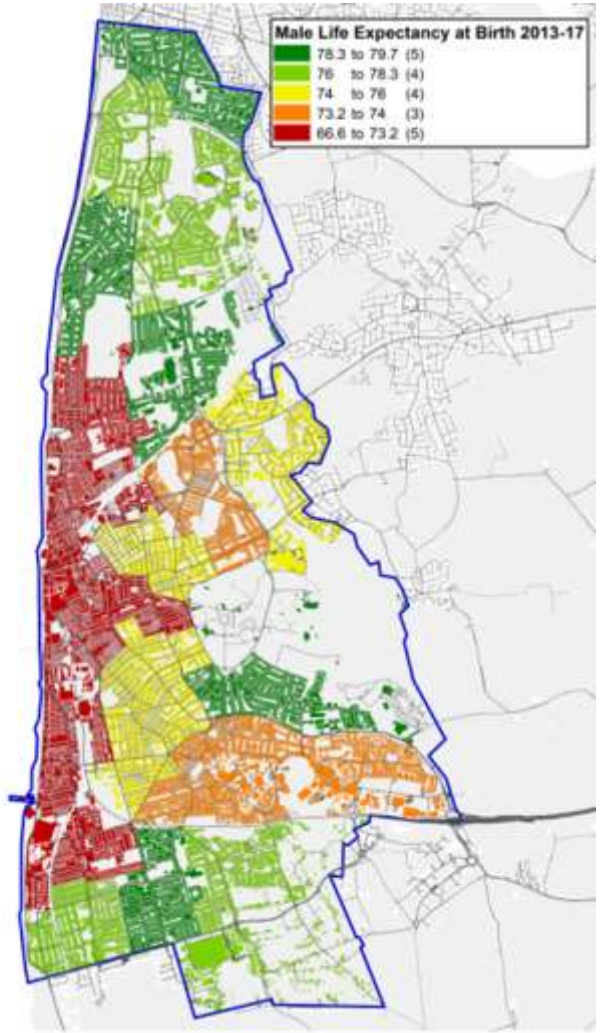
JNSA 2020/ Mjobling.



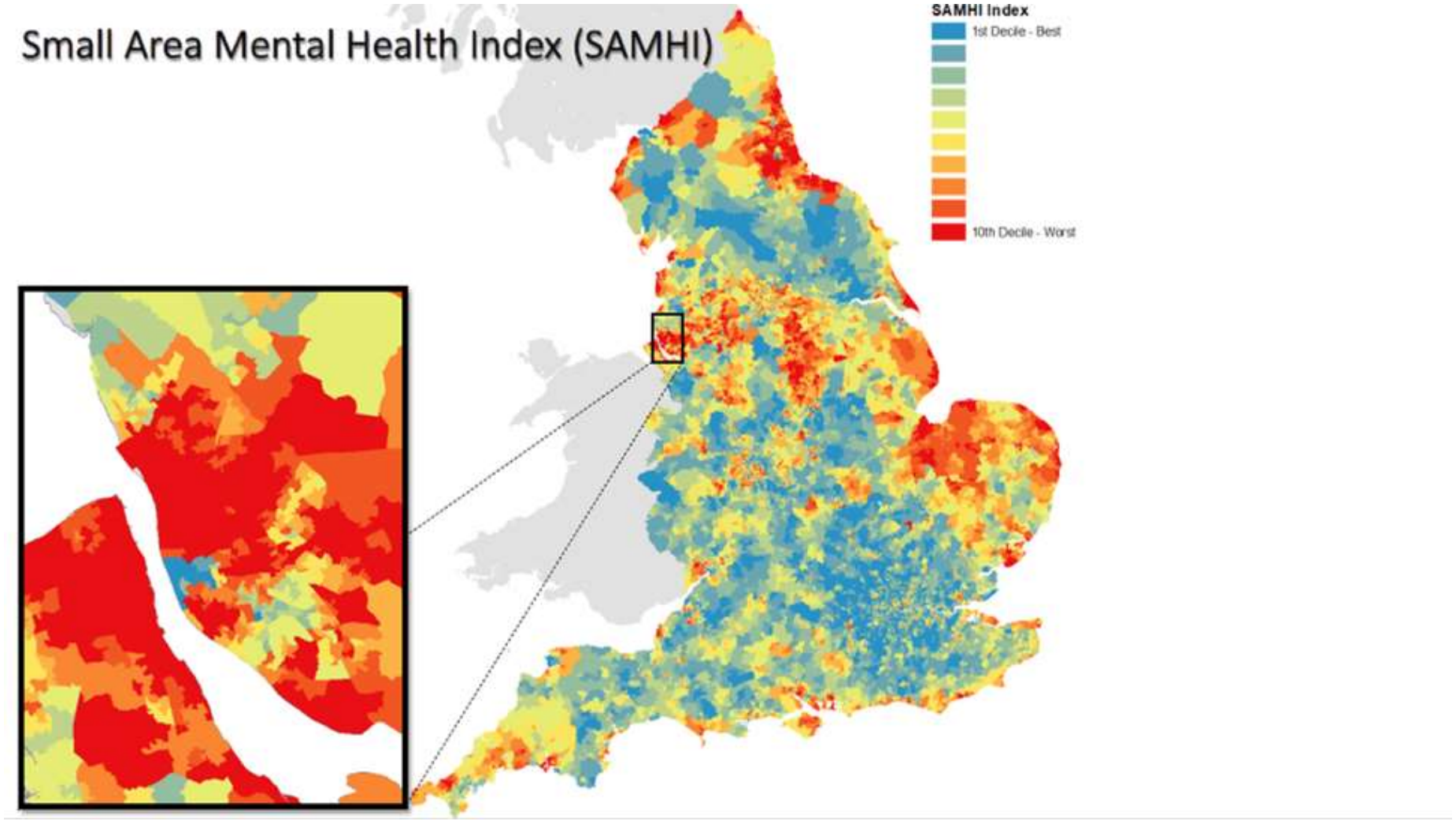
The ill health effects of deprivation start early. Obesity age 4-5 (L), age 10-11 (M), male life expectancy (R), Blackpool. (JSNA)



