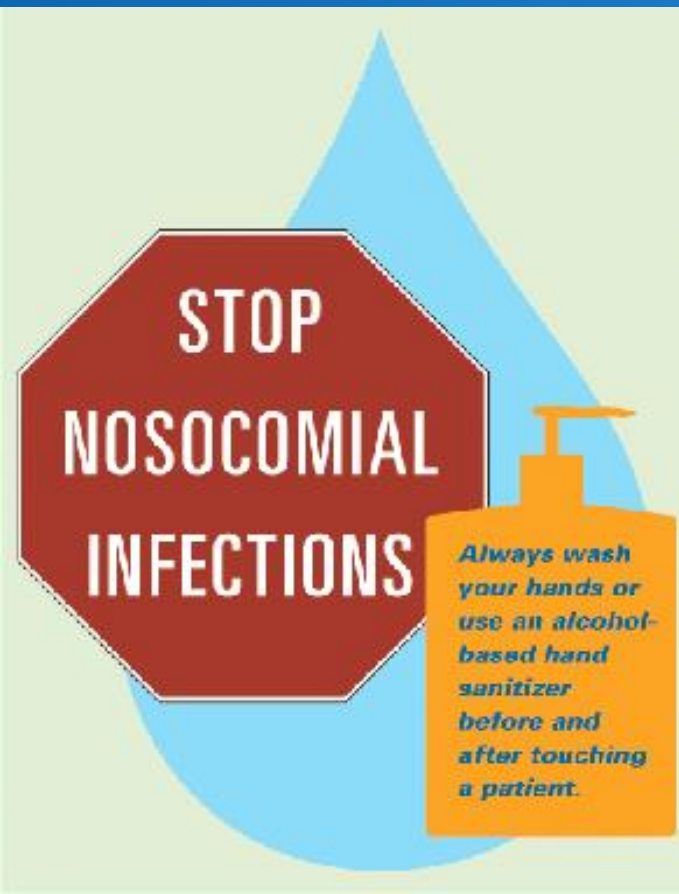


Nosocomial Infections

CLS 212 medical microbiology



What's meant by Nosocomial Infections?

- Any infection causing illness *that wasn't present* (or in its incubation period) when the subject entered the hospital or received treatment in outpatient clinic.
- This type of infection is also known *as a hospital-acquired infection* (or more generically healthcare-associated infections).
- Infections are considered nosocomial if they first appear *48* hours or more after hospital admission or within *30* days after discharge.

WHO notes that the rate of nosocomial infections will continue to rise as a result of four factors :

- Crowded hospital conditions
- Increasing number of people with compromised immune systems
- New microorganisms
- Increasing bacterial resistance



There are five main routes of transmission:

- 1-Contact
- 2-Droplet
- 3-Airborne
- 4-Common vehicle
- 5-Vectorborne

Note: *The same microorganism may be transmitted by more than one route*

Routes of Transmission of Nosocomial Infections

There are 5 main routes of transmission of pathogens:

1. Contact Transmission (direct or indirect):

It is the most important and frequent mode of transmission of nosocomial infections. •

Microorganisms can be transferred by body surface-to-body surface or by contaminated intermediate object, such as instruments, needles, and dressing. •

Routes of Transmission of Nosocomial Infections

2. Droplet transmission:

- Droplets generated by coughing, sneezing, or respiratory tract procedures such as bronchoscopy, or suction



3. Vector transmission:

Transmitted through insects and Other invertebrate animals

(e.g. Mosquitoes → malaria & yellow fever
Fleas → plague)

