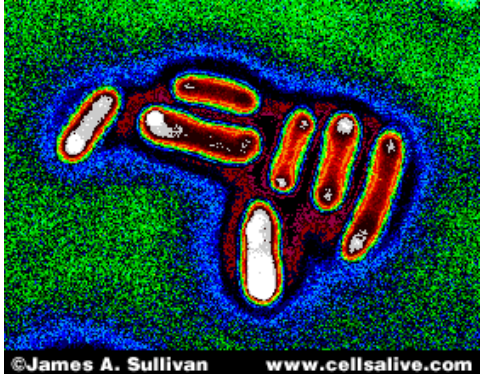
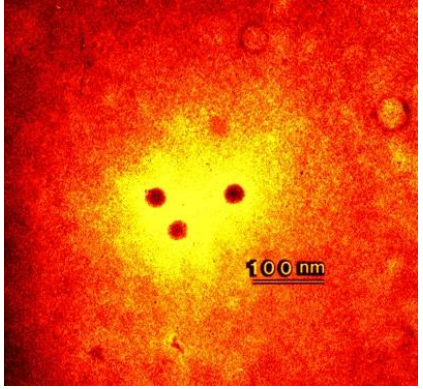
Community medicine

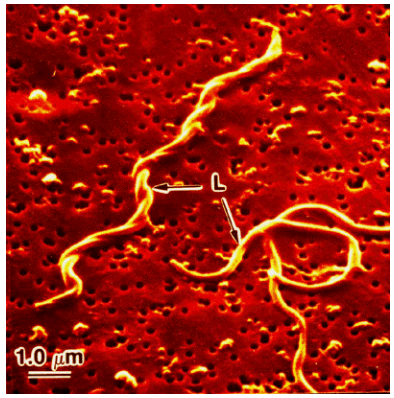
Infectious Disease Epidemiology

Done by : Aya Altaki





Infectious Disease Epidemiology



Dr Munir Abu-Helalah

Associate Professor of Epidemiology and Preventive Medicine

- Infectious diseases - History
- Why study Infectious diseases
- What is infectious disease epidemiology
- Concepts / definitions – IDE

Since the 14th century infectious diseases have played important role in the health of the whole world population

- 14th century - Europe - plague kills 20-45 % of the world's population
- 1819- - 50 million deaths due to H1N1 spanish Flu
- 1831 - Cairo – 13 % of population developed cholera
- 1854-56 - Crimean war – deaths due to dysentery were 10 times higher than deaths due to casualties
- 1899-1902 - Boer War – deaths due to dysentery were 5 times higher than deaths due to casualties

The doctor mentioned the 14 century ,1831 ,1819 and the significant events related to each one

