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DEGLI STUDI DI BARI
ALDO MORO

CORSO DI IGIENE

**Scuola
di
Medicina**

Epidemiology of infectious diseases



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Agenda

- Definitions
- Burden of infectious diseases
- Determinants of infectious diseases
- Spread of the diseases



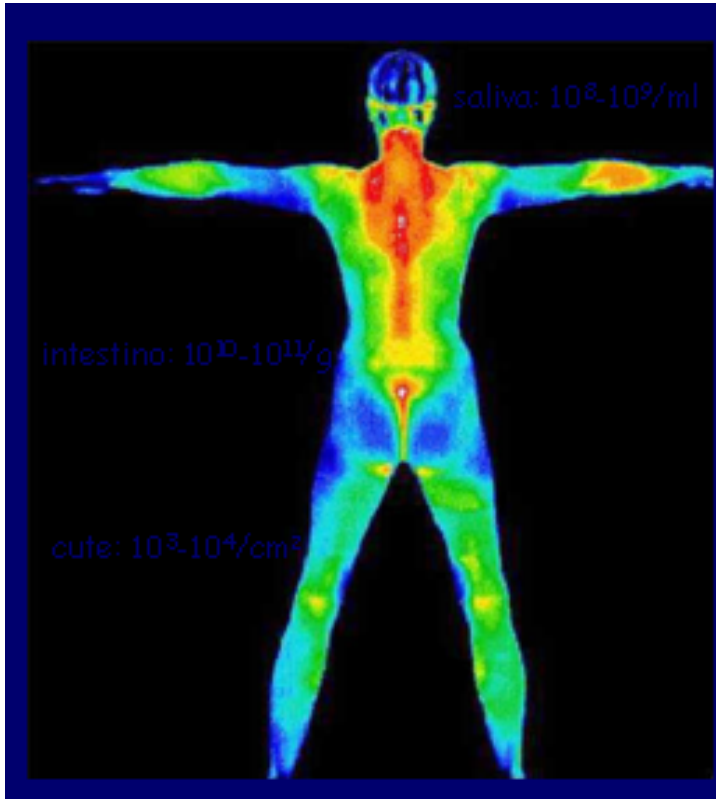
Infectious agents

all micro-organisms or macro-organisms capable of producing an infection or an infectious disease

- Virus
- Bacteria
- Fungus
- Prion
- protozoan



Infectious agents



- A great part of our body is colonized by bacteria
- After a shower, for 1 cm^2 of the skin, we can collect 100.000 bacteria



Classification of bacteria

- Pathogen

Bacterium able in causing disease in the host

- Commensal

a parasitic organism that causes no harm to the host



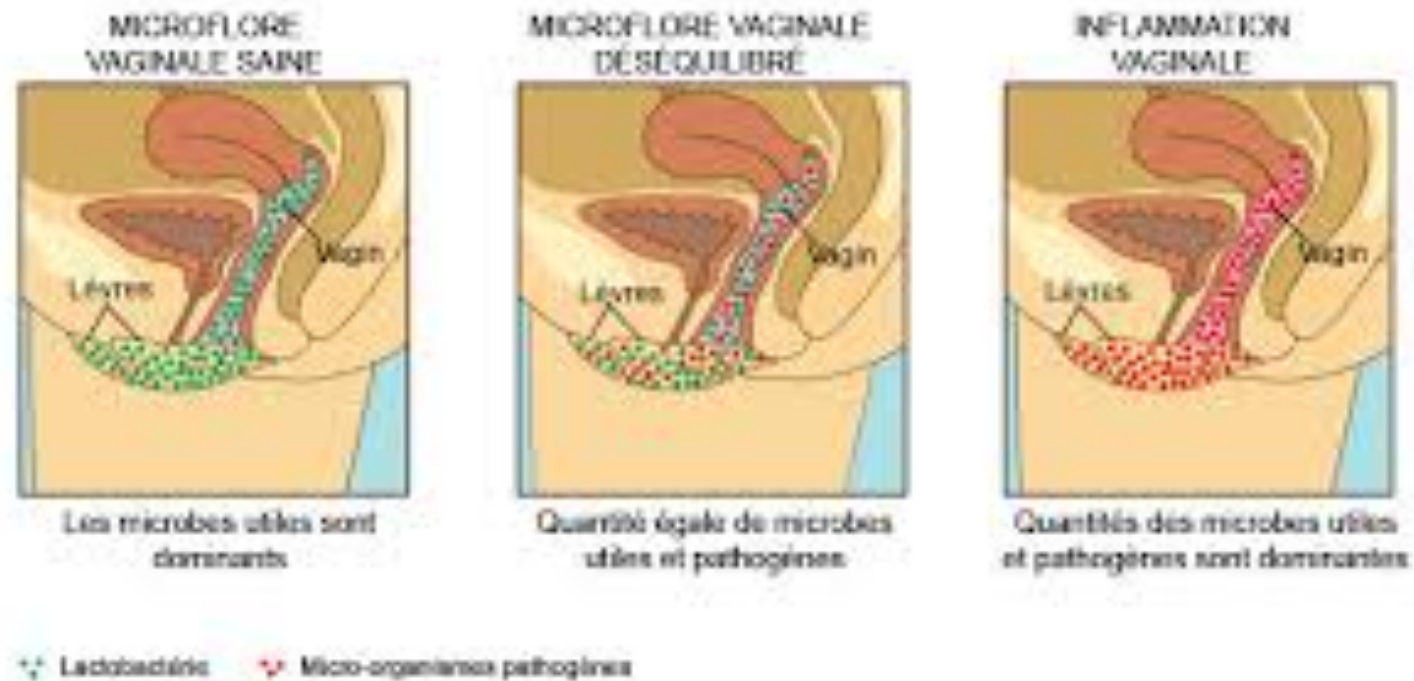
Characteristics of a pathogen bacterium

- Invasivity
- Toxicity

*The grade of expression of pathogenicity is named **Virulence***



Commensal bacteria





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Commensal bacteria



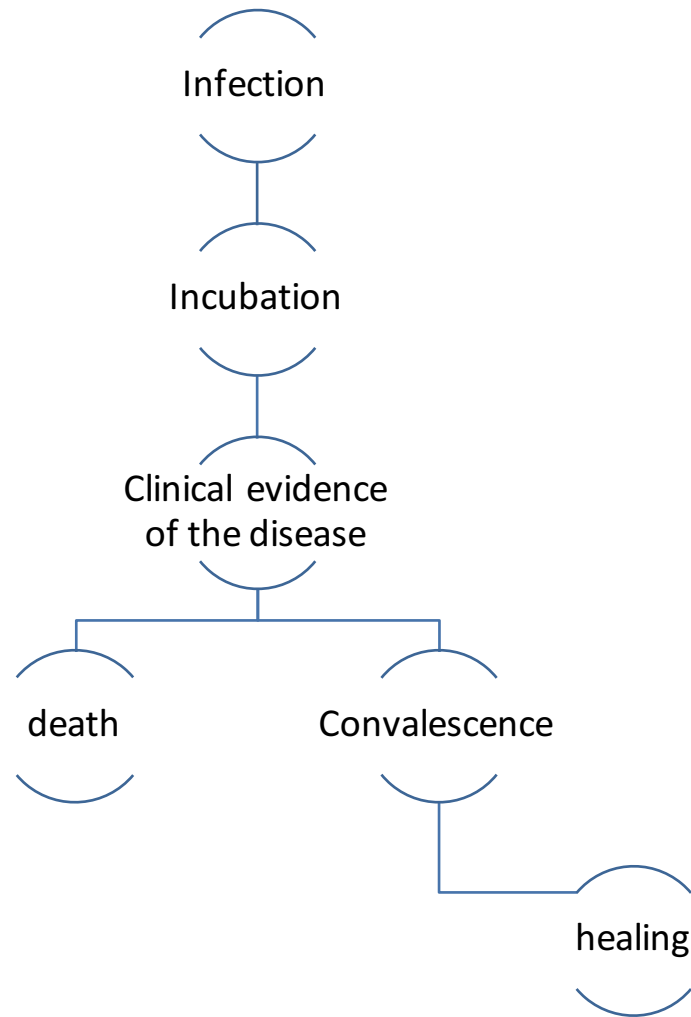


Infectious disease

- illness caused by a **specific infectious agent** or its **toxic product**
- ID results from transmission of the agent or its products from an infected person, animal, or reservoir to a susceptible host, either **directly** or **indirectly** through an intermediate plant or animal host, vector or inanimate environment



