Epidemiology

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Rec 19

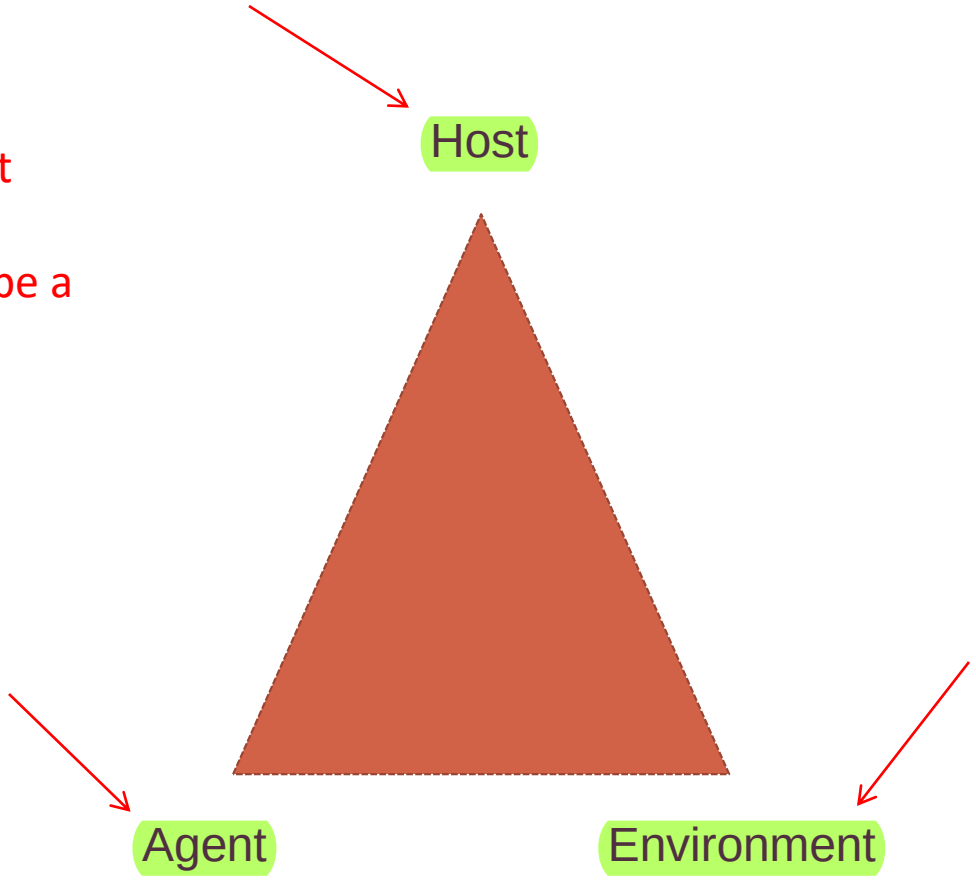
Communicable diseases

- A communicable disease is due to a specific infectious agent or its toxic products that is transmitted to a susceptible host. Transmission can occur from an infected person, an infected animal or an inanimate reservoir.

- Non communicable disease: occurs when the infection doesn't arise by transmission from host to host i.e you can't catch the infection from an infected person (performed toxin e.g. Staphylococcus food poisoning, endogenous infections by normal flora, environmental source e.g. legionella, Clostridium tetani)

Food poisoning such as canned food .
Even if we sterilized foodstuff , we can not neutralize the toxic material , so it will still toxic even it organism free .

The relationship between different angle of triangle determine if will be a disease or not >



The Epidemiologic Triangle

Interaction among pathogens, hosts, and the environment

- **Pathogen:** pathogenicity and virulence, number of organisms

- **Host:** health status, nutritional status, life style and socioeconomic level

التوازن الغذائي

Health status : immunecompetent / immunecopromised

- **Environment:** geographical region, sanitary and housing condition, drinking water

Ingestion : بلعب دور كبير بانتشار المرض

↓ Population crowding --- ↑ health state

Pathogen :

1- virulence : has a pathogen gen cause a disease

2- infection dose : pathogen vary by the level of infection dose

-some pathogen need single bacterial cell ⟶ enough to get a disease (coccila) , that's mean virulence 1000 time more than other .