Global Burden of infectious diseases

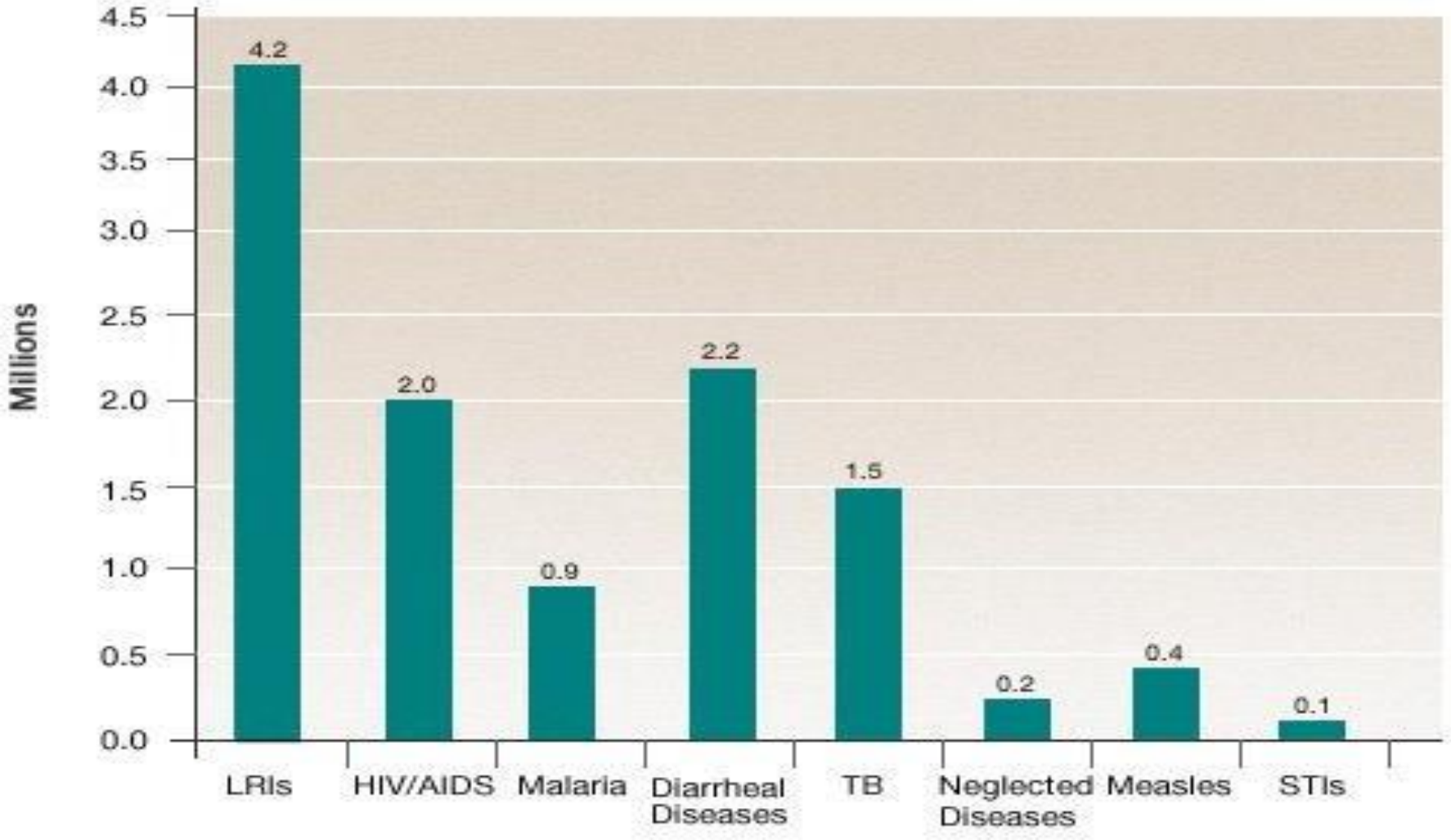
- **One death in three of the 54 million deaths** worldwide is from an infectious cause
- Virtually all of these deaths are in **developing areas** of the world – mainly India and sub-Saharan Africa
- Disproportionately affect **children**
- Many of the developing world deaths are due to **preventable**

  Causes (the key thing in epidemiology and preventive medicine is that The large portion of these cases that have been leading to mortality and Severe morbidity they can be prevented we can look at:

  - Pneumonia and Diarrhea – account for 40% of these deaths
  - Tuberculosis
  - Measles
  - Malaria
  - In Jordan for example before the introduction of rotavirus vaccine Rotavirus was placed in a major burden especially during summer on The healthcare system, so pneumonia now is a major burden and we hope by the introduction of the PC vaccine we will control one of the major cause of the invasive meningococcal disease such as : pneumonia meningitis

15 million deaths

we can look at distribution infection (this is the distribution may cause death)



21st Century

- Microbes are back in news particulary after COVID-19 pandemic
- Resistance
- Newer pathogens
- Changing environment – warming
- Bioterrorism

Currently we have major challenges actually facing the disease control and prevention