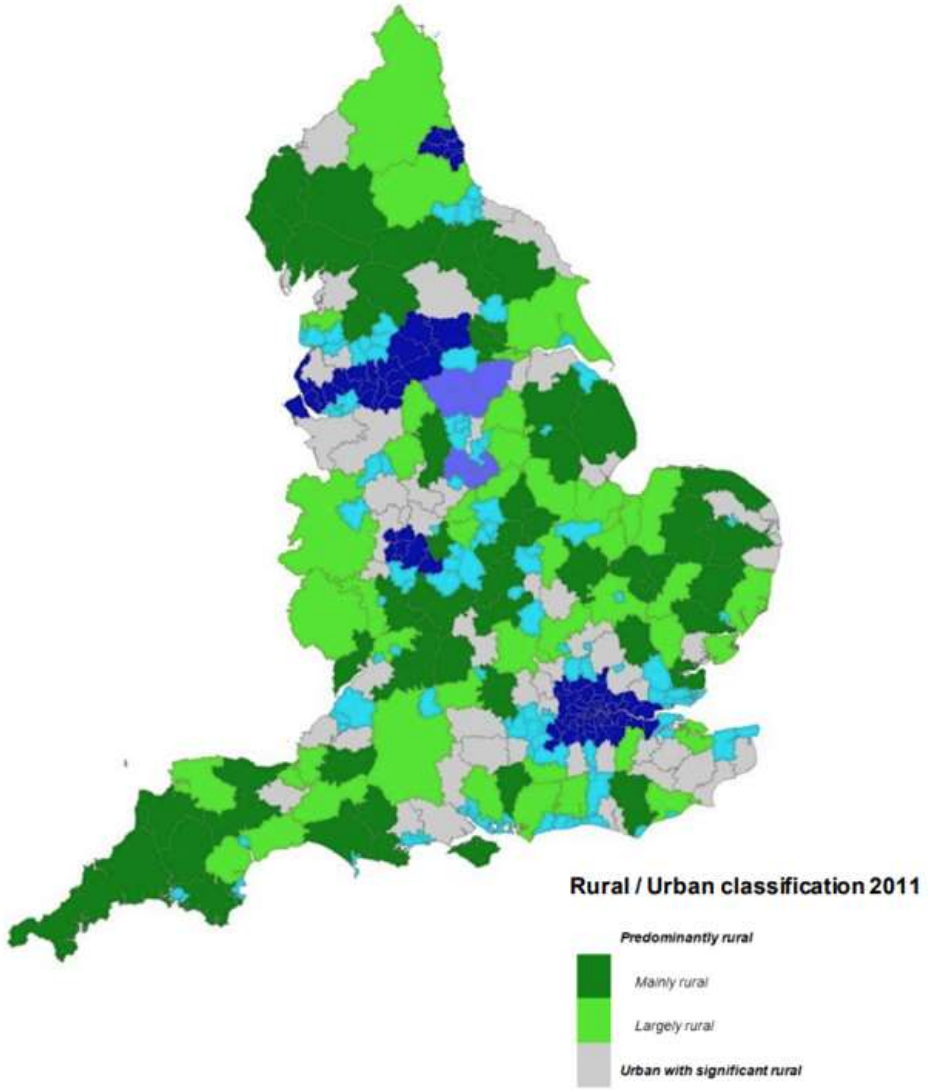


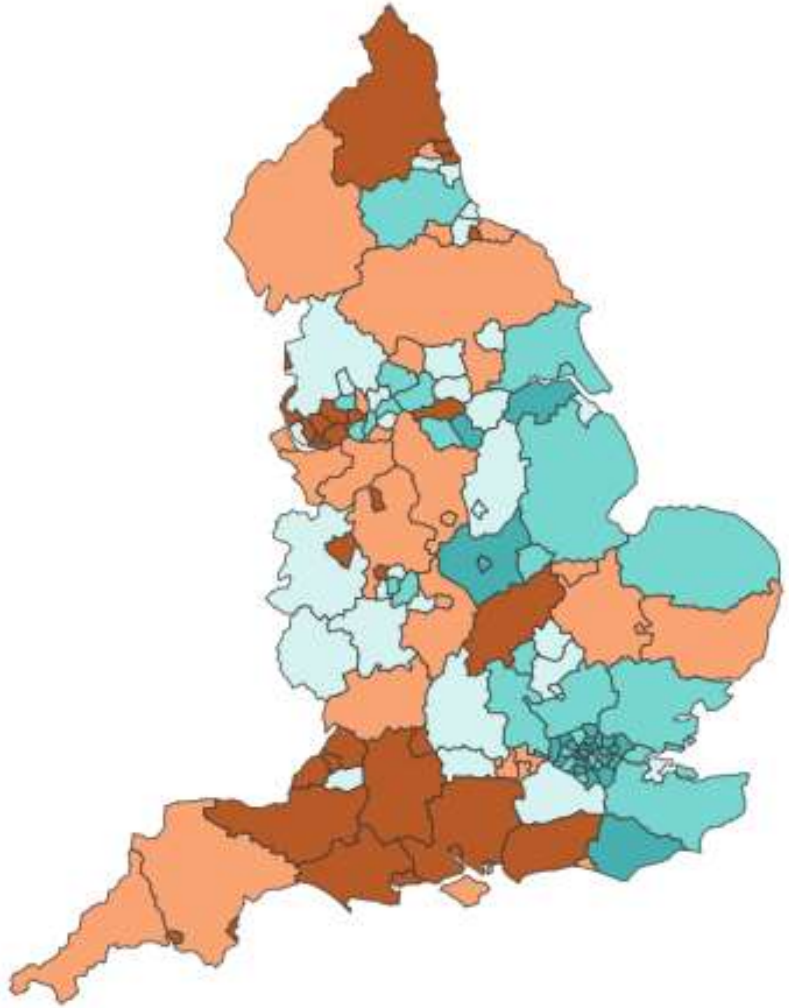


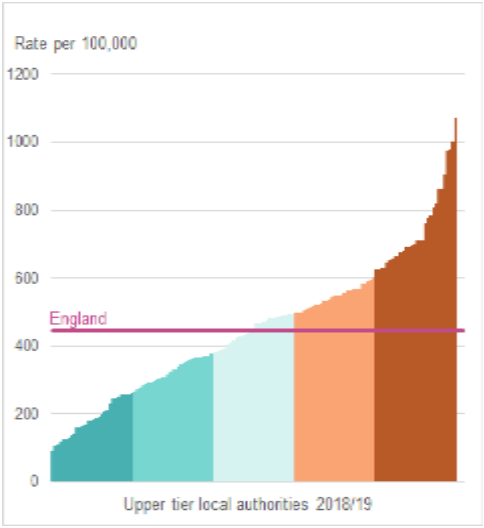
Mental as well as physical health variable at a large and small scale.