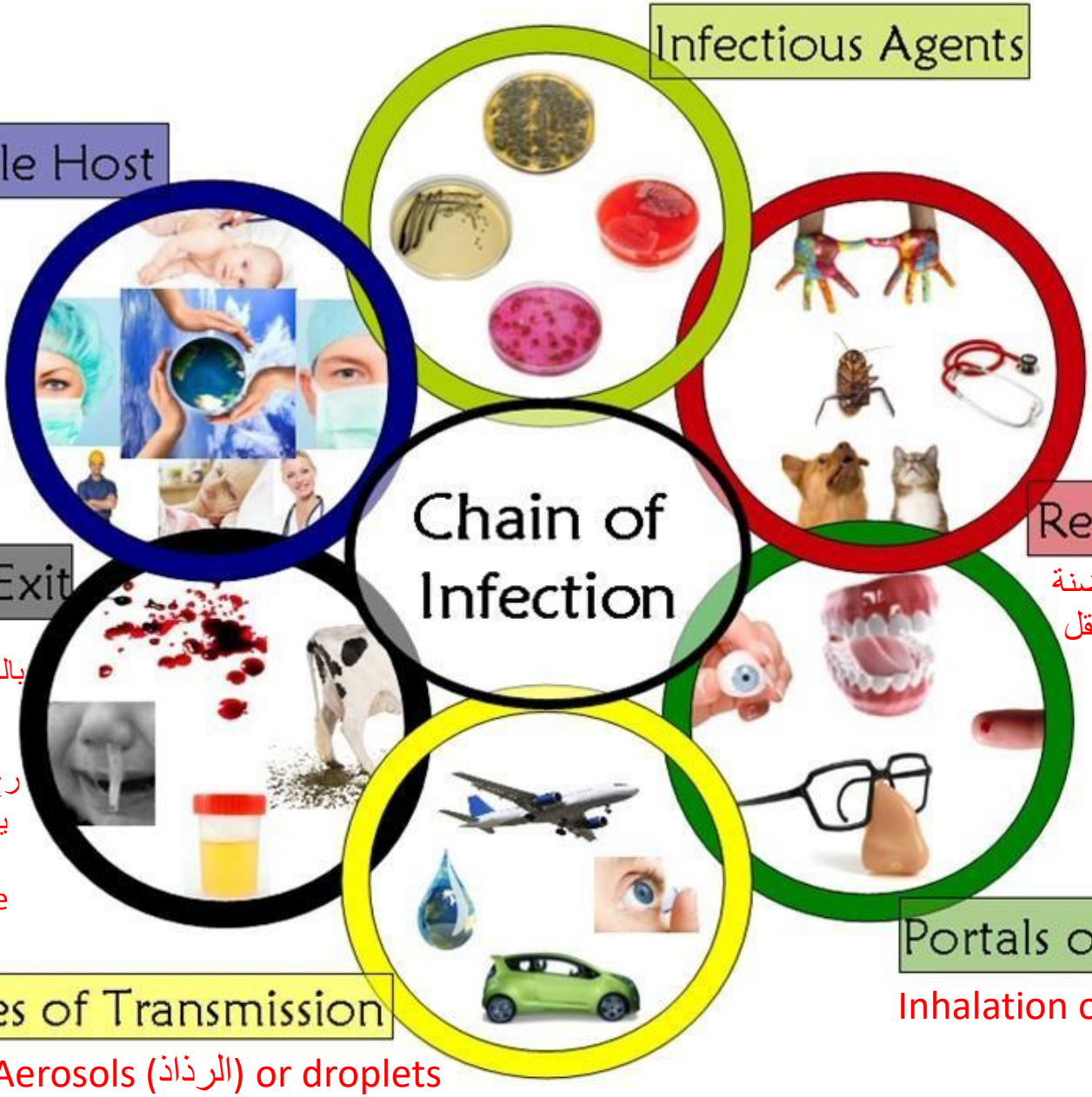
- Some pathogen need 500 bacterial cell to establish the infection ,, others need thousand (salmonella)