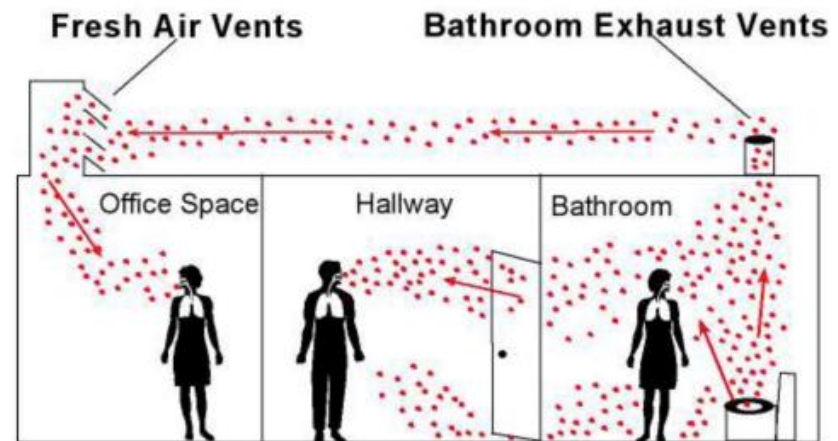


Routes of Transmission of Nosocomial Infections

4. Airborne transmission:

- Tiny droplet nuclei (≤ 5 microns) or dust particles that remain suspended in the air

Infectious Droplet Nuclei Recirculation in buildings



5. Common vehicle transmission:

- Transmitted indirectly by material contaminated with the infectious (e.g. contaminated food, blood products, water or contaminated instruments and other items)



Why do nosocomial infections occur?

- Hospital setting harbors many pathogens & potential pathogens.



illustration: Don Smith

Pathogens Most Commonly Associated with Nosocomial Infections

The following **seven group** of bacteria are the most common causes of nosocomial infections:

Gram Positive Bacteria

- *Staphylococcus aureus*.
- Coagulase-negative *Staphylococci* (CNS).
- *Enterococcus spp.*

Gram Negative Bacteria

- *Escherichia coli* (*E. coli*).
- *Pseudomonas aeruginosa*
- *Enterobacter spp.*
- *Klebsiella spp.*