Hospital admissions due to self harm in young people (10-24 yr, R) rural areas (L).



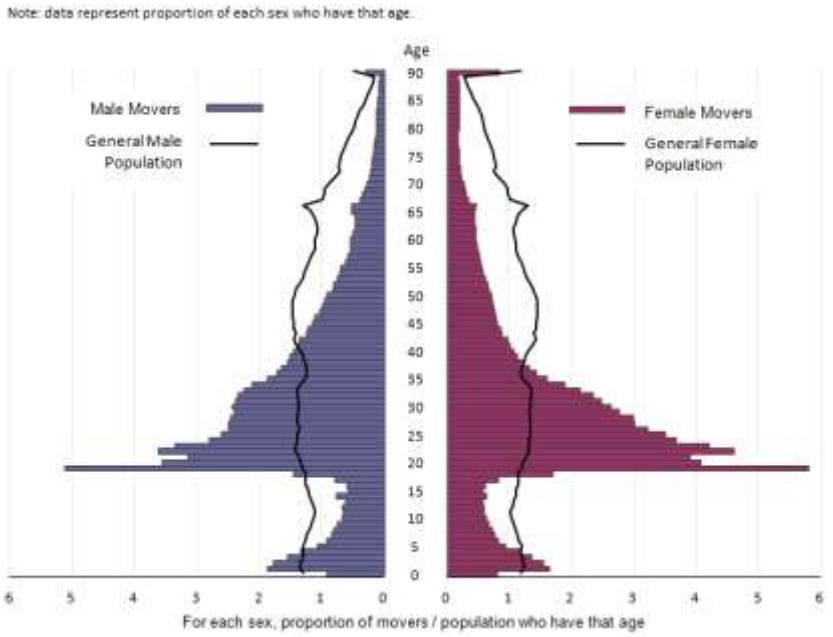




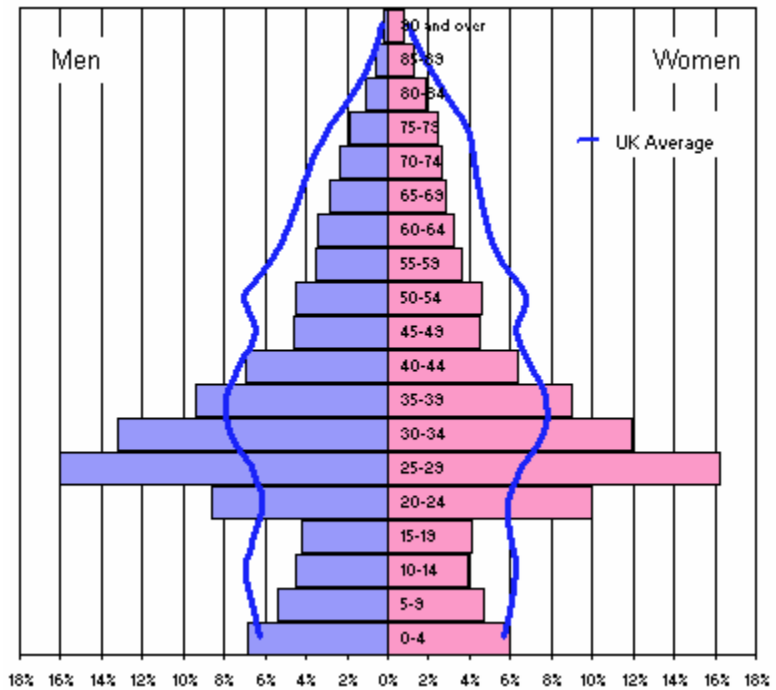
PHE/DEFRA

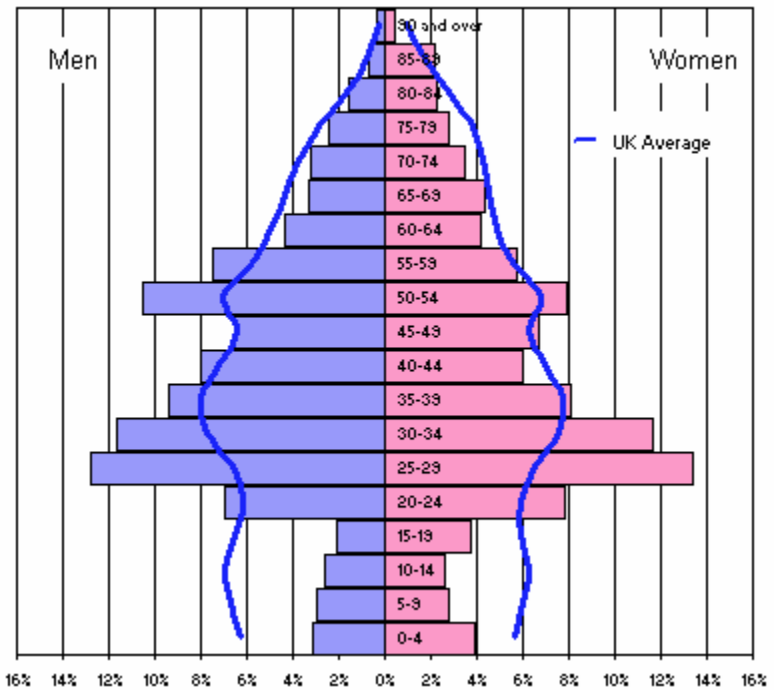
Internal (UK) migration.

- People tend to move into cities for university, college or first job.
- They tend to move out after children (especially second).
- The result is cities remain ever young, and the ageing of the rest of the country is faster.
- This has significant implications for the future geography of disease.