Natural history of infectious disease





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Contagious disease

Infectious disease
transmitted through
contact with ill or
carrier persons





Infection

- the entrance and development of an infectious agent in a human or animal body, whether or not it develops into a disease
- The detection of this state in which there are no signs of a recognized related disease is called **unapparent infection**



Contamination

The **presence** of an infectious agent on a **body surface**, on or in clothes, beddings, toys, surgical instruments or dressing, or other articles or substances including water and food



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Infestation

*Lodgment,
development and
reproduction of
artropods or
parasitic on the
surface of the
body or in the
clothing*





Vector of infection

An insect or any living carrier that transports an infectious agent from an infected persons or its wastes to a susceptible individual or its foo





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Vector of infection



Reservoir of infection

- Any person, animal, plant, soil or substance in which an infectious agent normally lives and multiplies.
- The infectious agent primarily depends on the reservoir for its survival.
- It is from the reservoir that the infectious substance is transmitted to a human or another susceptible host



Types of reservoirs

- Humans reservoirs
 - Case
 - Carriers
- Animal reservoirs
- Non living reservoirs



Carriers

individual that has the pathogen present but is **not showing the signs and the symptoms of the disease**

- convalescent carrier

salmonellosis

- incubatory carrier

measles, meningococcal

- healthy carrier

rubella, mumps, hepatitis A, epstein barr virus



Reservoir of infection

Pathogen	Reservoir
Measles	Human subject
Legionella	water
Toxoplasma	cat
Meningococcal	Human subject
Rabies	Dog, fox



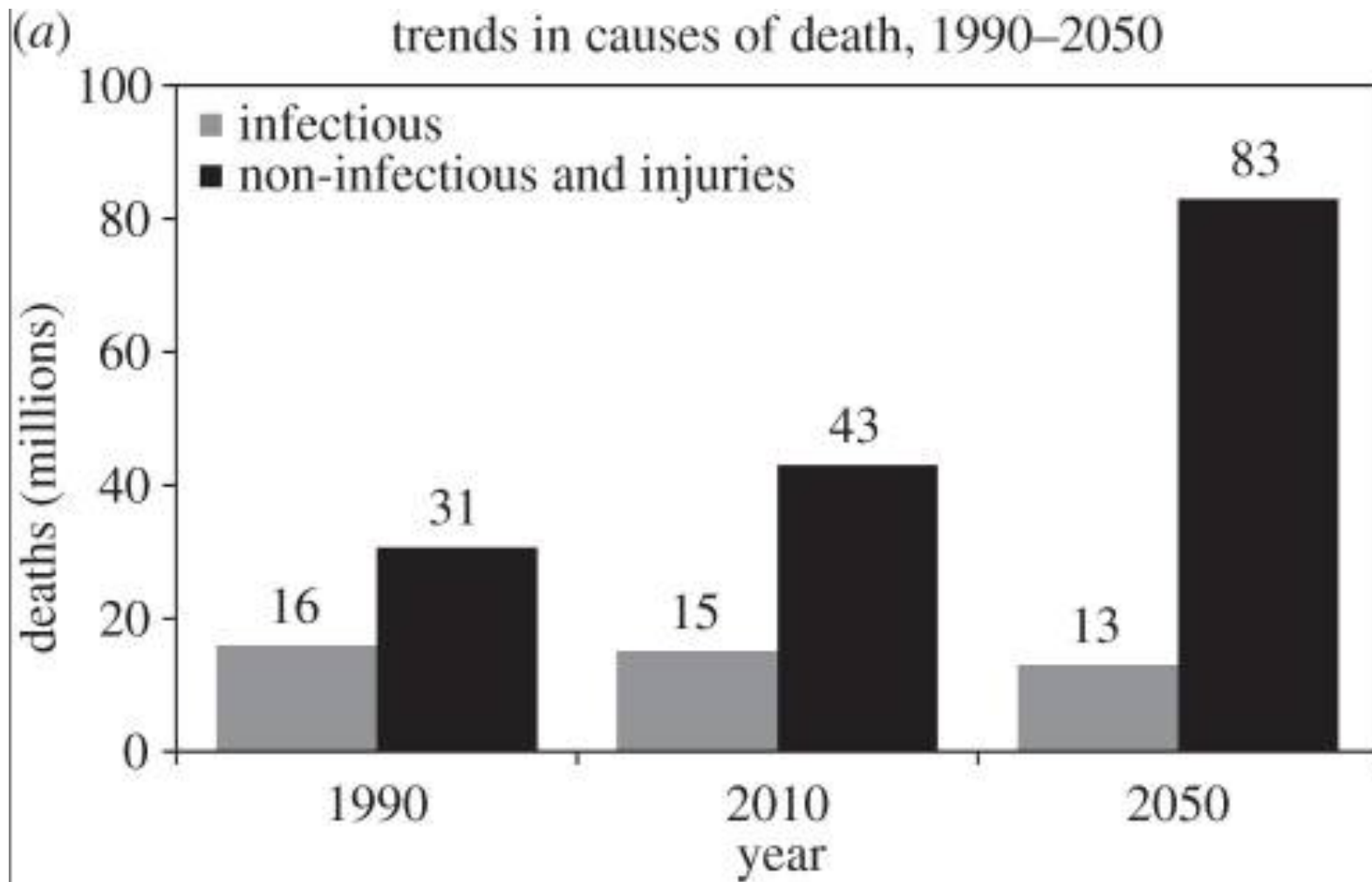
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BURDEN OF INFECTIOUS DISEASES