Pathogens Most Commonly Associated with Nosocomial Infections

Viruses

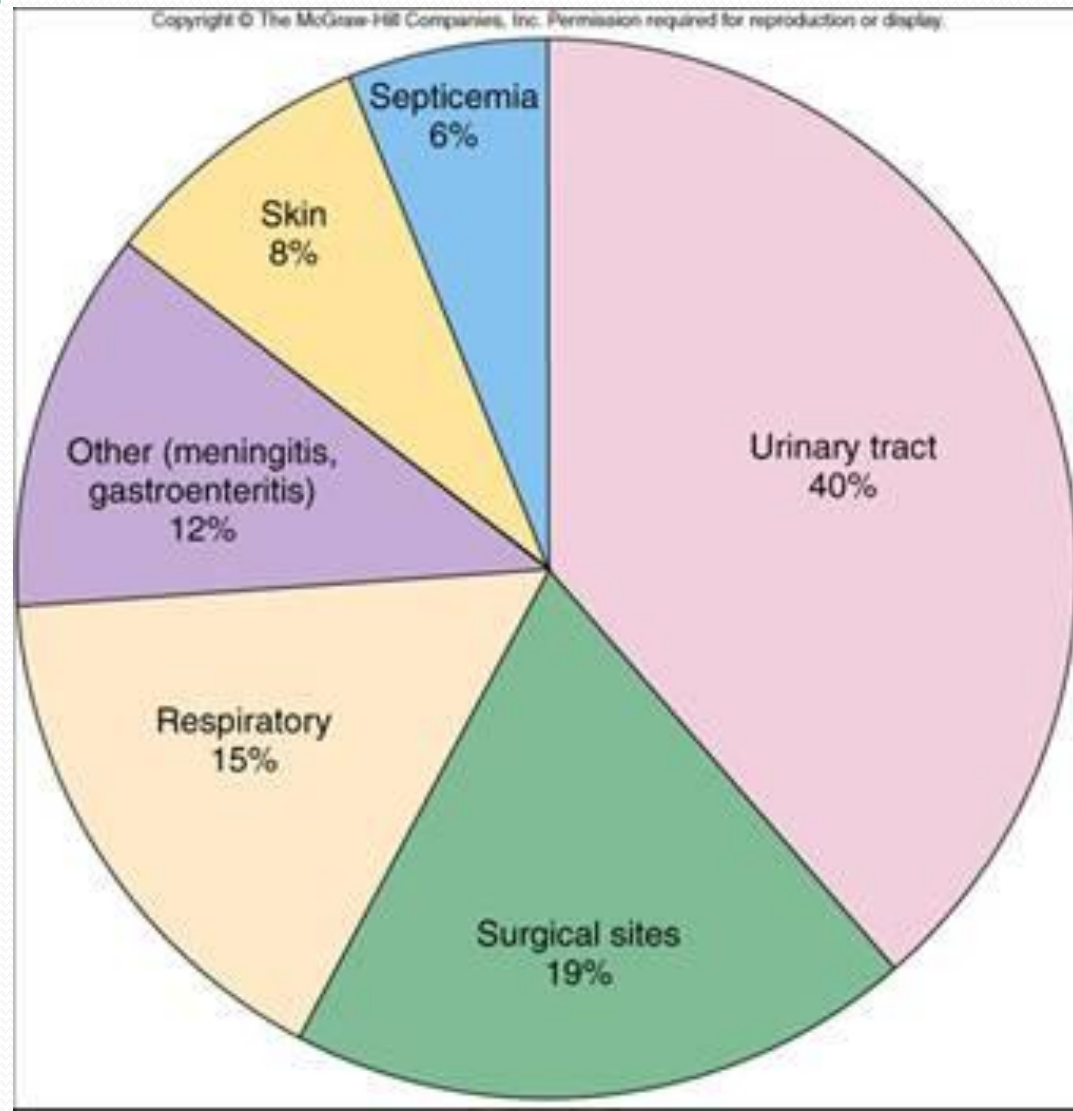
- Herpes simplex virus (HSV)
- Cytomegalovirus (CMV)
- Hepatitis B & Hepatitis C
- HIV

Fungi

- Candida spp.
- Aspergillus spp.

Sites of the most common nosocomial infections

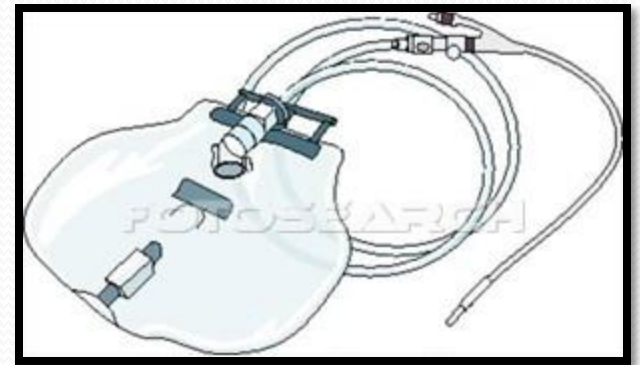
- 1- Urinary tract Infections
- 2- Surgical sites infections
- 3- Respiratory tract Infections
- 4- Blood stream infections



Sites of the most common nosocomial infections

- 1-Urinary tract infections:

This is the most common nosocomial infection **80%** of infections are associated with the use of an indwelling bladder catheter .



The bacteria responsible arise from the gut flora either normal (*Escherichia coli*) or acquired in hospital (**multiresistant Klebsiella**). positive quantitative urine culture ($\geq 10^5$ microorganisms/ml, with a maximum of 2 isolated microbial species).