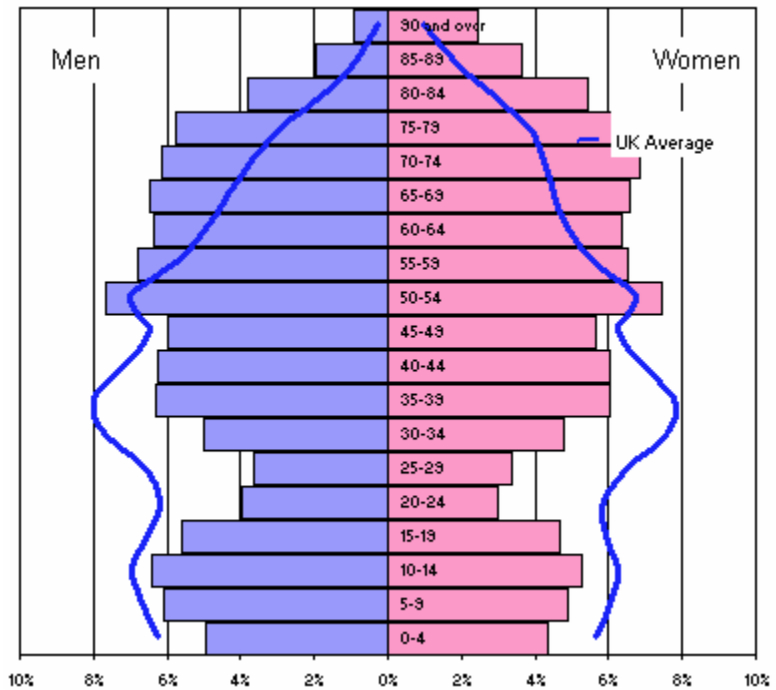


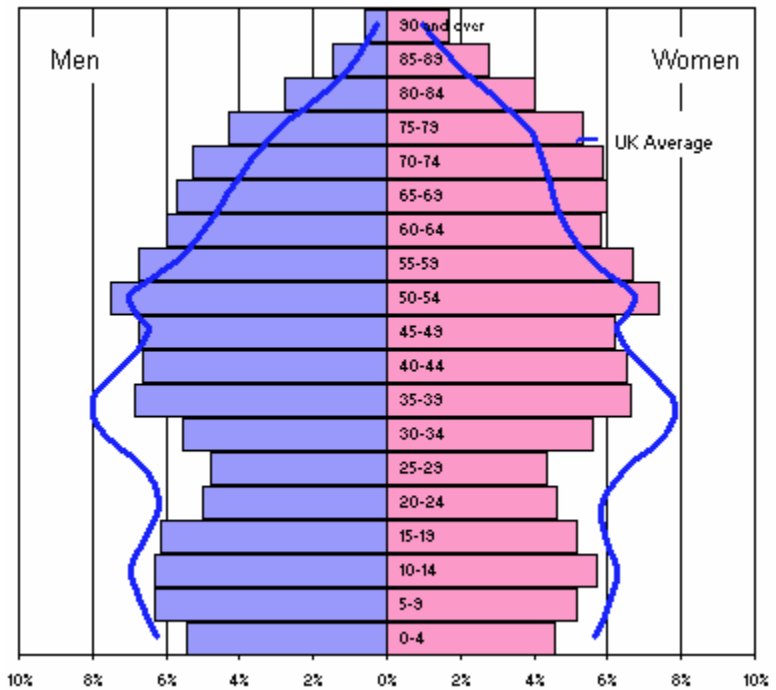
Wandsworth (L), City of London



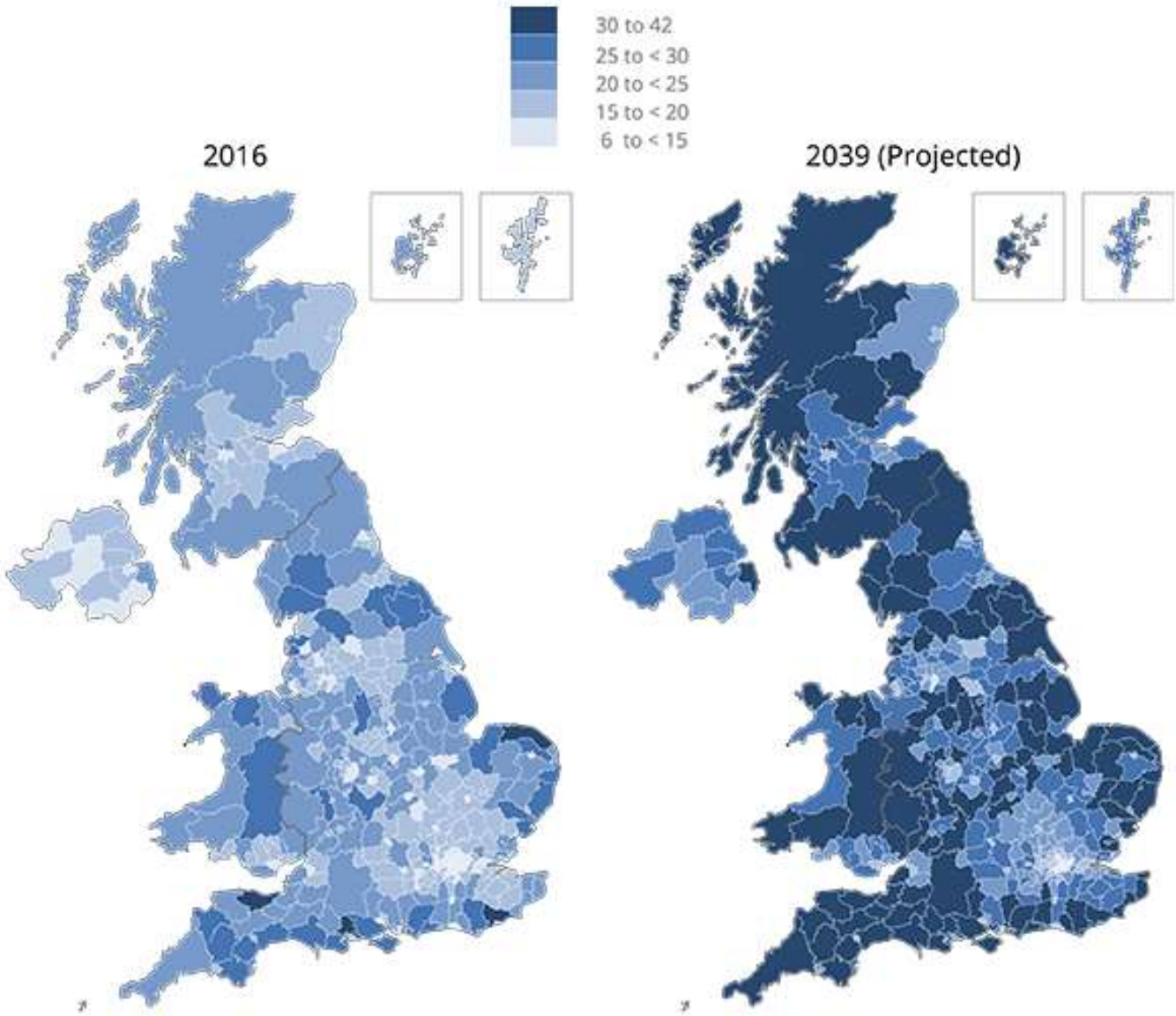


The other side of the equation: Rother (L) and Chichester