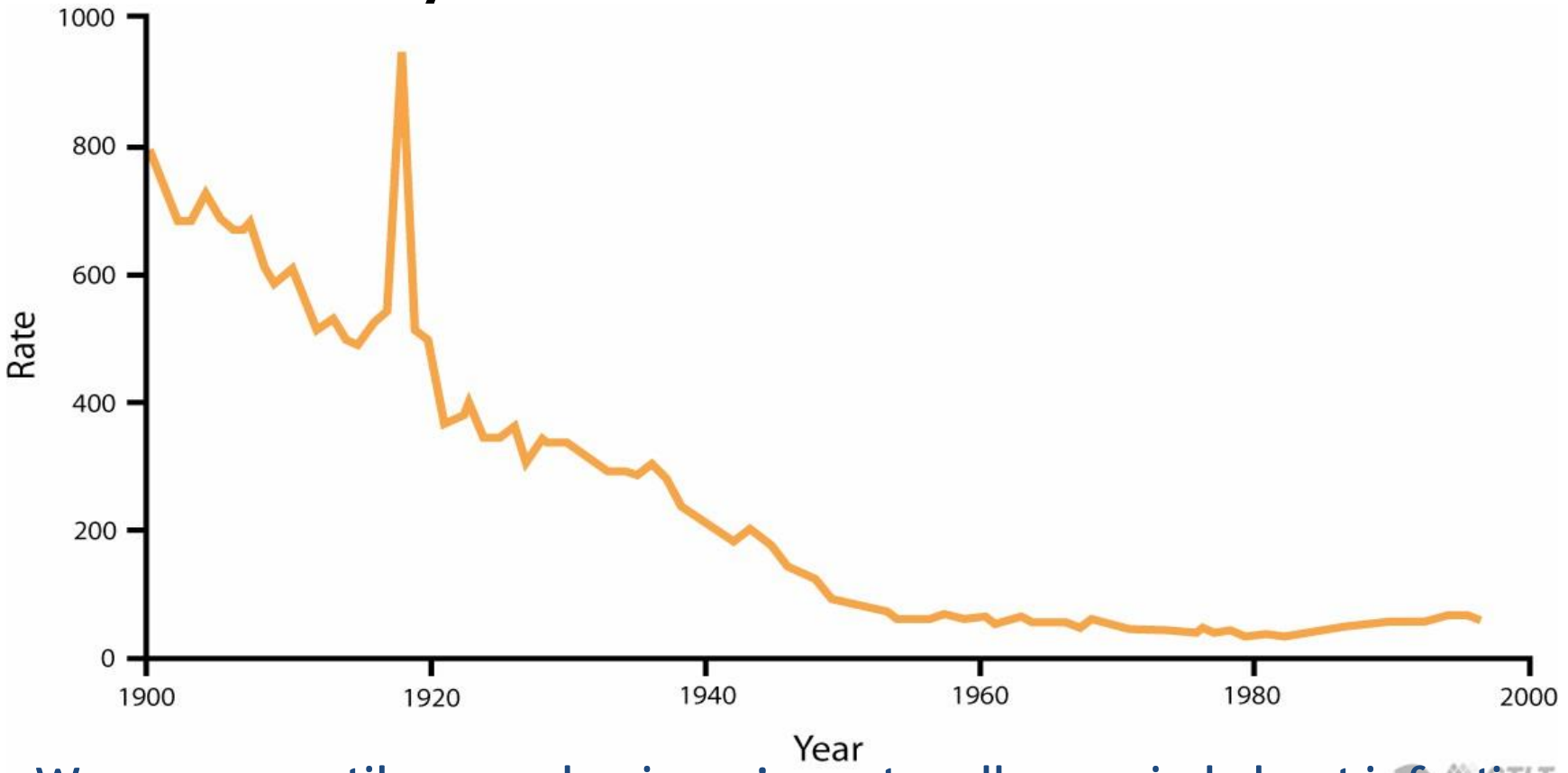
SUCCESSES

- Eradication of Smallpox in 1977
- Elimination of Poliomyelitis from the Western Hemisphere in 1994
- Potential elimination of global poliomyelitis in the next 5 to 10 years