Sites of the most common nosocomial infections

- 2-Surgical site infections:

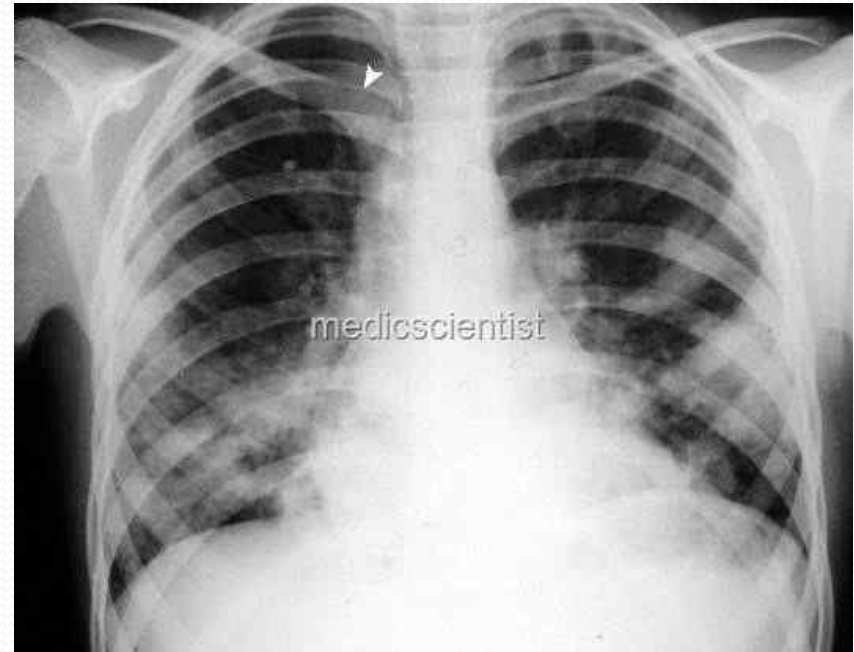
they are also frequent: the incidence varies from 0.5 to 15% depending on the type of operation and underlying patient status.



Sites of the most common nosocomial infections

3. Respiratory tract infections:

- The most important are patients on ventilators in intensive care units.
- Any machine that assist or control respiration can cause infection when become contaminated.
- Organisms include *Pseudomonas*, *Acinetobacter*, or *Enterobacteriaceae* such as *Klebsiella*.



Problems of nosocomial infections:

Nosocomial infections will become more important as public health problem , as it causes :

- 1- Additional suffering.
- 2- Prolong hospital stay.
- 3- Increase the cost of care significantly.

- *Nosocomial infections are important contributors to morbidity and mortality.*

Major Factors Causing Nosocomial Infections

1. Increase number of drug resistant pathogens (due to misuse of antibiotics).

- About 70% of nosocomial infections involve drug-resistant bacteria

VRE: Vancomycin Resistant Enterococcus,

MRSA: Methicillin Resistant *S. aureus*,

MRSE: Methicillin Resistant *S. epidermidis* ,

MDRTB: Multi-Drug Resistant *Mycobacterium Tb*,

which are common in hospitals and nursing homes as a result of the many antimicrobial agents that are used there.

- Drug resistant microbes can be other than bacteria like: viruses (HIV), fungi (*Candida spp.*), or protozoa (malaria).



