Unwelcome Guests: Human Diseases

Gresham College Lecture 2013
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The tendency to assume infections can be stopped at national borders is natural, longstanding and almost always wrong.

'This fortress built by nature for herself against infection and the hand of war'

*Shakespeare*
Global spread rapid even in pre-industrial times: plague
Plague an example of the power of infectious disease to shape human history across space-and human capacity to respond.

• Plague reduced the world population from an estimated 450 million down to 350–375 million in the 14th century.
• 30-60% of Europe’s population died.
• Risk of a plague epidemic now zero (WHO).
Where there is trade, travel or war

Disease will follow

Syphilis:
- Arrived Europe C1493
- In Edinburgh by 1497
Foreigners are often blamed, not always fairly...

- French Pox (Morbus Gallicus)
- Spanish pox
- Neapolitan disease
- German measles
- Spanish ‘flu
- Mexican pig ‘flu
Influenza killed more in 20th C than war - 22m in 1918-1922 alone
Influenza 1918

Approximate beginning of the epidemic, 1918

Source: America’s Forgotten Pandemic - The Influenza of 1918 - 1989
Spread of HIV in Africa, 1984 to 1999

Estimated percentage of adults (15–49) infected with HIV

- 20.0% – 36.0%
- 10.0% – 20.0%
- 5.0% – 10.0%
- 1.0% – 5.0%
- 0.0% – 1.0%
- Trend data unavailable outside region
Complexity of networks and speed of travel increasing.
Infectious diseases often cause panic disproportionate to the real risk

2001-5 dead. 650 people a week die on the roads
Or because the risk is uncertain in a new disease: SARS, BSE

- Between November 2002 and July 2003 SARS caused 8,273 cases and 775 deaths in 37 countries.
- Around $40bn cost to global economy
- cf around 100,000 smoking-related deaths in UK a year.
Many diseases you can catch overseas and import will not be transmitted because they need a tropical vector (e.g., malaria, dengue).
Or because you have to catch it from something you eat—especially uncooked exotic foods.
Other things that can transmit infections UK citizens are as liable to do as others:

- Breathing
- Eating
- Drinking
- Touching
- Sex
The mathematics of transmission - $R_0$

- If greater than 1 - increasing
- If 1 stable
- If less than 1 - decreasing. Elimination possible.

![Image showing the initial phase of an epidemic ($R_0 = 3$) and disease being endemic ($R = 1$).](image)
Tuberculosis UK- socioeconomic development.
Gapminder World Map 2010

Money GDP per person in US dollars (purchasing power adjusted) (log scale)
Access to water and sanitation

- Cholera
- Typhoid
- Polio
- Scabies
- Trachoma
Better housing, less crowding; examples TB, typhus

[By the] Abbey of Westminster there lie concealed labyrinths of lanes and courts, and alleys and slums, nests ... of squalor, wretchedness, and disease; whose atmosphere is typhus, whose ventilation is cholera; in which swarms of huge and almost countless population... haunts of filth, which no sewage committee can reach.

Cardinal Wiseman 1850
HUT ON WHEELS, FORMERLY USED BY MIGRATORY LABOURERS IN THE ROMAN CAMPAGNA
Better nutrition

• Total protein-energy nutrition for most infections
• Specific deficiencies such as Vitamin A (measles) Vitamin D (TB)
Scurvy (as a proxy for nutrition) and measles mortality, England 1901-1967
Vaccines
Mortality from selected infectious diseases, England and Wales 1840-1970
Better access to cure - antibiotics
The herd effect

- What is good for my neighbour is also good for me
Infectious disease at the extremes of life. CMO

Meningococcal Reference Unit isolates of Neisseria meningitidis rates by age and sex, England, 2010

Average annual mortality rate due to infectious and parasitic diseases (and sub-categories) by age and sex, England, 2008-10

Source: Meningococcal Reference Unit, HPA. 2010 population estimates, ONS. (Analysis by HPA)
Deliberate action to eradicate disease
Polio endemic countries

Polio 1988-2013

Data in HQ as of 24 September 2013

Excludes vaccine-derived polioviruses and viruses detected from environmental surveillance.
Malaria 1948
Migrants often highly concentrated geographically (HPA/PHE)

- Clustering within urban centres, and often specific areas.
- Top- West and Central African born
- Bottom South Asian born.
When do the infectious potential of being a migrant wane? Generally very very rapidly.

- **Not until diagnosed or treated:** HIV, Hepatitis B.
- **Potentially not for some years:** TB.
- **Within a few weeks:** Almost all acute bacterial and viral infections.
Most new and emerging infections from animals
Animals transmitting to humans: avian influenza H5N1.
Poultry, pig and cattle density, England
Global poultry population density (FAO)
Gradual reduction in human/animal contact
Antimicrobial resistance - probably the greatest current risk of imported infections

- Antibiotic resistance to bacteria.
- Antituberculous drugs. TB
- Antiviral drugs. HIV, influenza.
- Antiparasitic drugs. Malaria.

- Driven by poor medical and vet practice, weak regulation, low adherence - not generally poverty.
Percentage of new patients with multidrug resistant tuberculosis (MDR-TB). (Zignol et al 2012)
Hospital infections: MRSA, Clostridium difficile
MRSA data from 2003, now improving. (Lyytikäinen et al 2004)
The greatest protection to us is development where the large populations live. *(UN population projections)*
UK has contributed substantially to the reduced risk of infections worldwide—research.
“Africa is experiencing some of the biggest falls in child mortality ever seen, anywhere.”

(Economist 2012)

• In Africa, Asia and Latin America incidence of many major infectious diseases falling fast over the last decade.

• This will not stop the emergence of new diseases- but substantially reduces the risk of old ones.
A broadly optimistic picture.

• Infections have always been imported; some have been devastating.
• Travel is increasing- however:
• Better water, sanitation, housing and nutrition make risks much lower than historically.
• Preventive and curative medicine reduce risk further.
• Many imported infections cannot be transmitted.
• Most new infections from animals- either here or overseas.
• The spread of antimicrobial resistance a serious risk.
• What is good for my neighbour is good for me- increasing prosperity and health worldwide.