TRANSMISSION OF INFECTIONS IN HEALTHCARE FACILITIES

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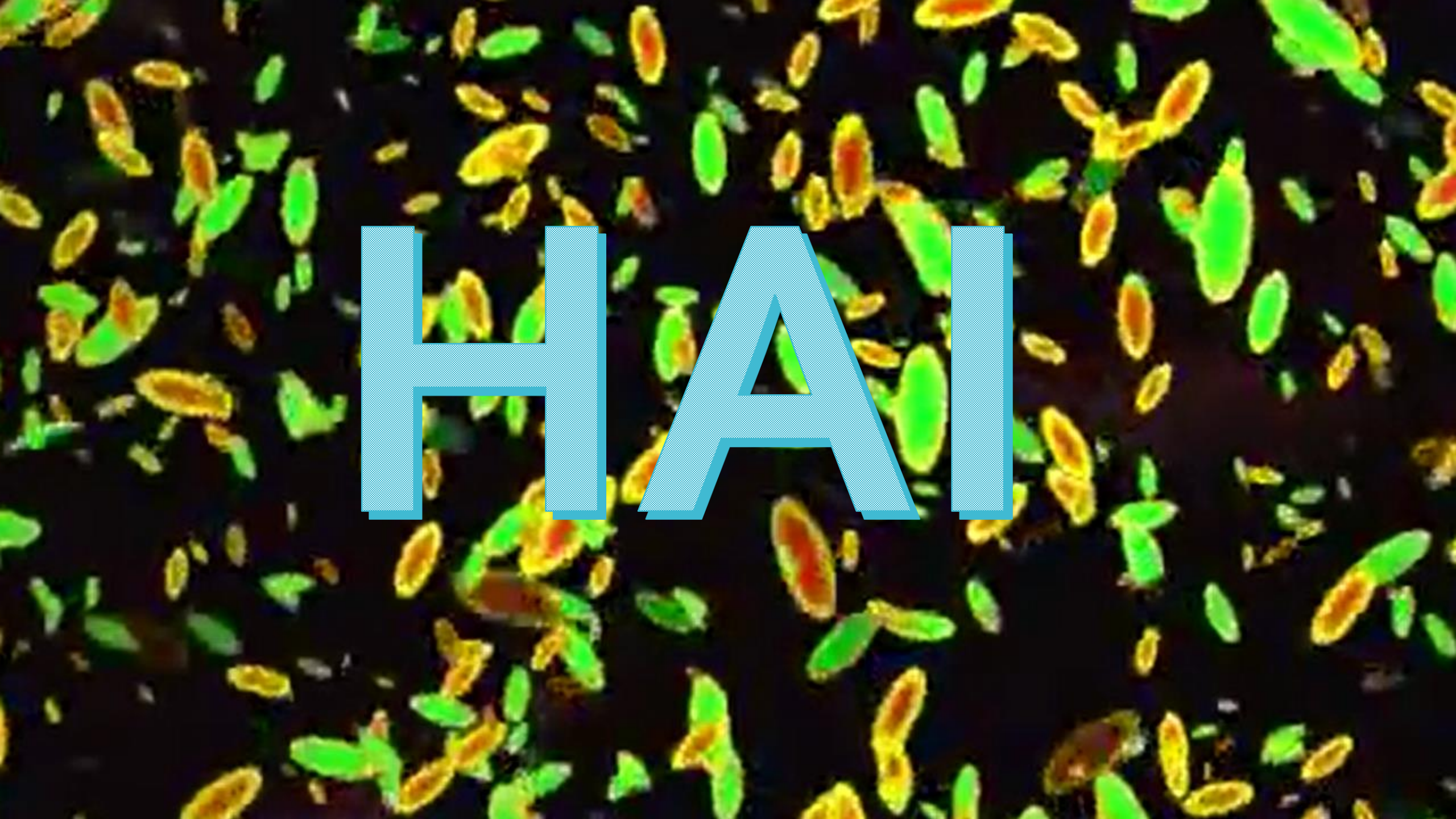
HAI

TRANSMISSION OF INFECTIONS IN HEALTHCARE FACILITIES

OUTLINE

- Healthcare associated infections
- Standard precautions
- Isolation precautions
- Hand hygiene

TRANSMISSION OF INFECTIONS IN HEALTHCARE FACILITIES

I. HEALTHCARE ASSOCIATED INFECTIONS

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Definition

- Healthcare associated infection means diseases or pathologies related to the presence of infectious agents or its products in association with exposure to healthcare facilities or healthcare procedures or treatments.

(definition for the purpose of Recommendations of the Council of the European Union, 2009)

in hospital

in outpatient medical facilities

in long-term care facilities

in day- care centres

in assisted living facilities etc.

Healthcare associated infections

HAI

WHAT EXACTLY are they?