Potential elimination of measles in the next 10 to 20 years(but now we have some outbreaks in the region and we hope that we can look at some potential solutions such as booster measles and the 10th class of some other options to control measles so it was controlled for some degree but we are having some outbreaks of the last five sex years

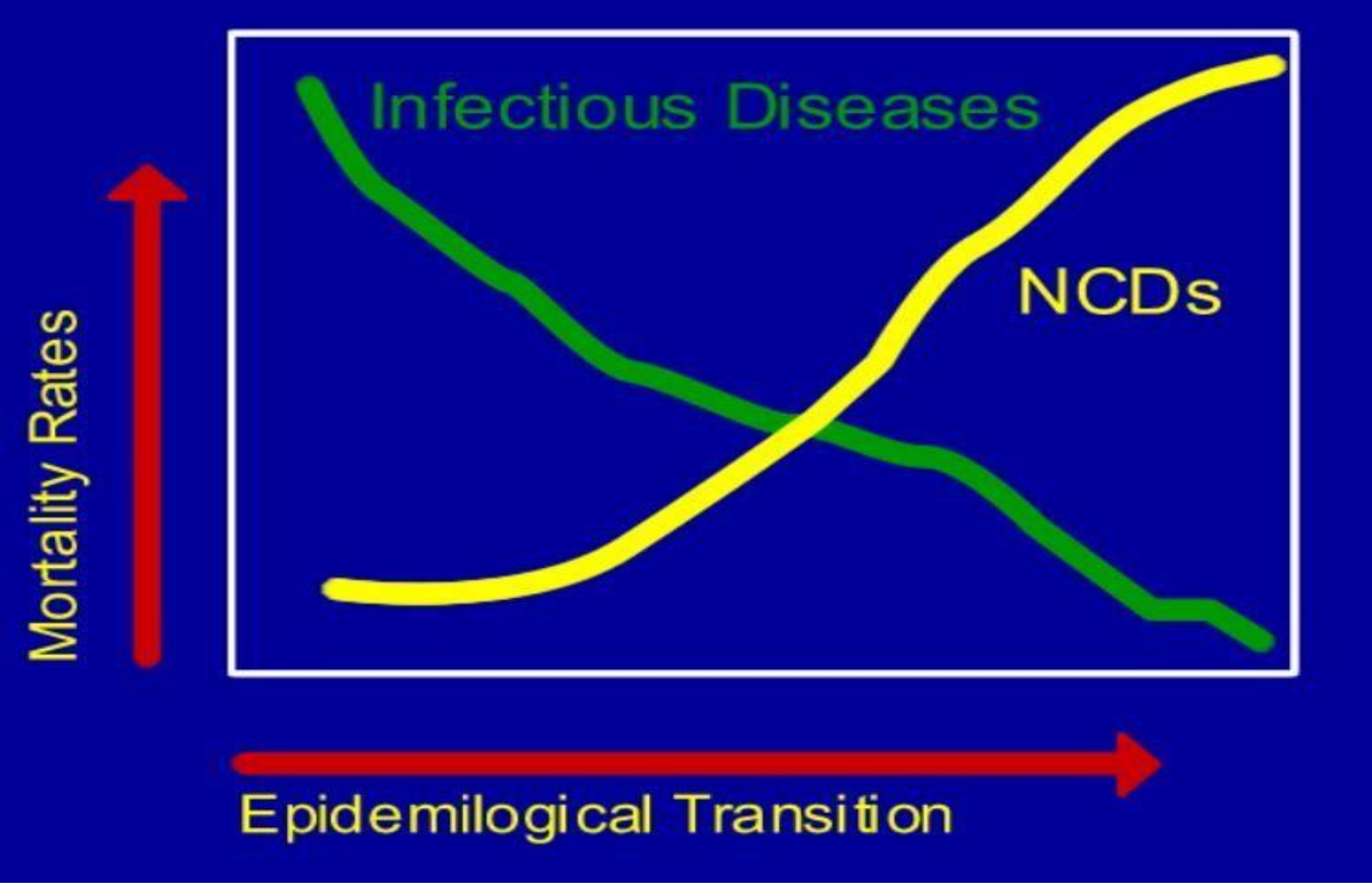
- Vaccines in development for prevention of diarrheal diseases, cervical cancer (HPV),