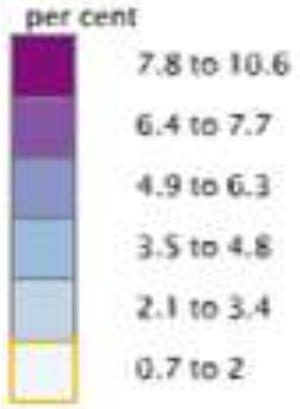


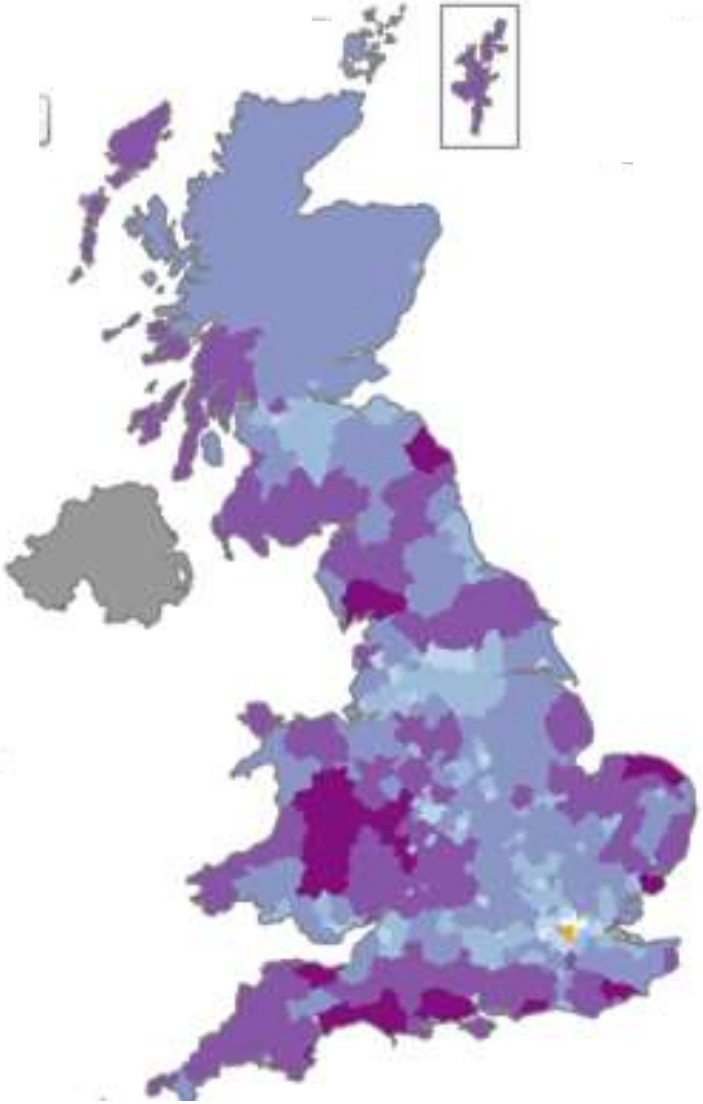


Proportion of the population aged over 65 years (ONS)



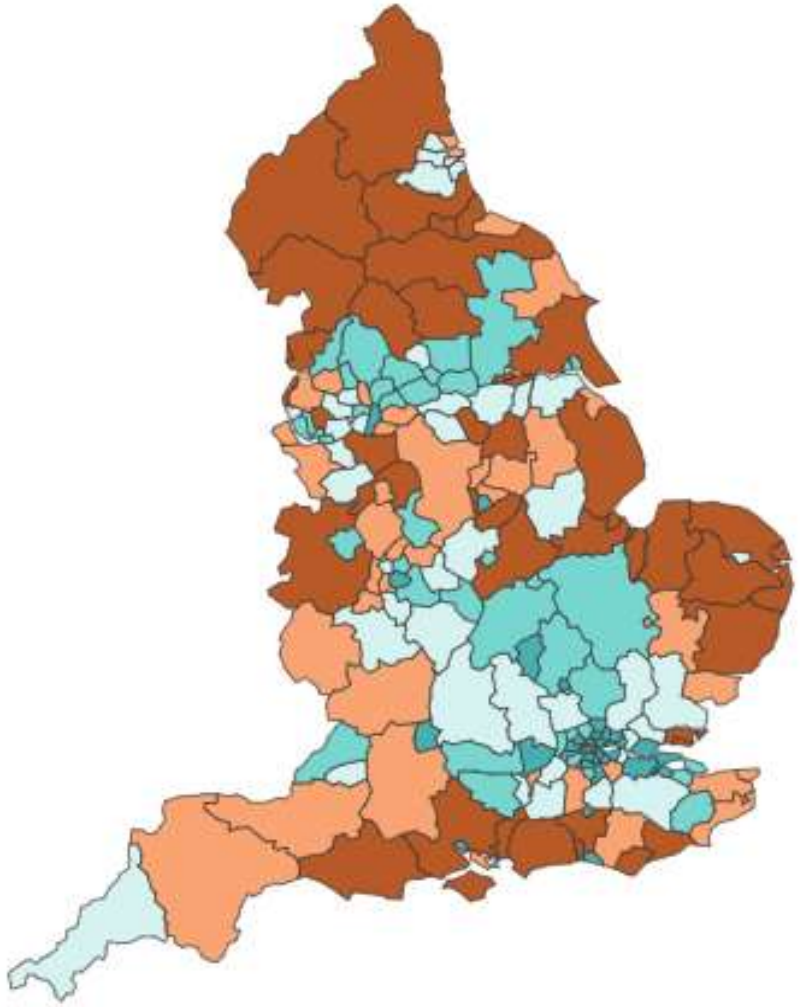
Population 85 and over: 1992, 2015, 2033 *(ONS).*