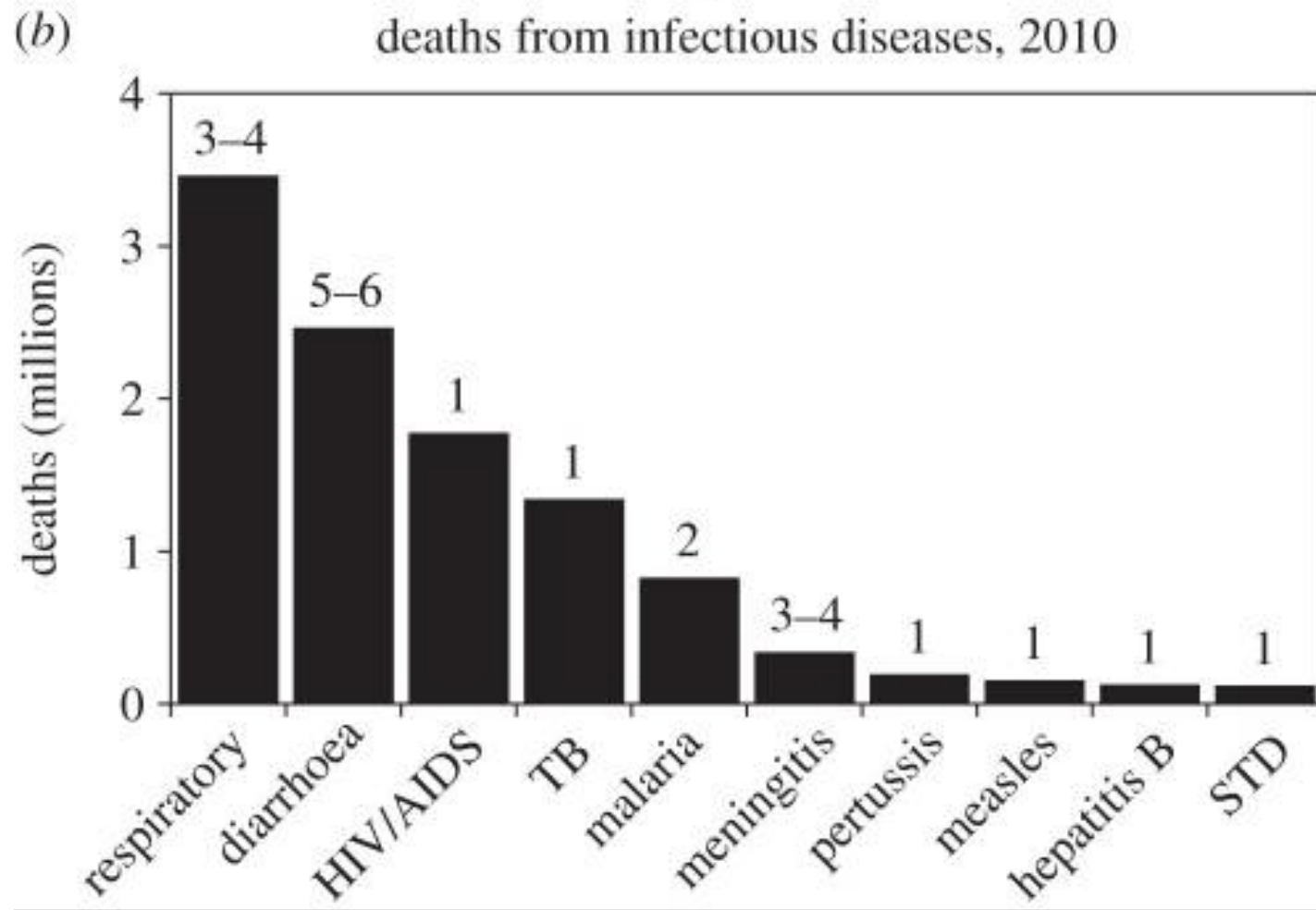


Burden of infectious diseases



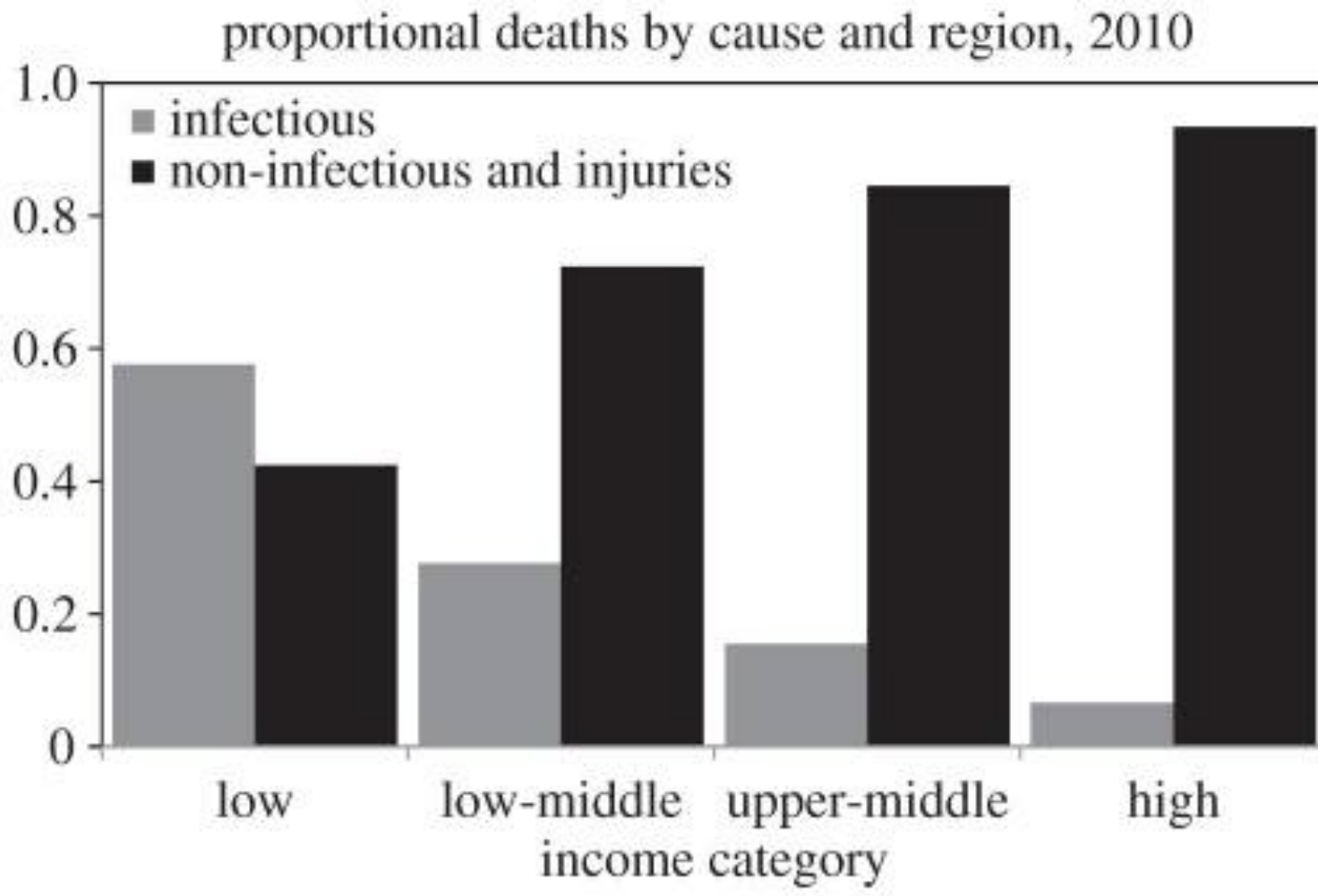


Burden of infectious diseases



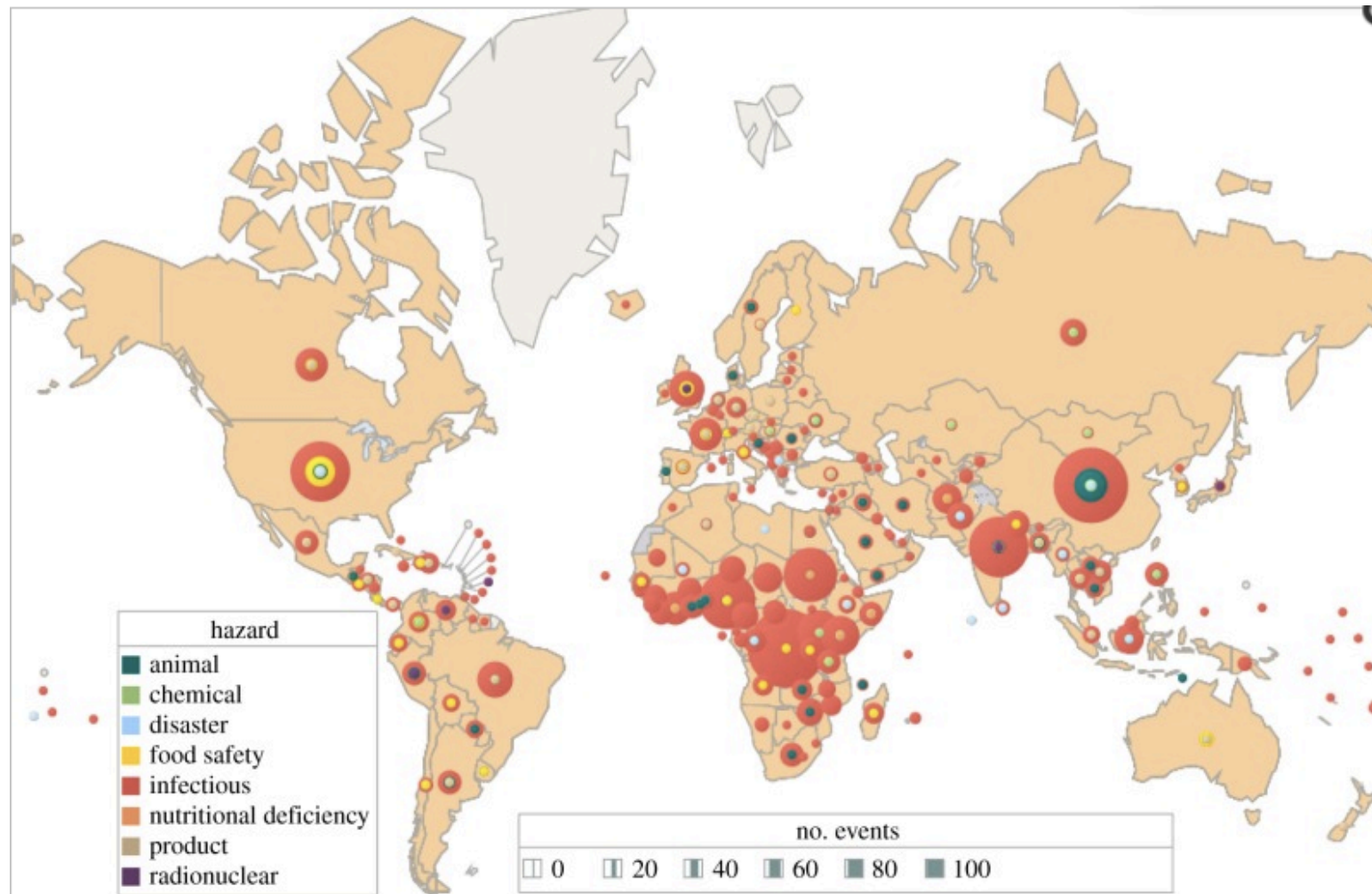


Burden of infectious diseases



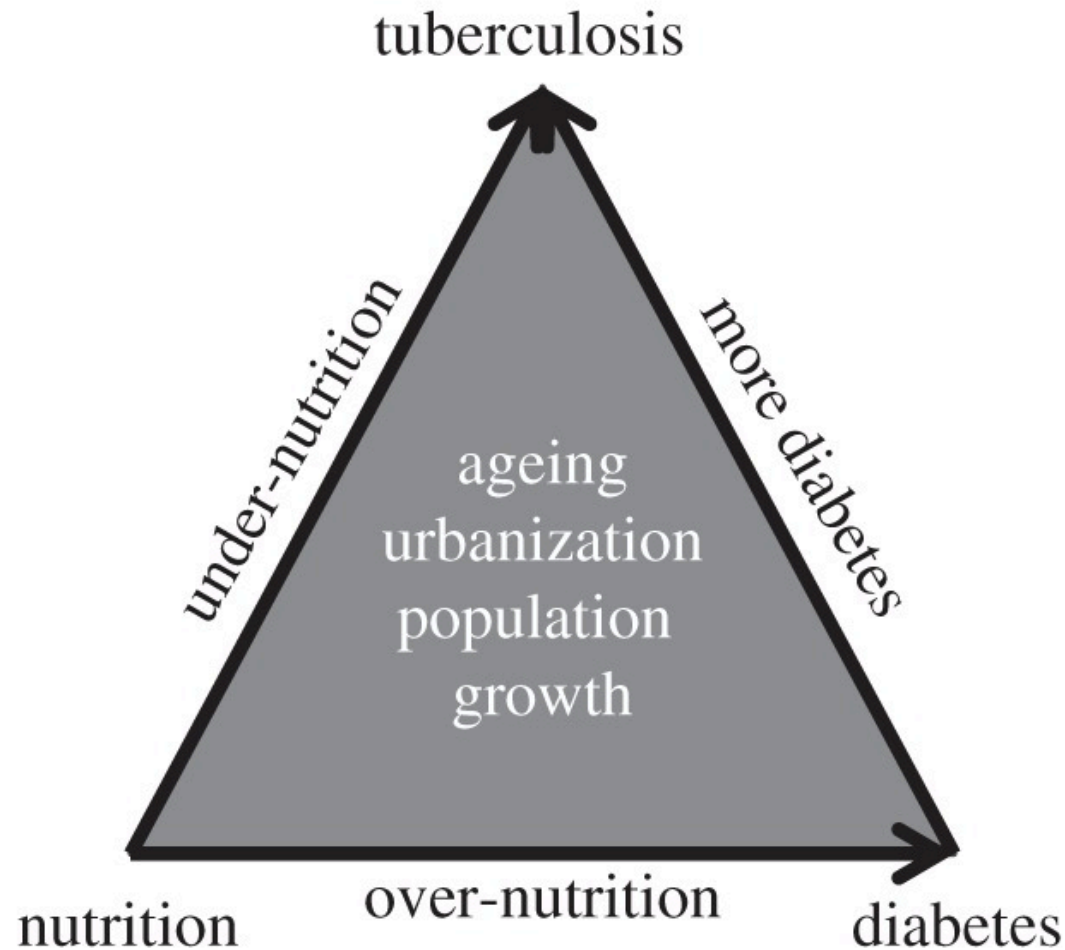


Burden of infectious diseases