Mortality due to infectious diseases



We can see until co pandemic we're not really worried about infectious diseases but now we are highly alert about the change in the microbiology infectious diseases epidemiology worldwide because now we are worried about more pandemic and we are worried about for example monkey pox or other infectious diseases that can lead to other pandemics but you can see the trend in decline

Mortality



Actually until recently we were just looking at non-communicable diseases because they were declining but now but now we have more decline in infectious diseases and incidents worldwide

CHALLENGES

- More pathogens have been identified than the drugs developed
- Many pathogens no longer respond to drugs
- Human activity has accelerated this imbalance
- HIV

Some Emerging Non- AIDS related Infectious Diseases

1. COVID-19
2. SARS
3. Variant CJD disease
4. Monkey pox
5. Ebola and Marburg viruses
6. Dengue
7. Influenza H5/N1 (?)
8. Hanta virus
9. *E. Coli O157 :H7*
10. Antibiotic-resistant
    - Pneumococci
    - *Staph-aureus*
    - Gonococci
    - Salmonella
11. Cryptosporidium
12. Anthrax
13. West Nile disease

Factors Leading to Emergence of Infectious Diseases

- AIDS
- Population growth
- Speed and ease of travel
- Dam building
- Global climate change
- Increased antibiotic use for humans and animals
- Encroachment of human populations on forest
- Industrial commercial agriculture
- War and social disruption
- Relocation of animals
- Growth of daycare
- Aging of the population
- Human-animal contact

Epidemiology

- **Study of distribution & determinants of disease and health related events and its application in control and prevention.**

Table 14.12 Terms Used to Classify Infectious Diseases

Term	Definition
Acute disease	Disease in which symptoms develop rapidly and that runs its course quickly
Chronic disease	Disease with usually mild symptoms that develop slowly and last a long time
Subacute disease	Disease with time course and symptoms between acute and chronic
Asymptomatic disease	Disease without symptoms
Latent disease	Disease that appears a long time after infection
Communicable disease	Disease transmitted from one host to another
Contagious disease	Communicable disease that is easily spread.
Noncommunicable disease	Disease arising from outside of hosts or from opportunistic pathogen
Local infection	Infection confined to a small region of the body
Systemic infection	Widespread infection in many systems of the body; often travels in the blood or lymph
Focal infection	Infection that serves as a source of pathogens for infections at other sites in the body
Primary infection	Initial infection within a given patient
Secondary infection	Infections that follow a primary infection; often by opportunistic pathogens

From the previous table the doctor wants from us to know some terms to be familiar with them what is acute disease, chronic disease,subacute disease , asymptomatic disease, what's latent phase for example , another example focal infection: infection that serves a source of pathogens for infections and other sites of the body , primary infection is initial infection within a given patient so these signs we should be familiar with them to understand the epidemiology of infectious diseases

Importance of Studying Communicable Diseases Epidemiology

- Changes of the pattern of infectious diseases
- Discovery of new infections
- The possibility that some chronic diseases have an infective origin.(there's more and more evidence that some chronic diseases such skin chronic disease they might have infective origin

What is *infectious disease epidemiology?*

Two or more populations

- Humans
- Infectious agents
  - Helminths, bacteria, fungi, protozoa, viruses, prions
- Vectors
  - Mosquito (protozoa-malaria), snails (helminths-schistosomiasis)
  - Blackfly (microfilaria-onchocerciasis) – bacteria?
- Animals
  - Dogs and sheep/goats – *Echinococcus*
  - Mice and ticks – *Borrelia*

We have all these components on total cycle of infectious diseases.

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What is *infectious disease epidemiology?*

The cause often known

- An infectious agent is a necessary cause

What is infectious disease epidemiology then used for?