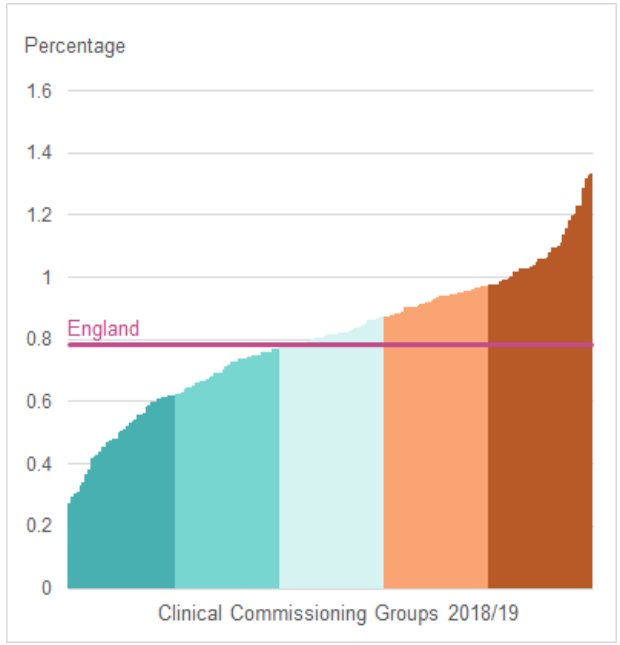




Dementia prevalence.

Dementia and frailty affected by deprivation, but age dominates.