Burden of infectious diseases





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The war against infectious disease has not yet won

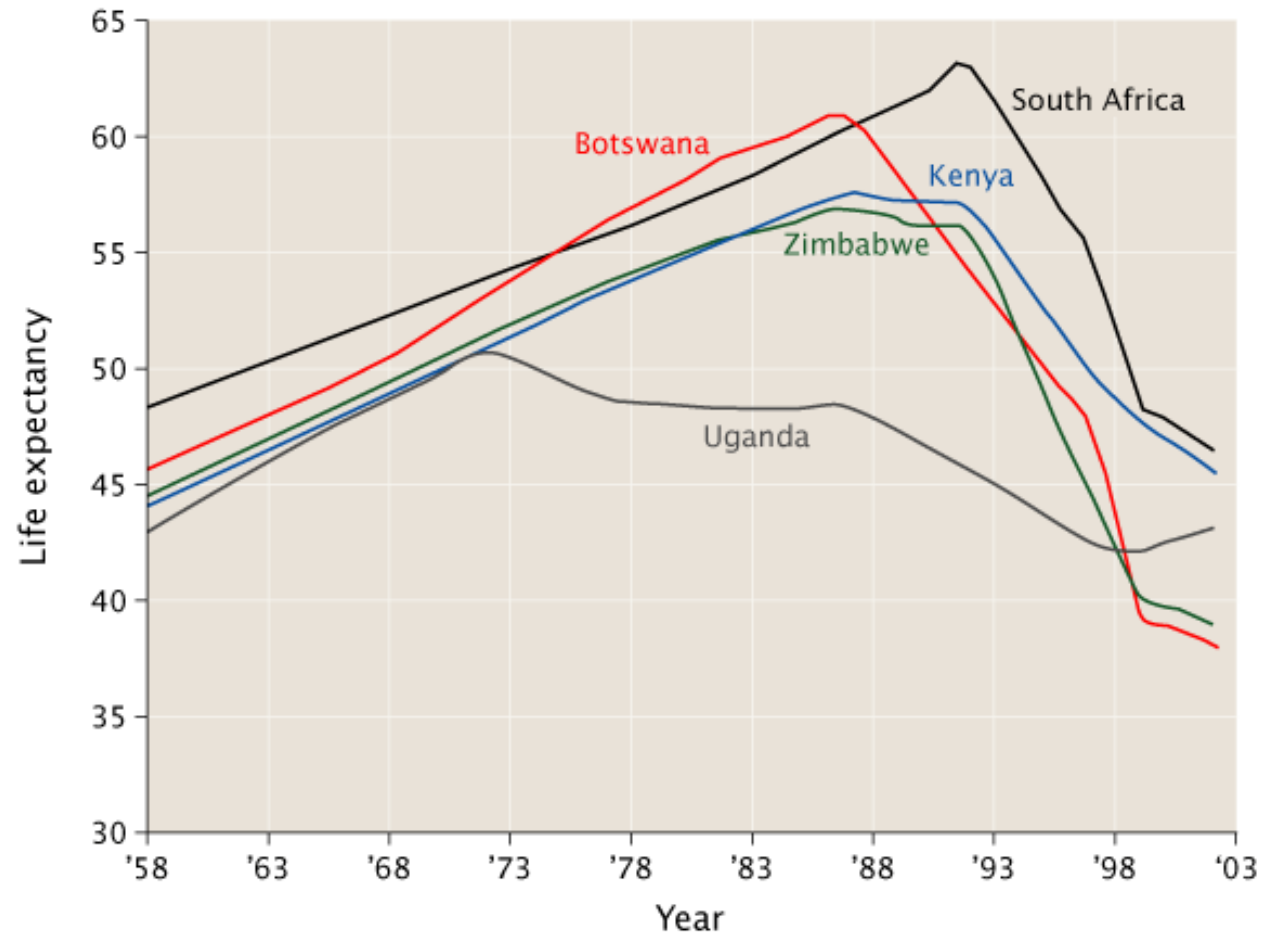




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A new infectious disease could rapidly change life expectancy