قدرة البكتيريا على تحويل الشخص لمريض تعتمد على الـ Virulent

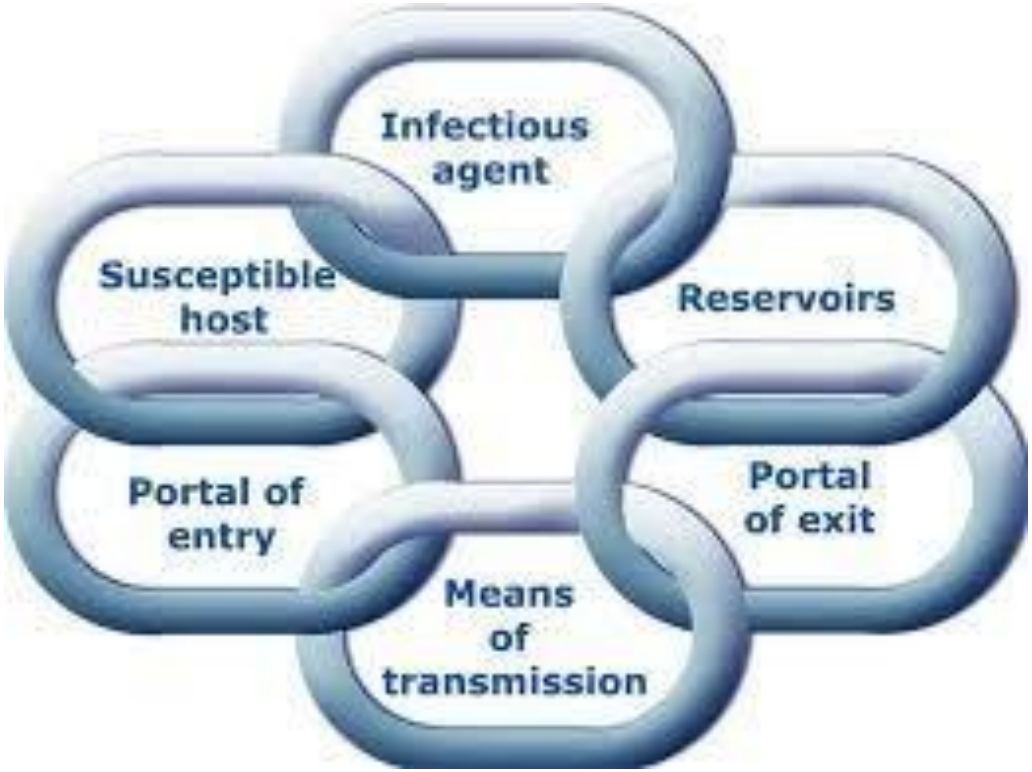
Chain of Infection

There are three major links in disease occurrence:

- The etiologic agent
- The method of transmission (by contact, by a common vehicle, or via air or a vector)
- The host.


Infectious Agents
Susceptible Host
receptors
Chain of Infection
Reservoir
البكتيريا بتحتاج حاضنة لتتكاثر فيها قبل لا تنتقل
Portals of Exit
طالما البكتيريا موجوة بالحاضنة ما حتسبب مشاكل
Mosquito لوعملت bites
Portal of exit رح يصير فيه يعني البكتيريا الموجوده داخل ال Mosquito exit to susceptible host
Portals of Entry
Inhalation or ingestion
Modes of Transmission
Ether by Aerosols (الرذاذ) or droplets