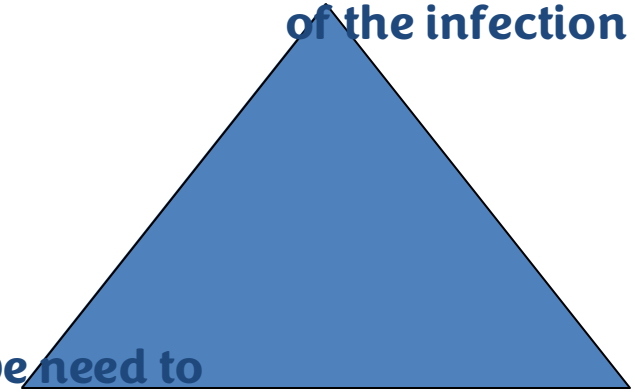
- Identification of causes of new, emerging infections, e.g. HIV, vCJD, SARS
- Surveillence of infectious disease
- Identification of source of outbreaks
- Studies of routes of transmission and natural history of infections
- Identification of new interventions

Actually we can't assess the burden of any infection in any location worldwide without having data on surveillance to know the burden of that infection that site So to know whether it's a major problem or not there is any outbreak we need To understand the epidemiology and data is very important actual infectious diseases because we can assist the burden also we need introduce any intervention such as a vaccine .we can assess the impact of this vaccine through The epidemiology

Epidemiologic triad

- Demographic characteristics
- Biological characteristics
- Socioeconomic characteristics

Host (for example studies have shown the poverties social economic status ,low education can play major role in the risk of the infection



Agent : we need to know about the organism, situation

- Biological agents
- Physical agents
- Chemical agents
- Nutrient agents
- Mechanical agents

Environment

- Physical environment
- Biological environment
- Social environment

Endemic - Epidemic - Pandemic

- **Endemic**
  - **Transmission occur, but the number of cases remains constant**(for example malaria in Sudan where we have the number of cases remain constant at high number)
- **Epidemic**
  - **The number of cases increases**
- **Pandemic**
  - **When epidemics occur at several continents – global epidemic**

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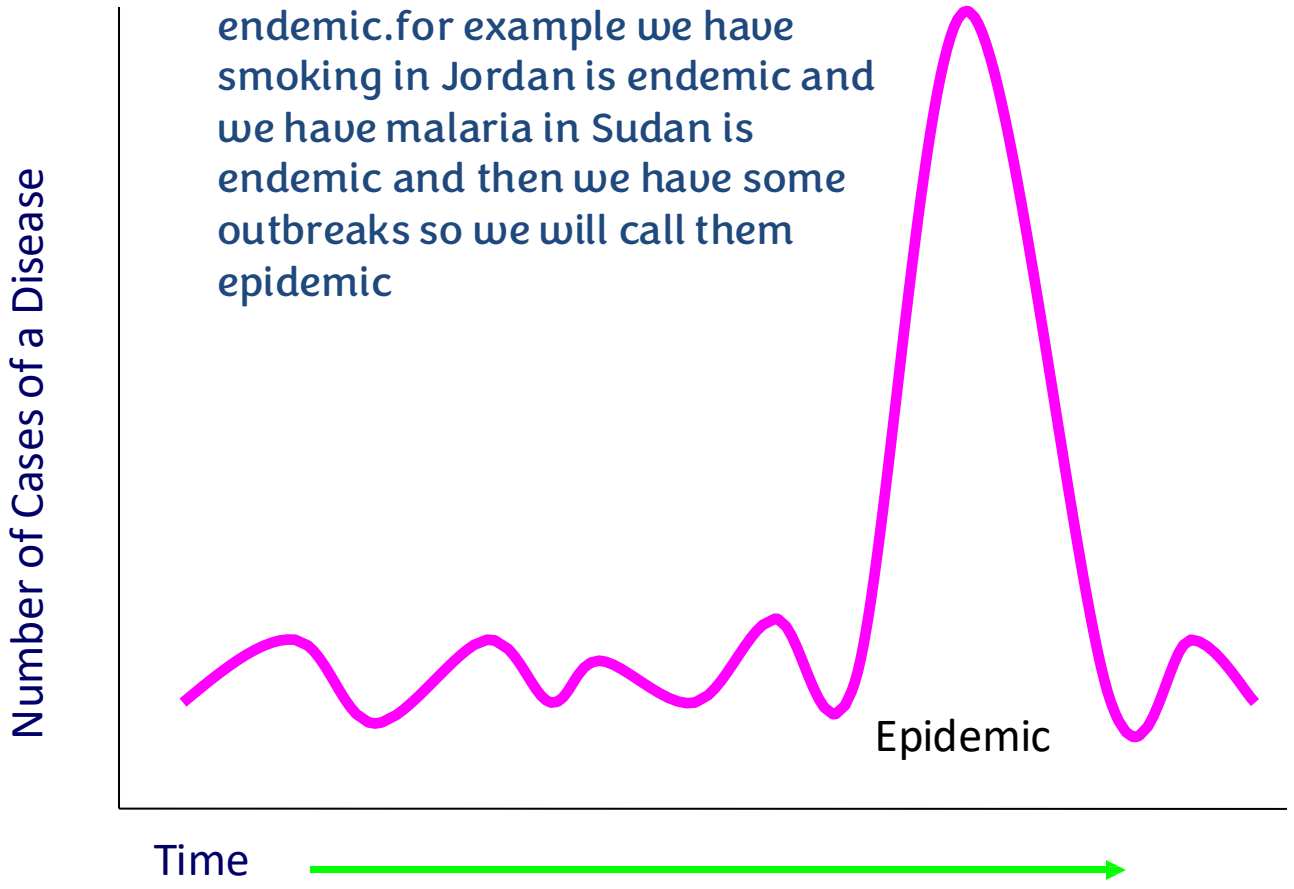
Endemic vs Epidemic