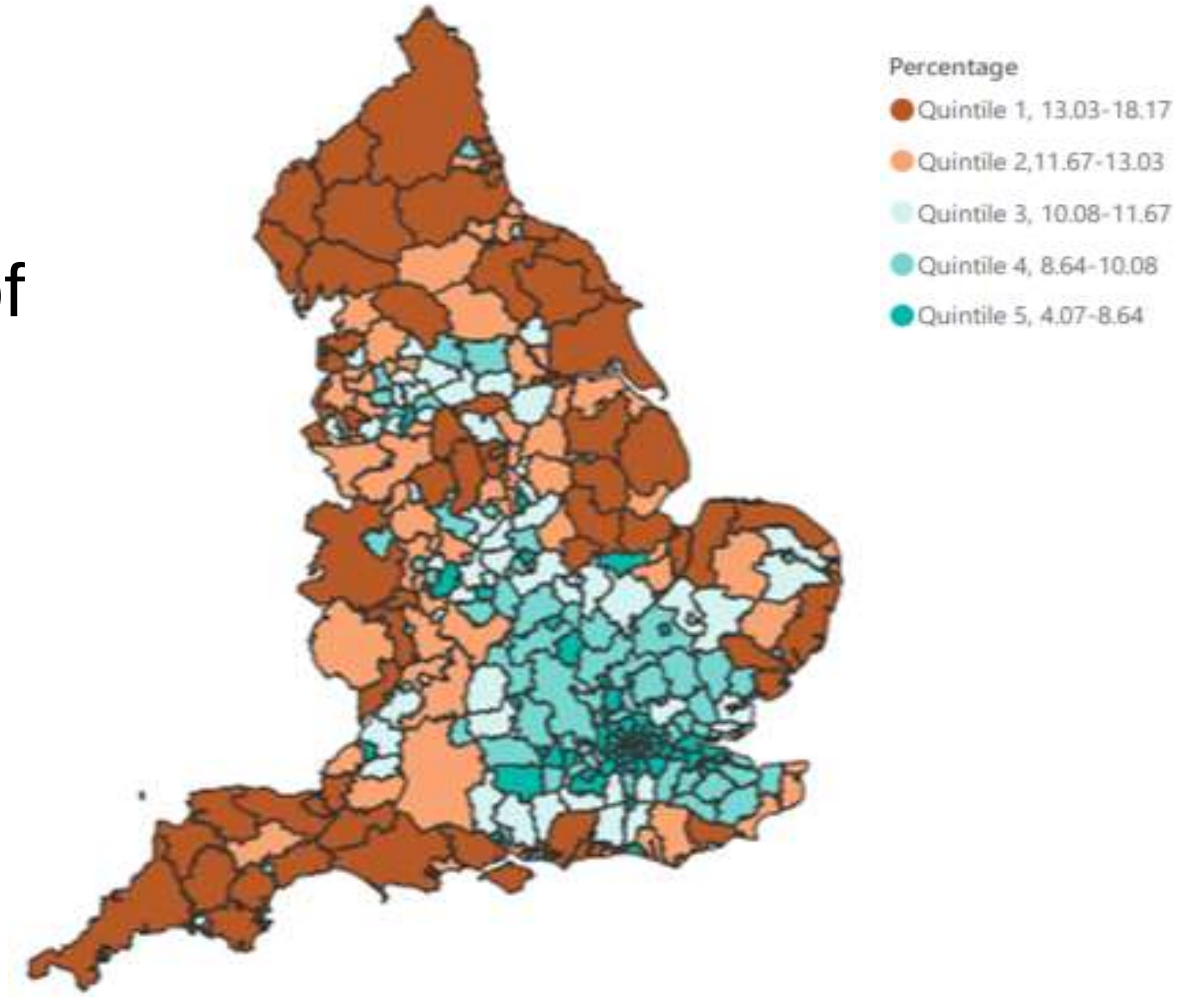




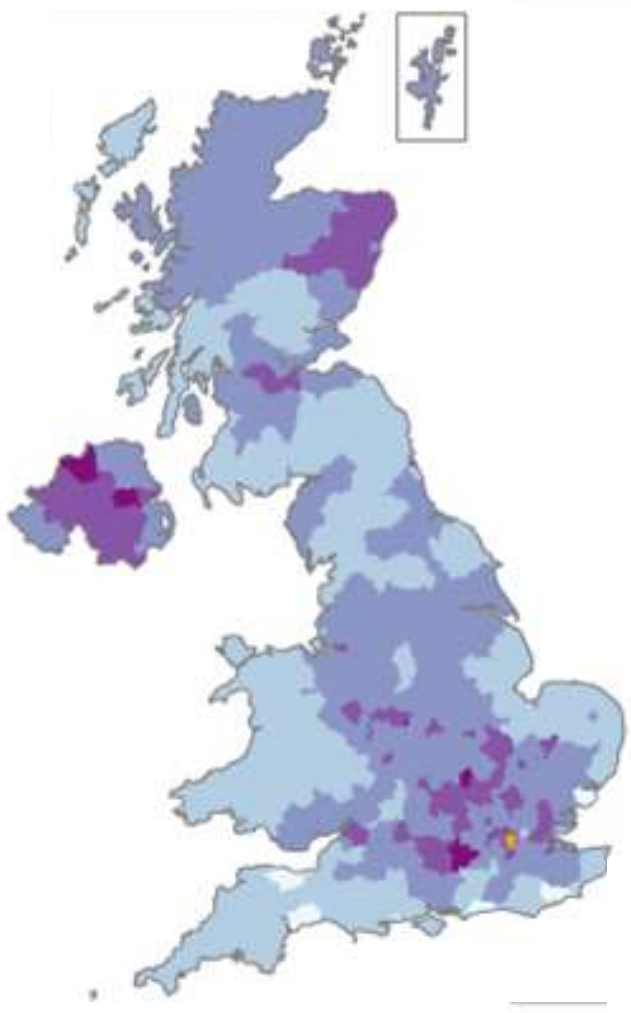
PHE

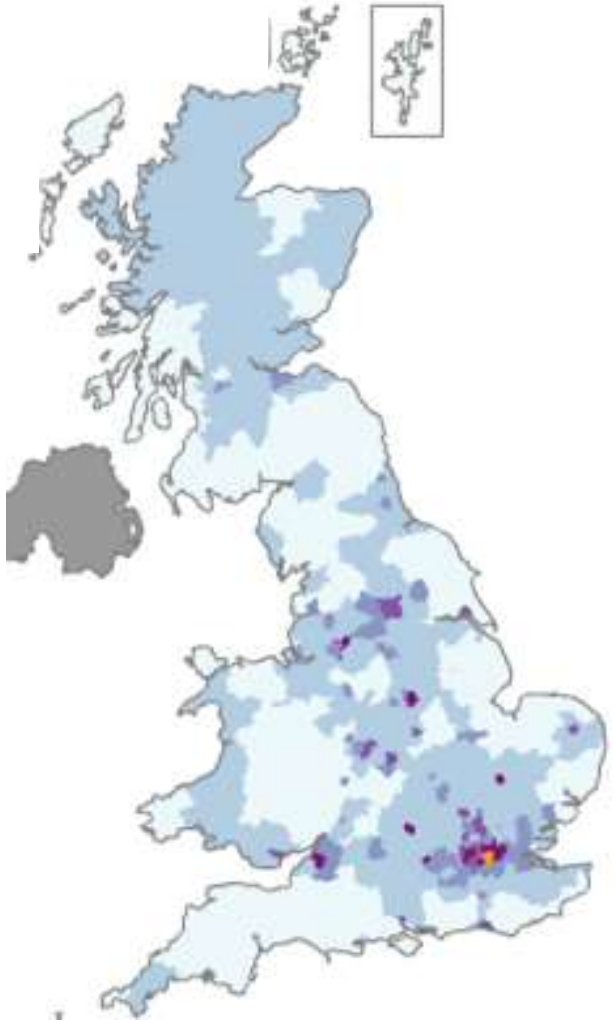
Overall heart and circulatory disease. Combination of deprivation and age; BHF data. The same is true for many cancers.

As those who are older concentrating in certain parts of UK, many diseases will concentrate there.



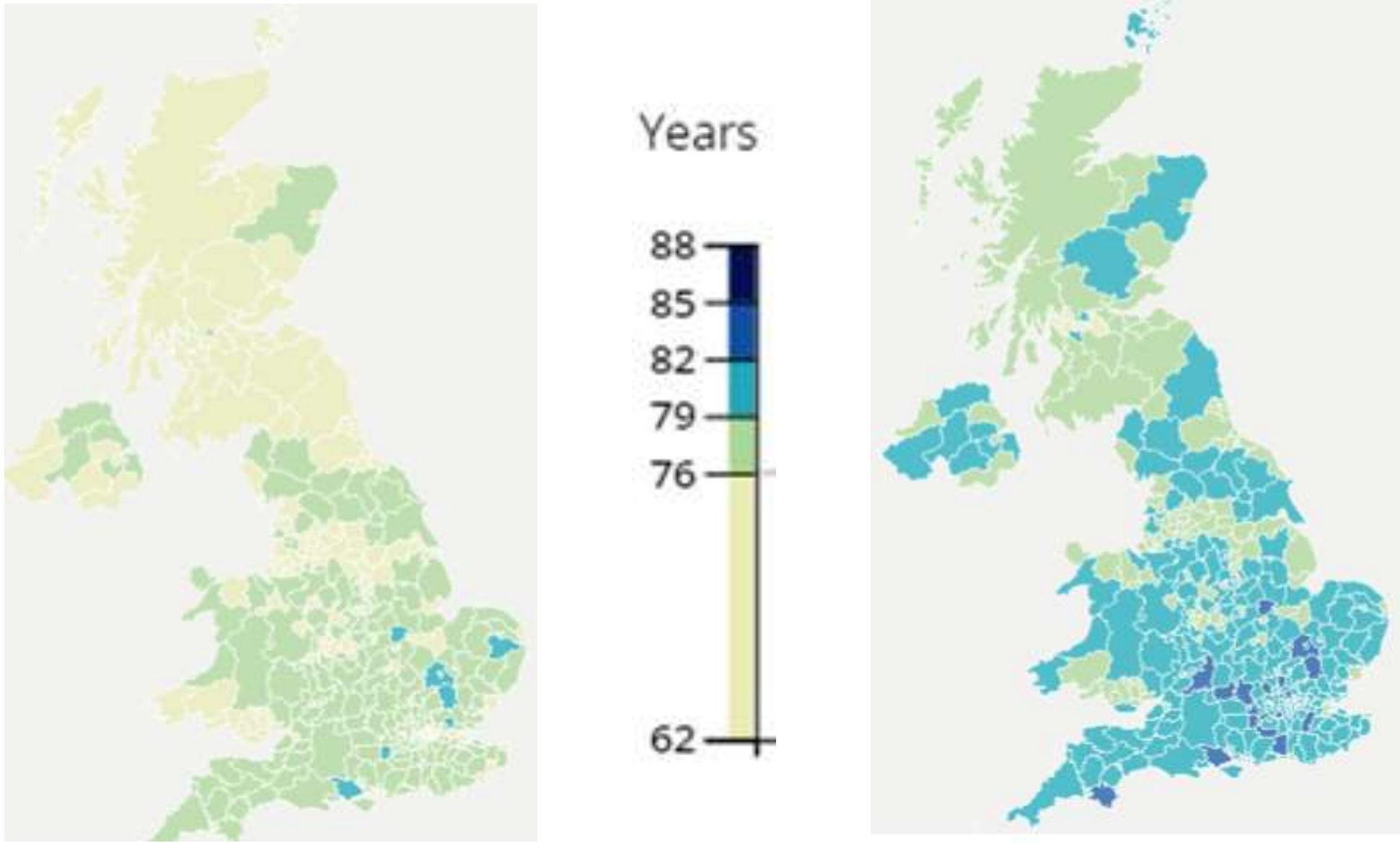
Age support ratio (working/pensioner), 1993 (L)-2033 (ONS)