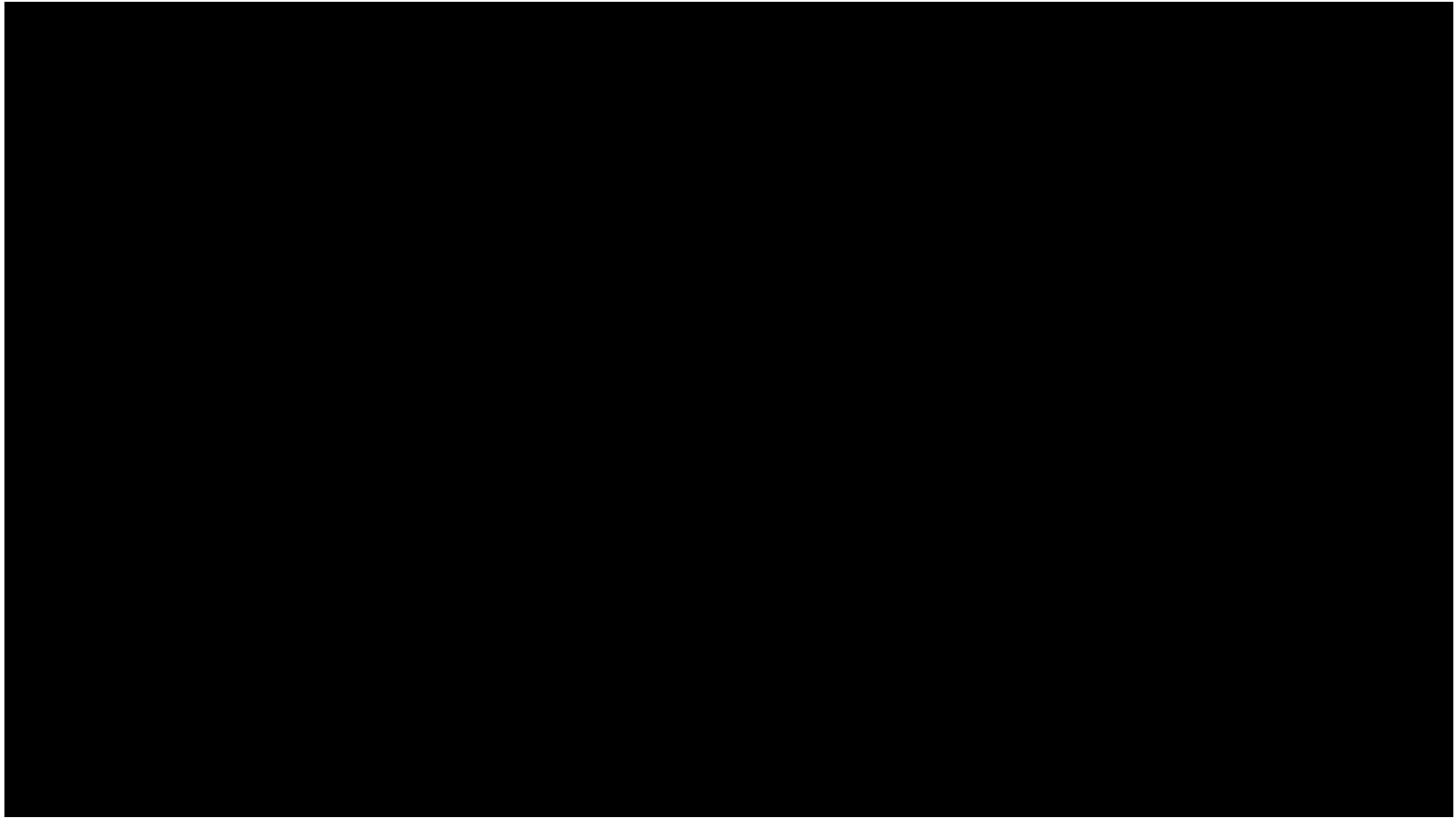
Source: World Bank World Development Indicators, 2004



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The case of Ebola virus

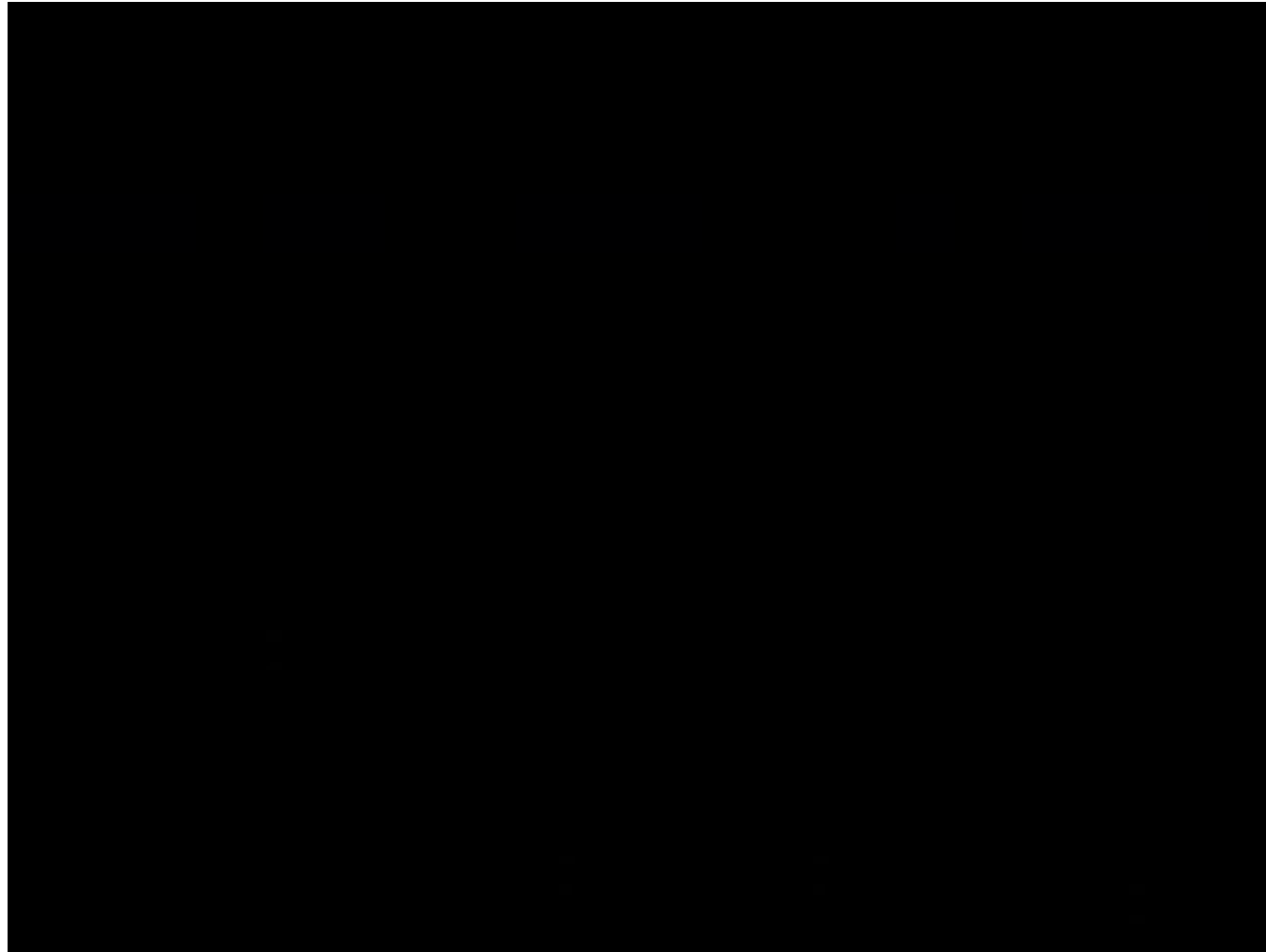




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**Also in developing countries there is
fear of infectious diseases**





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**Also in developing countries there is
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DETERMINANTS OF INFECTIOUS DISEASES