Endemic:still there present there but we have some outbreaks there so it's epidemic. The infection will stay in that country at high rates as endemic.for example we have smoking in Jordan is endemic and we have malaria in Sudan is endemic and then we have some outbreaks so we will call them epidemic



Hyperendemic and holoendemic

- **The term "hyperendemic" expresses that the disease is constantly present at high incidence and/or prevalence rate and affects all age groups equally .**

- **The term "holoendemic" expresses a high level of infection beginning early in life and affecting most of the child population, leading to a state of equilibrium such that the adult population shows evidence of the disease much less commonly than do the children (e.g. malaria)**

Sporadic

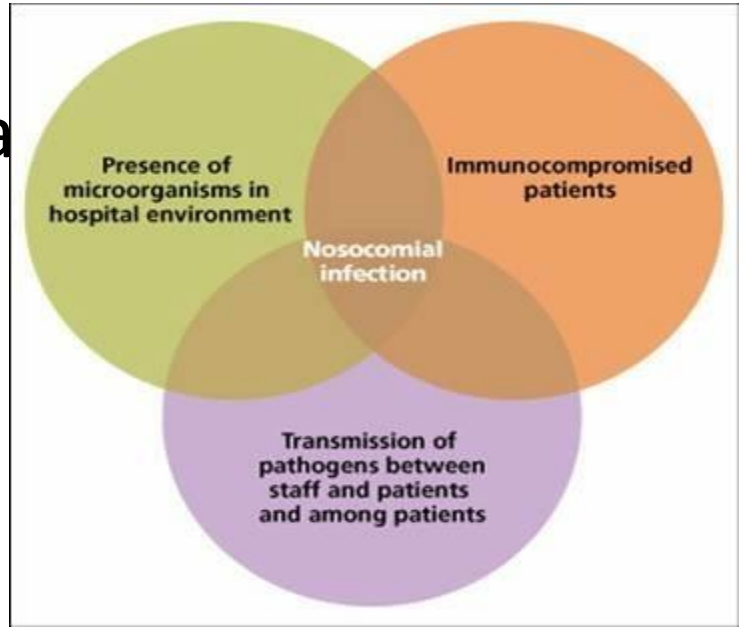
- The word sporadic means “scattered about”.
- Cases - irregularly, haphazardly and generally infrequently.
- Cases - few and separated widely in time and place e.g. polio, meningococcal meningitis, tetanus…(these cases are few and separated widely in time and place . Somtimes these cases can lead to epidemic if they spread the infection to other cases so it’s not at constant state as epidemic or endemic
- May be starting point of an epidemic