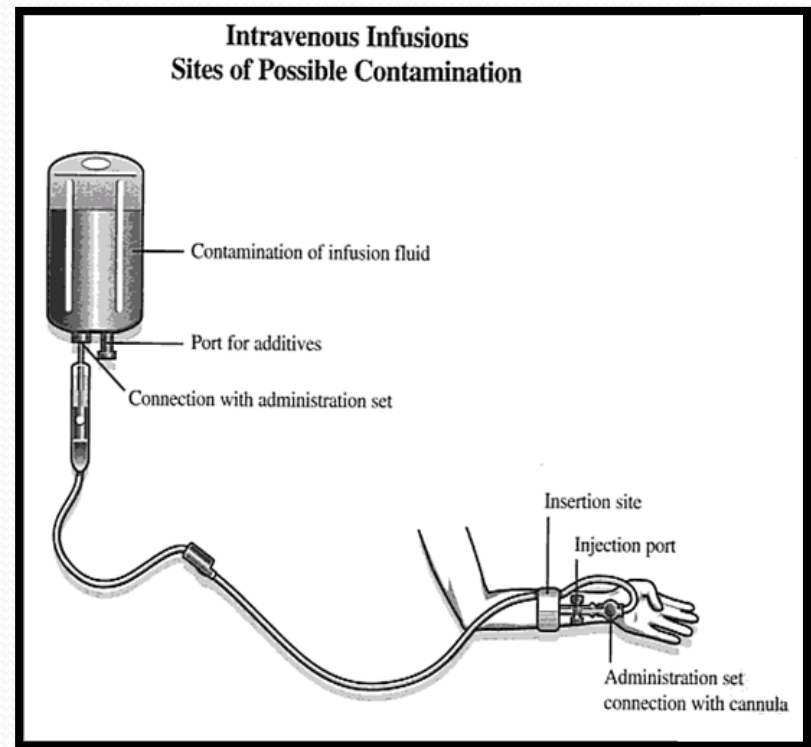
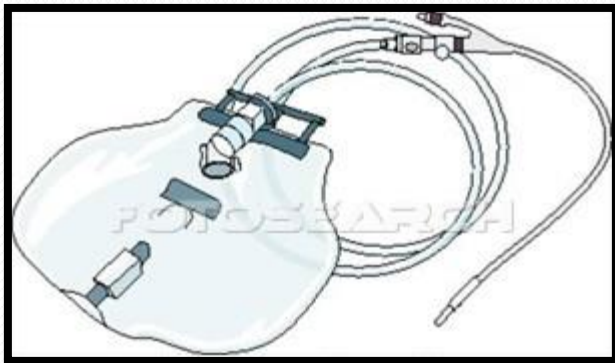
Major Factors Causing Nosocomial Infections

2. Increase number of immunocompromised patients.



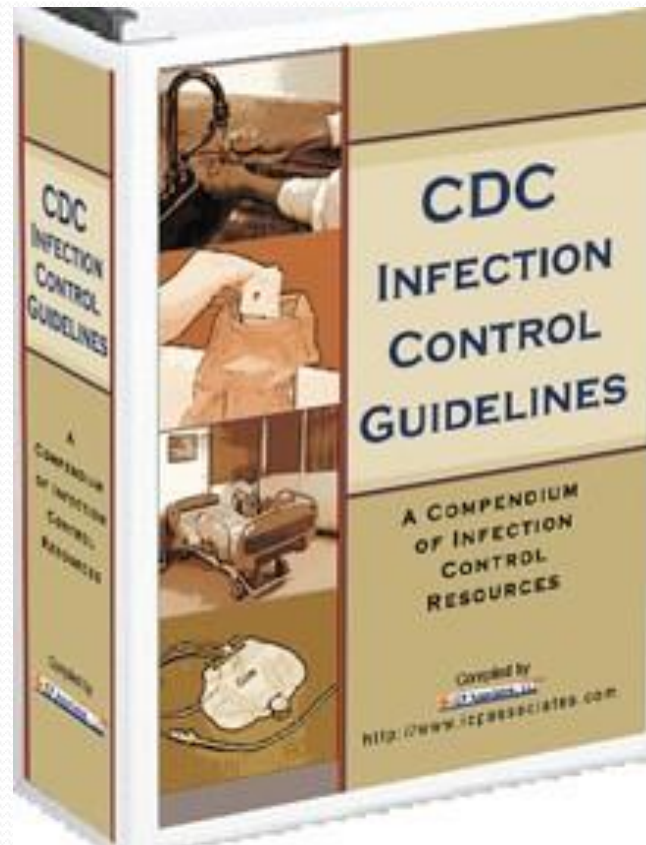
Major Factors Causing Nosocomial Infections

3. The performance of invasive medical and therapeutic procedures (vascular and urinary catheter or anything that crosses protective barriers).