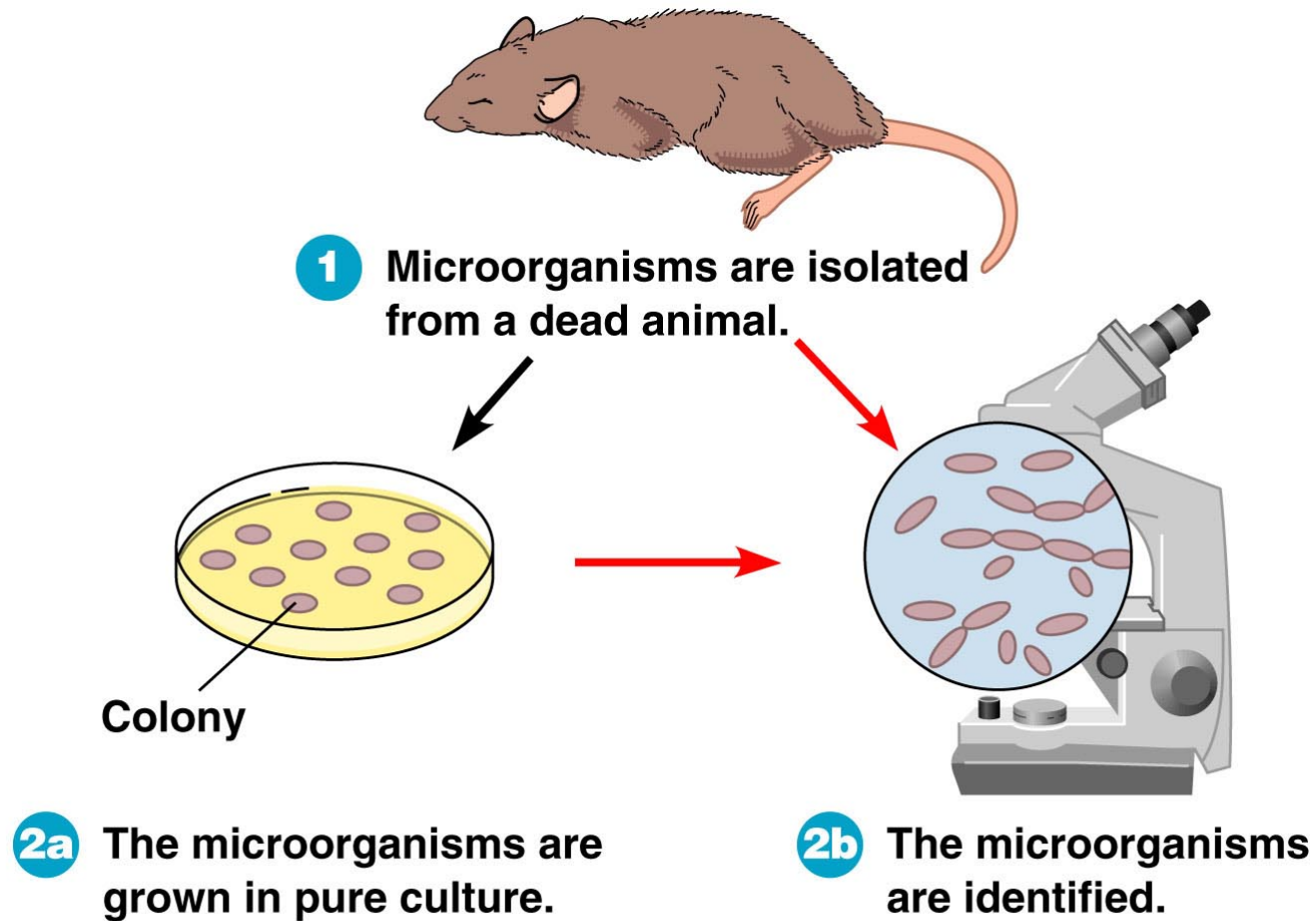


Koch's Postulates

- Pathogen must be present in all cases of disease
- Pathogen must be isolated and grown in lab in pure culture
- Pathogen from pure cultures must cause disease when inoculated into healthy, susceptible lab animal
- Same pathogen must be isolated from the diseased lab animal

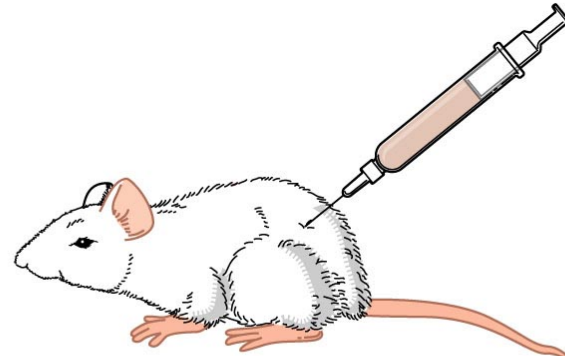


Koch's Postulates





Koch's Postulates



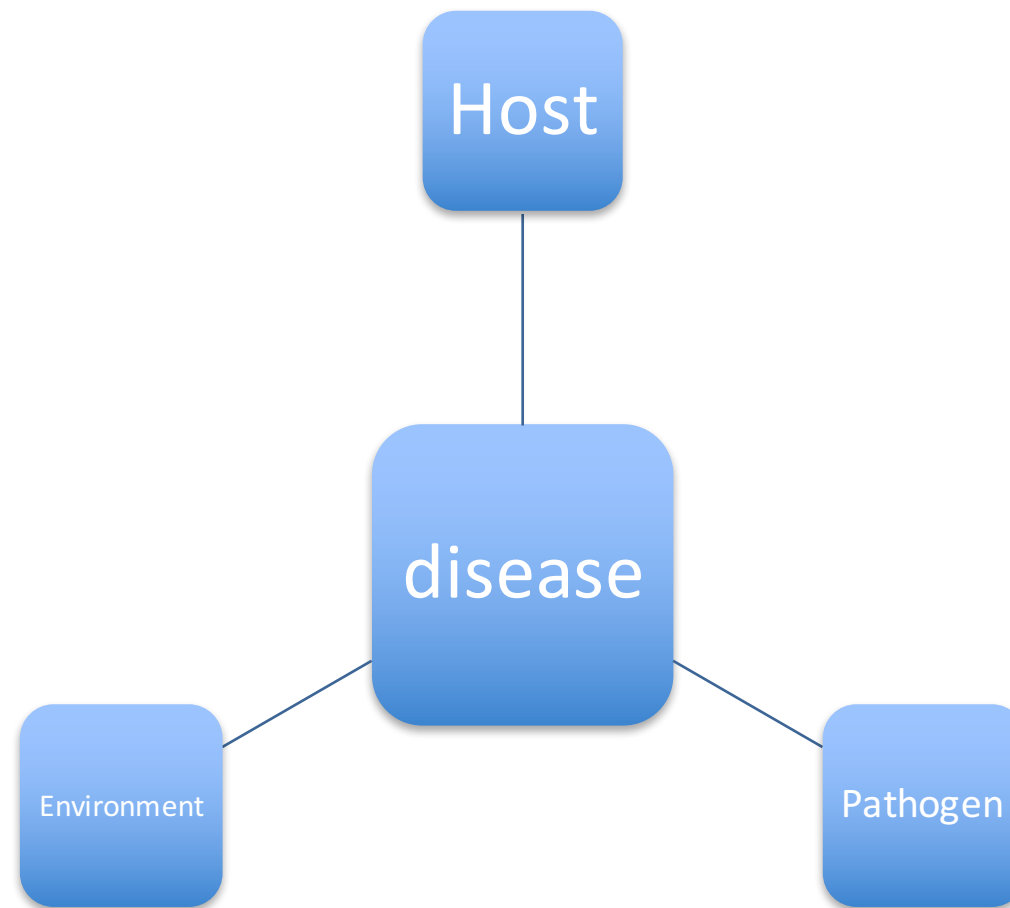
- 3** The microorganisms are injected into a healthy animal.



- 4** The disease is reproduced in the second animal; microorganisms are isolated from this animal.