The six components in the chain of infection



Strategies for Breaking the Chain of Infection

Goals

- Eliminate or contain the reservoirs of pathogens or curtail the persistence of a pathogen at the source
- Prevent contact with infectious substances from exit pathways By 1- sanitization 2- neutralization 3- distinction To be no infection material
- Eliminate means of transmission Viable transmission or non viable (mechanical , physical)
- Block exposure to entry pathways Prevent face to face contact
- Reduce or eliminate the susceptibility of potential hosts

Methods of breaking the chain of infection

If we break the chain between any 2 compartment , we stop the infection . Like :
Prevent agent from entering or reservoir , prevent transmission and so on …

- Practicing effective hand hygiene procedures
- Maintaining good nutrition and adequate rest and reduce stress
- Obtaining immunizations against common pathogens
- Practicing insect and rodent control measures
- Practicing proper patient isolation procedures

- Ensuring proper decontamination of surfaces and medical instruments
- Disposing sharps and infectious wastes properly
- Using gloves, gowns, masks, respirators, and other personal protective equipment, whenever appropriate to do so
- Using needle safety devices during blood collection

Reserviors

- The reservoir is any site where the pathogen can survive and multiply until it is transferred to a host
- Living reservoirs include human, household pets, farm animals, insects, ticks and mites
- Non living reservoirs include air, soil, dust, food, water, and fomites

Modes of Transmission

- Healthcare professionals must be thoroughly familiar with the sources (reservoirs) of potential pathogens and pathways for their transfer.

- The five principal modes by which transmission of Pathogens occurs are:

- Contact (either direct or indirect),
- Droplet it is wet ,and weighs five times more than airborne so it travels shorter distance
- Airborne for long distance بتسبّب أمراض تنفسيّة,
- Vehicular
- Vector transmission. ex: fleas....البراغيث

Transmission

- The method of transmission is the means by which the agent goes from the source to the host.
- Transmission can be:
- Biological: the vector actively participate in the life cycle of the pathogen i.e malaria
- Mechanical: the vector becomes contaminated through mechanical contact with an infected source i.e Chlamydia trachomatis (trachoma), fomite transmission: a mechanical transmission where the agent is an inanimate object (bedding for scabies)

Mode of transmission

during pregnancy

- Vertical transmission: mother to child in utero or in breast milk (all other transmission is horizontal)

breast feeding

- Direct contact: direct person contact is a major transmission route for the spread of infectious agents in hospitals and other health care facilities (nosocomial infections); other forms of direct contact are sexually transmitted diseases (syphilis, herpes, HIV) and skin to skin transmission (scabies)

Mode of transmission

- Indirect contact: transmission of microorganisms from an infected source to a susceptible host via contaminated objects (wound surface…to glove…next patient)
- Airborne: microorganisms can transmit in fine spray from host to host via air, may occur at a site remote in geography or time
- Droplet: transmission from host to host via air, occurs in the same room in a short distance from the source directly to the new host

Mode of transmission

- Vectorborne: mediated by a variety of invertebrate and vertebrate sources

- Common vehicle: microorganisms transmitted by contaminated items i.e food (Salmonella, E.coli); water (cholera, cryptosporidium); equipments (shower, pools, medications)

the most dangerous , can cause massive infection distribution

الدكتور صار يحكي إنّه إذا انت متعوّد على مطعم معيّن وعالجراثيم والميكروبات اللي فيه خلّيك عليه لأنّه إذا غيرته ممكن تكون معرّض ل infection

Public health agencies

هاي مؤسّسات عالميّة بتعمل على مراقبة ظهور الأمراض والتحكّم بانتشارها

they make reports for disease, especially for serious conditions, which must be reported...ex: TB

- World health organization (WHO)
- Centre for disease control and prevention (CDC)

The prevention and control of epidemics include measures to:

- Increase host resistance through the development and administration of vaccines that induce active immunity and maintain it in susceptible persons good nutrition

- Ensure that persons who have been exposed to a pathogen are protected against the disease (e.g., through injections of g-globulin or antisera)

- Segregate, isolate, and treat those who have contracted a contagious infection to prevent the spread of pathogens to others