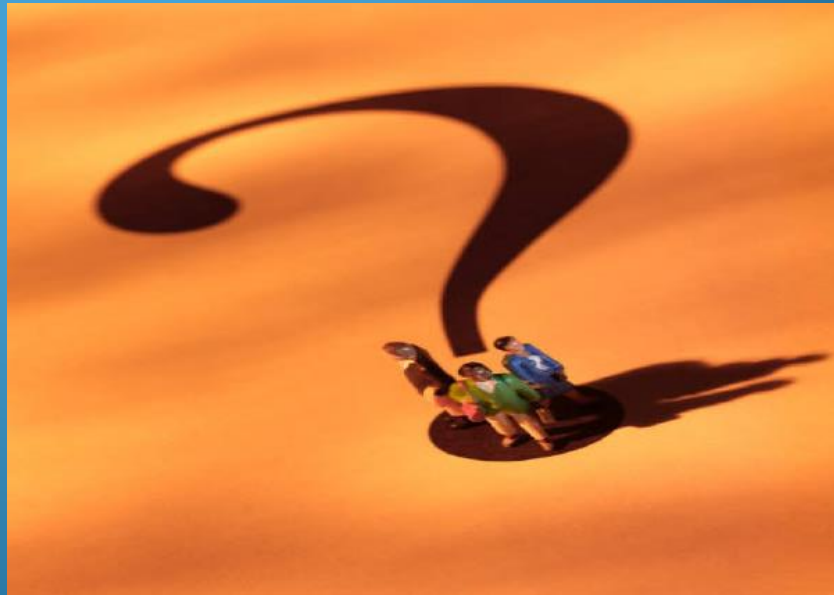


Major Factors Causing Nosocomial Infections

4. Not following infection control guidelines.



What can we do??



The most important steps in preventing nosocomial infections are to:

First detect their occurrence.

Then establish policies and guidelines to prevent their development.

Each hospital should have an
Infection control committee

Prevention and Control

Functions of the Infection Control Department:

- To do surveillance and infection monitoring of hygiene practices.

- Educate the Medical and Paramedical staff on policies relating to prevention of infection, and safe procedures.

-

Hand Hygiene

Hands are the most common vehicle of transmission of organisms



Six stage handwashing technique



1. Palm to palm



2. Backs of hands



3. Interdigital spaces



4. Fingertips



5. Thumbs and wrists



6. Nails

Key recommendations for hand hygiene in ambulatory care settings:

Key situations where hand hygiene should be performed include:

- Before touching a patient, even if gloves will be worn •
- Before exiting the patient's care area after touching the patient or the patient's immediate environment •
- After contact with blood, body fluids or excretions, or wound dressings •
- Prior to performing an aseptic task (e.g., placing an IV, preparing an injection) •
- If hands will be moving from a contaminated-body site to a clean-body site during patient care •
- After glove removal •
- Use soap and water when hands are visibly soiled (e.g., blood, body fluids), or after caring for patients with known or suspected infectious diarrhea (e.g., *Clostridium difficile*, norovirus). •
- Otherwise, the preferred method of hand decontamination is with an alcohol-based hand rub.* •

Disinfection and Sterilization Techniques

- All equipments, instruments, and hospital facilities should be kept sterile at all times.
- Use of disposable syringes, needles, catheters and drainage bags then proper disposal of them.
- Disinfection of surgical instruments, crockery, walls, floors, and furniture by appropriate chemicals.
- Basic cleaning, waste disposal, and laundry should be carried out regularly.

Isolating Infectious Patients

- Isolation of the source of infection to protect the susceptible or immunocompromised.
- It needs a highly disciplined approach by all staff to ensure that none of the barriers to transmission are breached.



Air filtration

In some critical situations such as bone marrow transplant units, where air borne contamination with environmental fungal spores is a problem the efficiency of an air filtration may be increased and laminar airflow maintained as barrier around the patient.