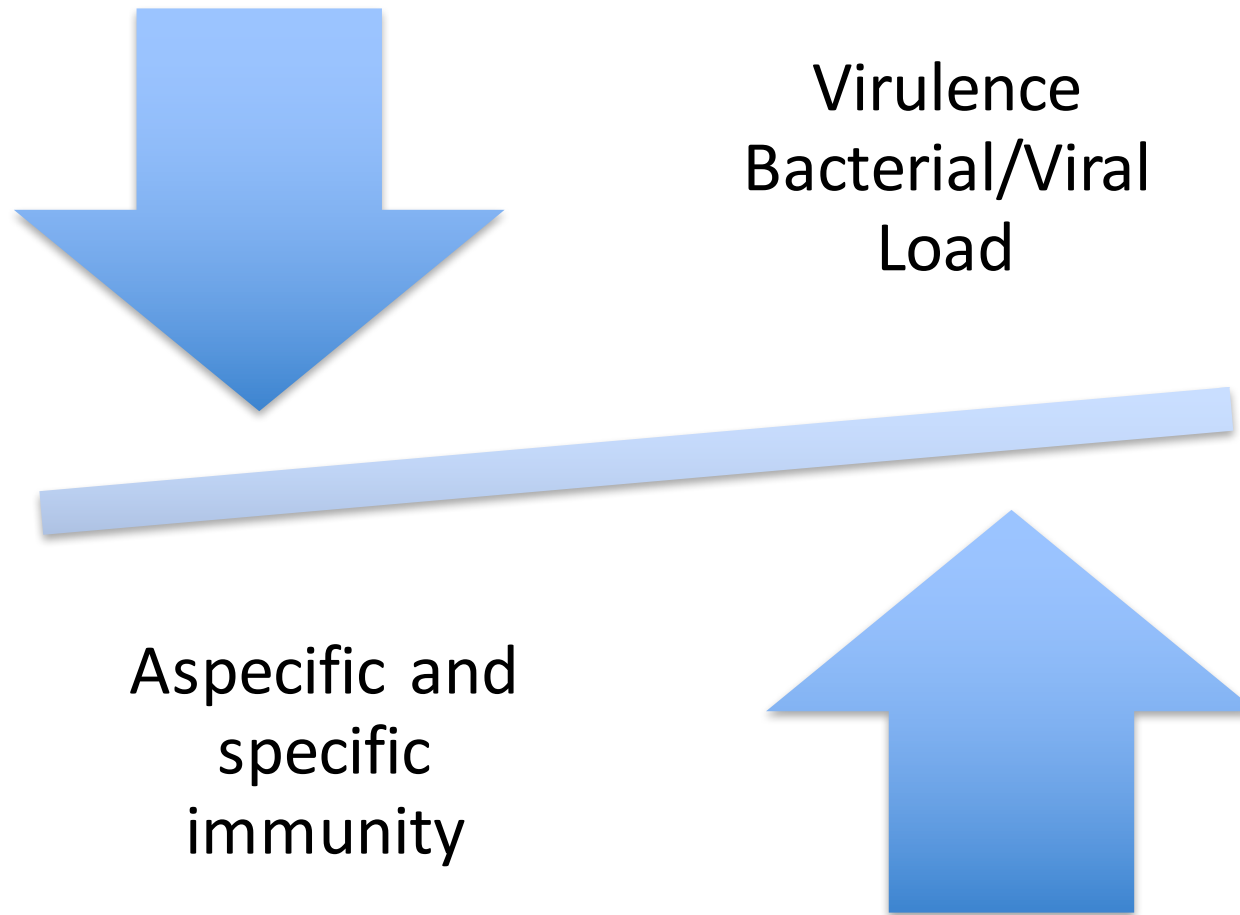


Infectious disease model



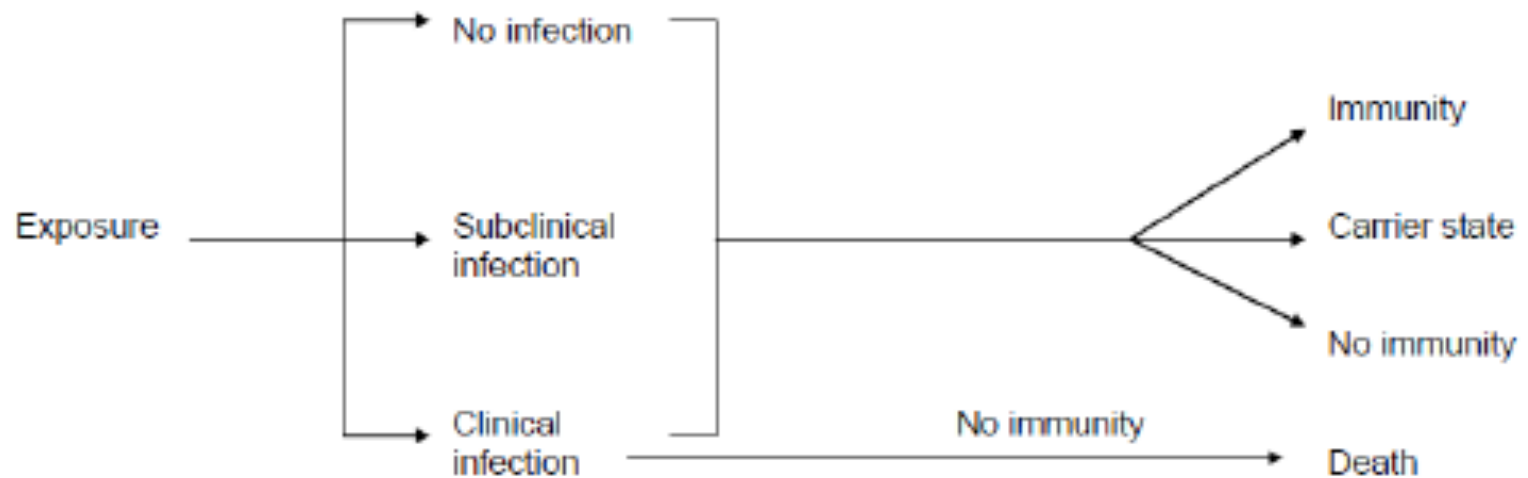


Determinants of infection





The different outcomes of an exposure to an infectious agent

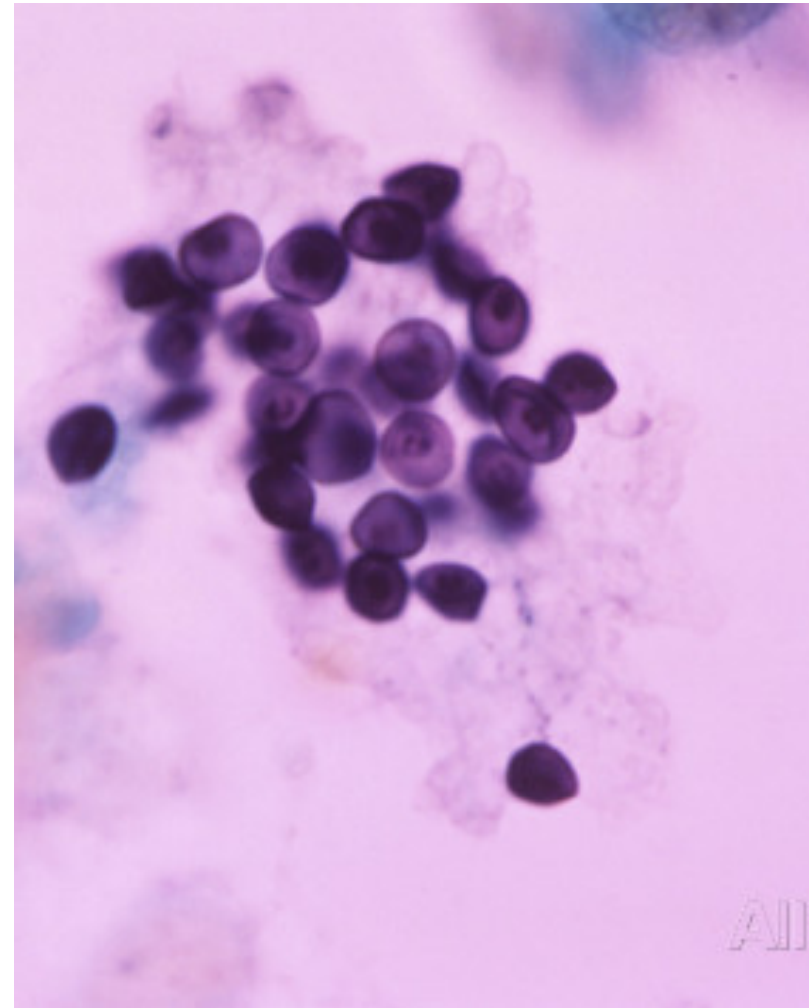


Kramer A, et al. Principles of infectious disease epidemiology. In *Modern Infectious Disease Epidemiology*, Kramer A, et al (eds). Springer Science + Business Media, 2010; p 92 (modified from Glesecke 1994)



Opportunistic infections

infections that occur more frequently and are more severe in individuals with weakened immune systems, including people with HIV





Opportunistic infections

- Candidiasis of bronchi, trachea, esophagus, or lungs
- Invasive cervical cancer
- Invasive fungine infections
- Cytomegalovirus diseases (particularly retinitis)
- Herpes simplex (HSV): chronic ulcer(s)
- Tuberculosis
- Pneumocystis carinii pneumonia