- Identify and control potential reservoirs and vectors of infectious diseases

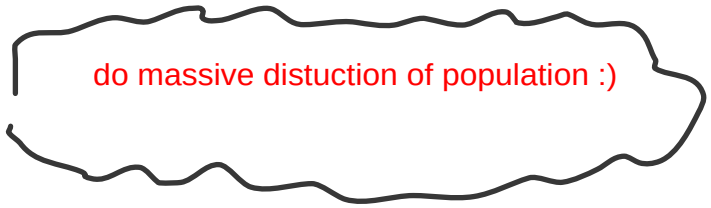
Bioterrorism and Biological Warfare Agents

- Use of biological agents to intentionally produce disease or intoxication in susceptible populations - humans, animals, or plants - to meet terrorist aims

these agents already exist in the environment , but human use them as terrorism agents

Ideal Characteristics for Potential Biological Terrorism Agent

- Inexpensive and easy to produce — cheap
- Can be aerosolized (1-10 μm) — can be used as droplet or airborne
- Survives sunlight, drying, heat — can live in a harsh environment
- Cause lethal or disabling disease — severe — have large mortality rate , in some cases 100%
- Person-to-person transmission
- No effective treatment or prophylaxis



Four of the most commonly discussed pathogens that are potential BW and bioterrorism agents are:

- *B.* anthracis الجمرة الخبيثة
- C.botulinum has a toxicity more than million times of the other toxic chemicals material
- Variola major small box disease
- Y. pestis plague

Anthrax

Anthrax is caused by *B. anthracis, a* spore-forming, Gram-positive bacillus.

types of anthrax

- GI disturbances
- skin infections in more than 95% patients
- lethal form (inhelation form)

very solid ,dark, died tissue

Black anthrax lesion (eschar) on a patient's forearm. malignant pastule

Botulism

cause paralysis

حيث تمنع النواقل العصبيّة من الوصول الى مستقبلاتها وبالتّالي بتخلّي المريض مشلول (flaccid)

- Botulism is a potentially fatal microbial intoxication, caused by botulinal toxin, a neurotoxin produced by *C. botulinum.*

- *C. botulinum* is a spore-forming, anaerobic, Gram-positive bacillus.

تأثير المرض بكون من الأعلى للأسفل حيث بالأوّل المريض بيفقد قدرته عالبصر بعدين ببطّل قادر يبلع ...بعدها إذا وصل للرئتين حيتوقّف التنفّس إلّا في حالة كنت حاط للمريض اوكسجين

الإشي المنيح بهاد المرض إنّه reversible فمجرّد ما عملت للمريض غسيل أمعاء كل الأعراض بتختفي

هلا بالنسبة للبيبي , في ناس بتحطّ على لثة الطّفل عسل مشان تقوى ولأنّه العسل مفيد .... بس المشكلة إنّه إذا العسل تلوّث من التربة اللي فيها هاي البكتيريا عشكل ممكن يُصاب البيبي بمرض ال botulism... spores

Smallpox

- Smallpox is a serious, contagious, and sometimes fatal viral disease.

- Patients experience fever, malaise, headache, prostration, severe backache, a characteristic skin rash , and occasional abdominal pain and vomiting.

انقرض من سنة ١٩٧٧ . وأخطر ما يكون إذا فات الجهاز التنفّسي

Child with smallpox.

Plague

النوع الثاني Pneumonic مرتبط بالرّئتين وهو قاتل

high mortality rate

النوع الأوّل Bubonic بيوصل للعقد الليمفاويّة وبخلّيها تتضخّم فبصير عندي Lymphadonopathy

وهاد ممكن يتطوّر للنوع الثاني عن طريق الانتقال عبر الدمّ إلى الرّئة

- Plague is caused by Y. pestis, a Gram-negative coccobacillus. Plague is predominantly a zoonosis and is usually transmitted to humans by flea bite

bleeding from all exits (ears , mouth...) because of explosion of blood vessels