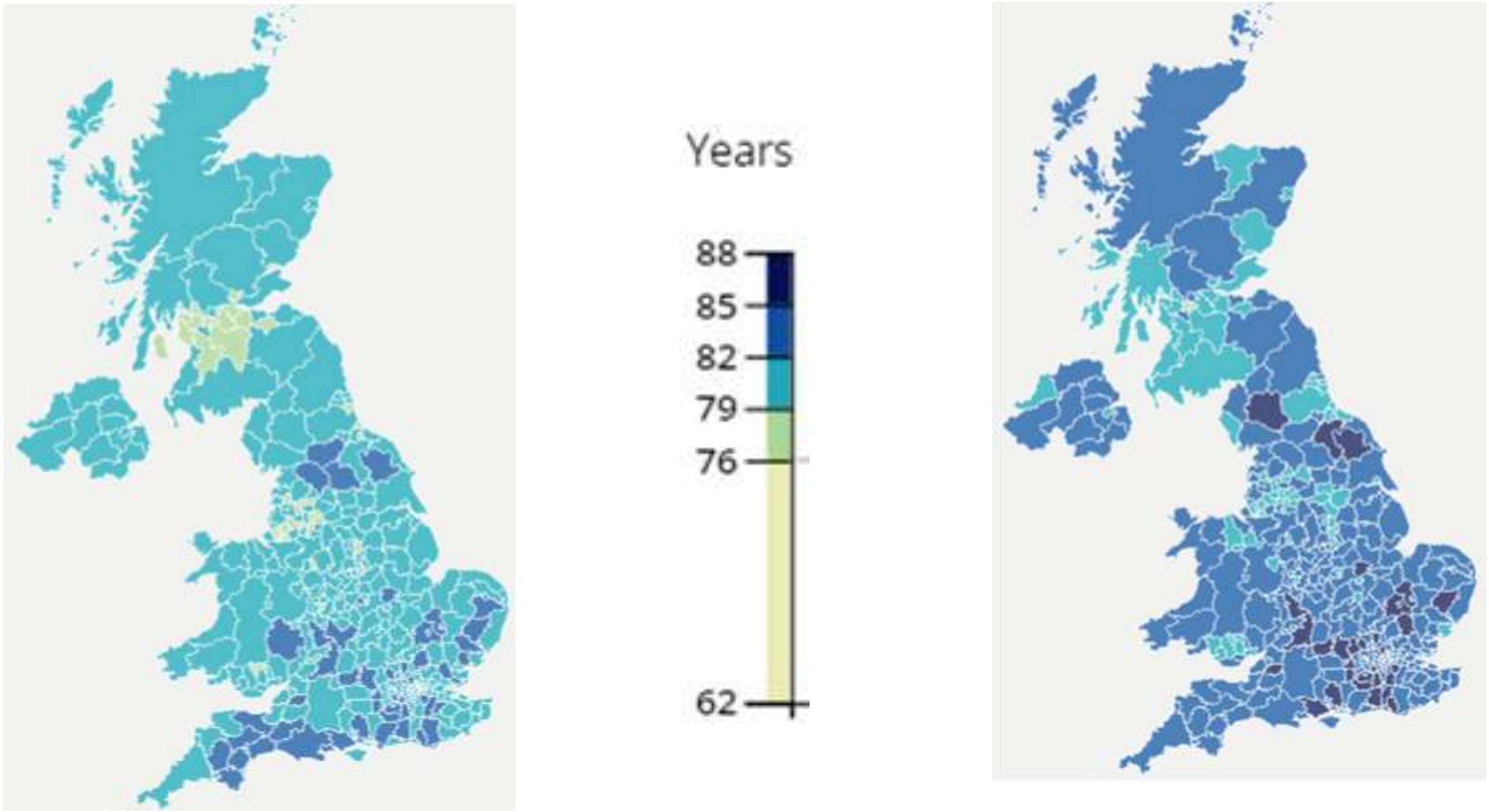


NHS

Male life expectancy at birth, 2001-3 (L) and 2016-18 (R) (ONS)



Female life expectancy at birth, 2001-3 (L) and 2016-18 (R) (ONS)



Wide variations in ill health occur over even quite short distances.

- Sometimes a consequence of the environment itself, especially for infectious diseases.
- More often the variation points to some other major driver of disease.
- Varies over time as well as space.
- Identifying this variation is essential to understanding disease, and tackling it.