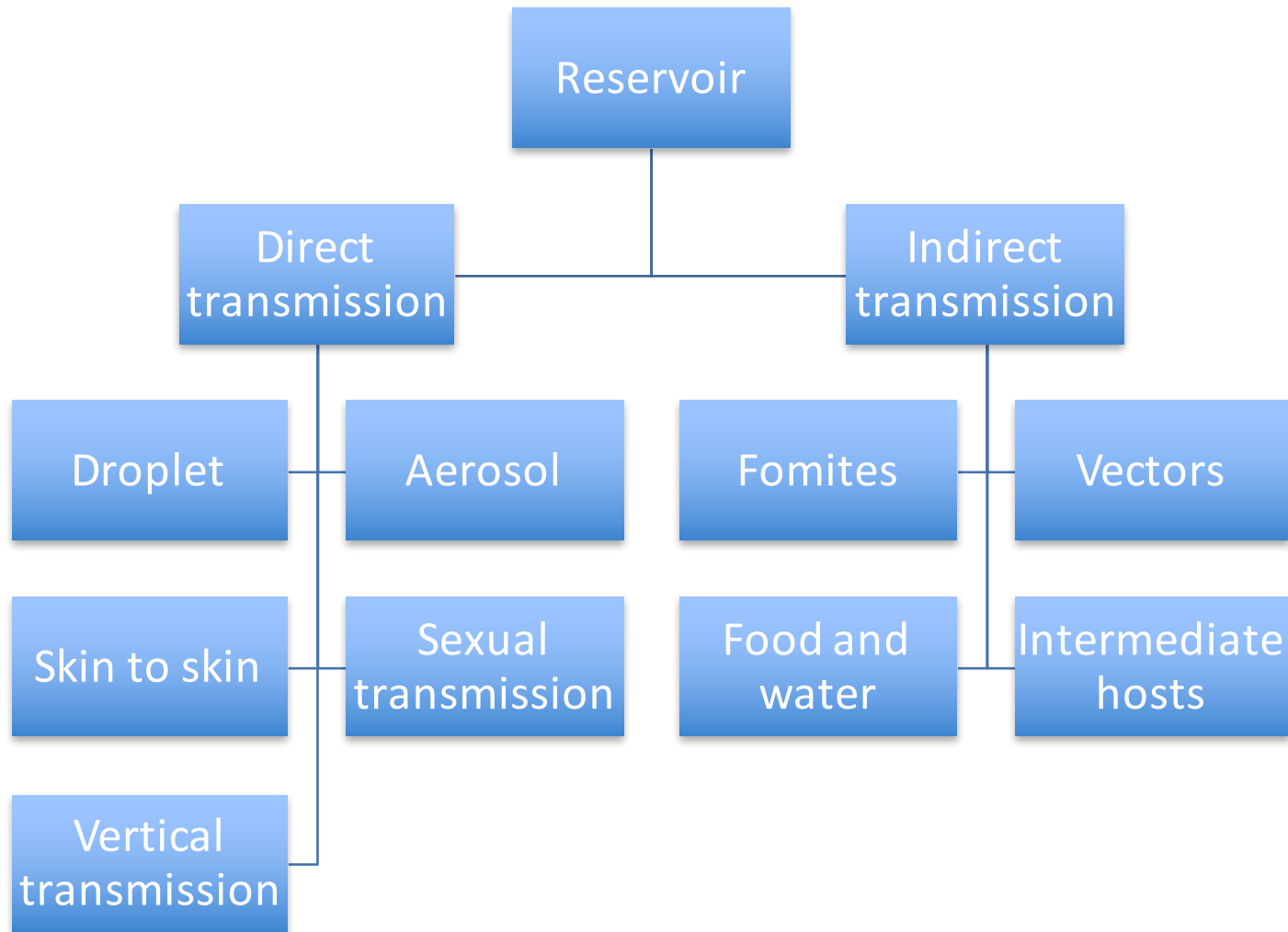
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MODE OF TRANSMISSION OF INFECTIOUS DISEASES



Mode of transmission





Transmission probability ratio TPR

- Measure of the risk transmission from infected to susceptible individuals during contact
- TPR depends by
 - Type of contact
 - Infectious agents
 - Infection routes
 - Infection strains



TPR

TPR	source	host
p00	unimmunized	unimmunized
p01	immunized	unimmunized
p10	unimmunized	immunized
p11	immunized	immunized



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SPREAD OF THE DISEASE



Spread of infectious disease

- Sporadic
- Endemic
 - Hyperendemic
 - holoendemic
- Epidemic/Outbreak
- Pandemic
- Cluster



Sporadic

disease that occurs infrequently and irregularly in a geographic area





Endemic

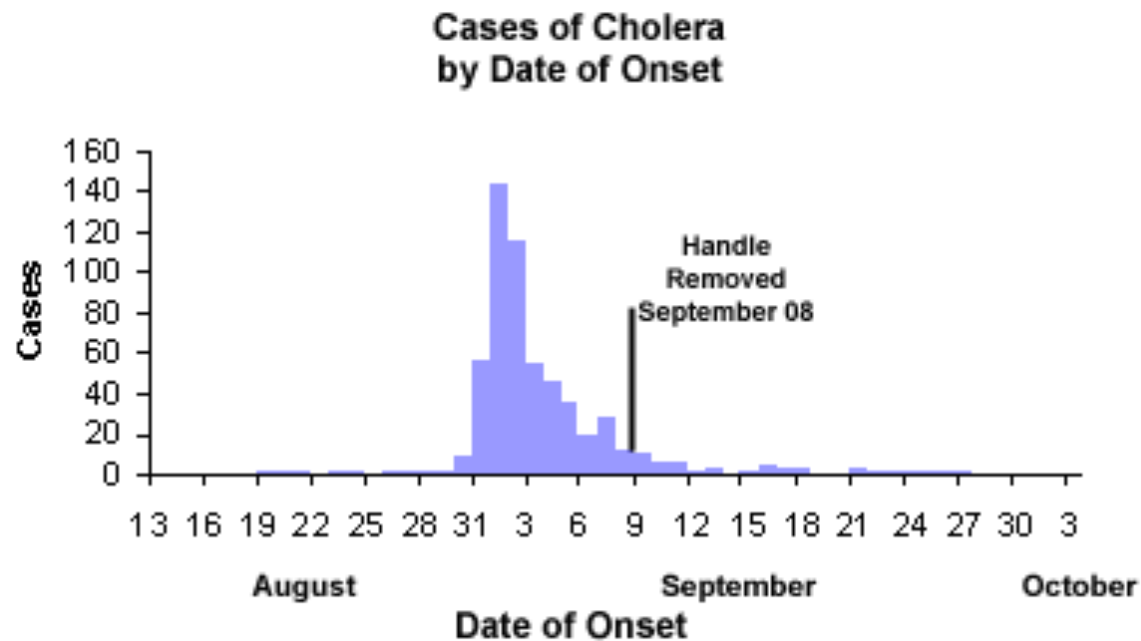
the ongoing, usual level of, or constant presence of a disease in a given population

- **hyperendemic**: persistent level of activity beyond or above the expected prevalence
- **holoendemic**: a disease that is highly prevalent in a population and is commonly acquired early in life in most all of the children of the population



Epidemic

occurrence of one specific disease in a group population, community, or geographical area, in excess of the usual level of expectancy



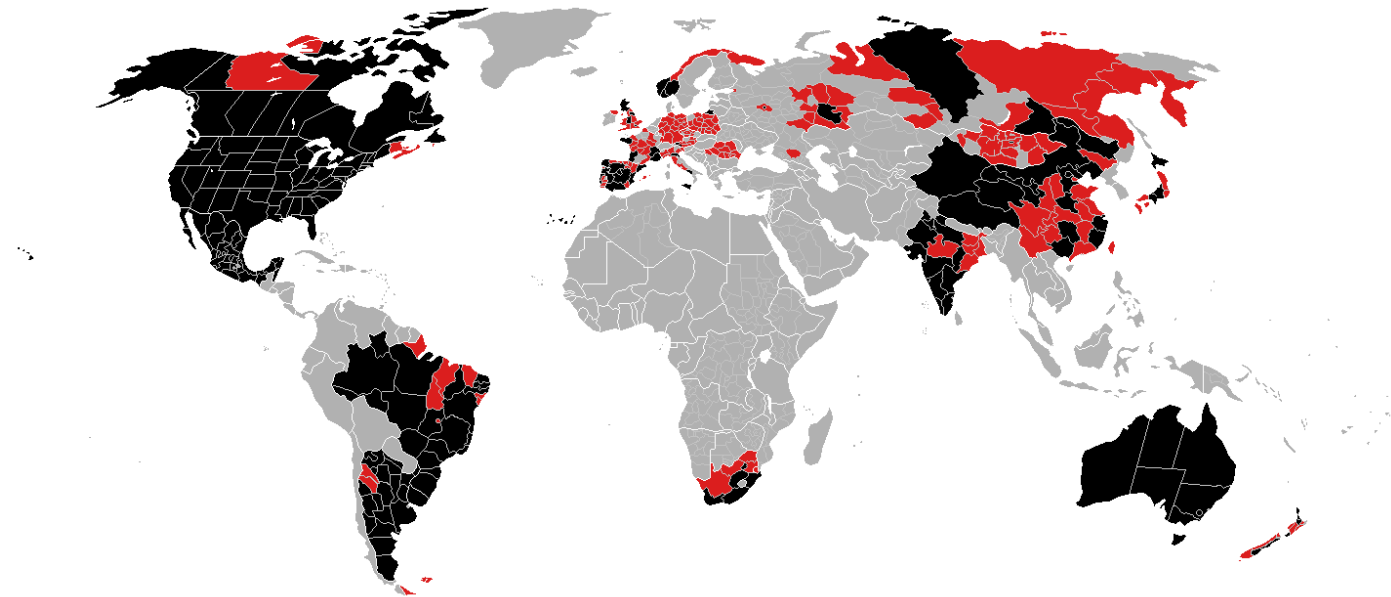


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Pandemic

epidemic that is widespread across a country, continent, or large populace, possible worldwide





Cluster

aggregation of cases
grouped in **place** and
time that are
suspected to be greater
than the number
expected, even though
the expected number
may not be known