Exotic

- **Exotic diseases** are those which are imported into a country in which they do not otherwise occur, as for e.g., rabies in the UK, Yellow fever in India, for example you have malaria in Jordan it's not an infection that is common to be in Jordan

Nosocomial infections

- Nosocomial (hospital acquired) infection is an infection originating in a patient while in a hospital or another health care facility. It has to be a new disorder unrelated to the patient's primary condition. E.g., infection of surgical wounds, hepatitis B and urinary tract infections.and they develop infection during hospitalization

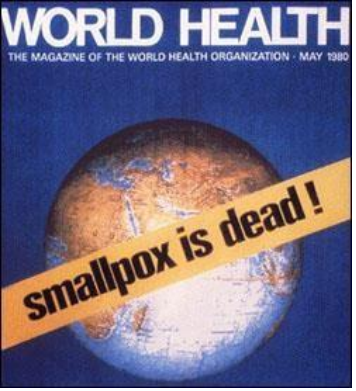


Opportunistic infection

- This is infection by organisms that take the opportunity provided by a defect in host defense (e.g. immunity) to infect the host and thus cause disease.
- E.g., opportunistic infections are very common in AIDS. Organisms include Herpes simplex, cytomegalovirus, M. tuberculosis etc.

Iatrogenic (Physician induced) Disease

- Any untoward or adverse consequence of a preventive, diagnostic or therapeutic regimen or procedure that causes impairment, handicap, disability or death resulting from a physician's professional activity or from professional activity of other health professionals
- E.g., hepatitis B infection following blood transfusion **or needle stick injury**



Eradication

- Termination of all transmission of infection by the extermination of the infectious agent through surveillance and containment. Eradication is an absolute process, an “all or none” phenomenon, restricted to termination of infection from the whole world.

We don’t have the organism or the infection has disappeared from the whole world

Elimination

- The term elimination is sometimes used to describe eradication of a disease from a large geographic region **but still present worldwide** . Disease which are amenable to elimination in the meantime are polio, measles, leprosy and diphtheria.

Cases

- A case is defined as “a person in the population or study group identified as having the particular disease, health disorder, or condition under investigation”

- **Index Case**(could be a primary or secondary case)
  - Person that comes to the attention of public health authorities(during start of the co pandemic we looking at index case to look at contacts and identify them so it's the first who came to attention of authorities fore example we have a case of polio who will presented to the hospital we know about this case , this index case isn't necessary to primary case
- **Primary Case**
  - Person who acquires the disease from an exposure and then will spread the infection to others so we might have the patient

  Presenting to the hospital could be the primary could be the index case
- **Secondary Case**
  - Person who acquires the disease from an exposure to the primary case
  - Secondary attack rate

Secondary attack rate

- The number of exposed persons developing the disease within the range of the incubation period, following exposure to the primary case.

- SAR = $\dfrac{\text{No. of exposed persons developing the disease within the range of incubation period}}{\text{Total no. of exposed / susceptible contacts}} \times 100$

Virulence and Case Fatality Rate

- **Virulence**
  - Degree of pathogenicity; the disease evoking power of a micro-organism in a given host.
  - Numerically expressed as the ratio of the number of cases of overt infection to the total number infected(for example we have 100subjects with influenza:60 of them they had clinical manifestation influenza so it will be variance 60 over100
  - When death is the only criterion of severity, this is the case fatality rate.

- **Case fatality rate**
  - Proportion of infected individuals who die of the infection. This is a function of the severity of the infection.

Case Fatality Rate

$$\text{Case fatality rate (\%)} = \frac{\text{Number of deaths due to disease}}{\text{Number of cases of disease}} \times 100$$