- Occur in a patient during the process of care in a hospital or other health care facility.
- Are not present and incubating at the time of admission.
- Can also appear after discharge.
- Represent the most frequent adverse event during care delivery.

"The patient in the next bed is highly infectious. Thank God for these curtains."

HAI definition from:

1) EU law http://eur-lex.europa.eu

2) National Healthcare Safety Network (NHSN)

A nosocomial infection associated to the current hospital stay is defined as infection that matches one of the case definitions

AND

- the onset of symptoms was on Day 3 or later (day of admission = Day 1) of the current hospital admission

OR

- the patient underwent surgery on day 1 or day 2 and develops symptoms of a Surgical Site Infection before day 3

OR

- an invasive device was placed on day 1 or day 2 resulting in an HAI before day 3.

En example of the case definition of „nosocomial" infection CRI: CATHETER-RELATED INFECTION

CRI3-CVC: microbiologically confirmed CVC-related bloodstream infection

- BSI occurring 48 hours before or after catheter removal

AND positive culture with the same micro-organism of either:

- quantitative CVC culture ≥ 103 CFU/ml or semi-quantitative CVC culture > 15 CFU
- quantitative blood culture ratio CVC blood sample/peripheral blood sample > 5
- differential delay of positive blood cultures: CVC blood sample culture positive two hours or more before peripheral blood culture (blood samples drawn at the same time)
- positive culture with the same micro-organism from pus from insertion site.

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Frequency

- **Frequency of HAIs from WHO data:**

- In developed countries in average at least 7% of hospitalized patients.
- In developing countries in average 15.5% of hospitalized patients.

- **ECDC** - Point prevalence survey of healthcare associated infections and antimicrobial use in European acute care hospitals 2016–2017:

- Prevalence of HAI in acute care hospitals in the PPS sample was 5.9% (country range: 2.9–10.0%).
- HAI prevalence was highest in patients admitted to ICU, where 19.2% patients had at least one HAI.

HAI

Consequences

- Prolonged hospital stay
- Long-term disability
- Unnecessary death
- Increased additional cost for care
- High cost for patient and his family
- Increased antibiotic resistance of germ
- Occupational hazards for healthcare workers

Prevention of HAIs is worth of a great attention across the world!

HAI

Epidemiological distribution

NON- SPECIFIC

- Common community-acquired infections brought by patient or other person.
- Primary pathogens
- e.g. respiratory or gastrointestinal infection

SPECIFIC

- Infection associated with specific procedures in health care facilities.
- Often caused by resistant microorganisms (superbugs) or opportunistic pathogens.
- e.g. urinary tract infection, blood-stream infection, ventilator-associated pneumonia,…

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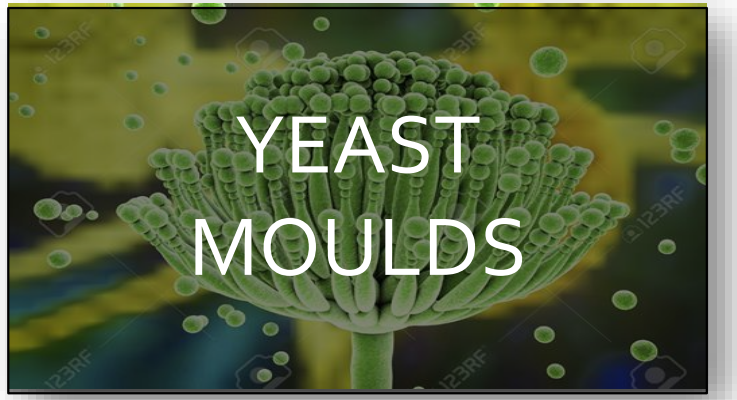
Causative agents



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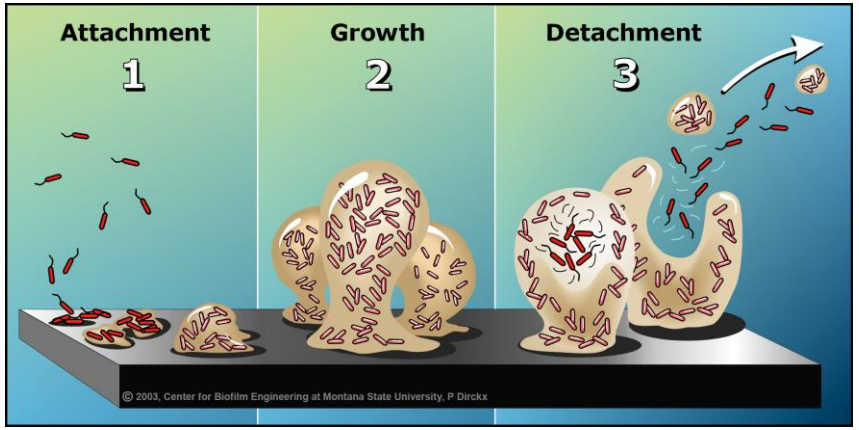
Most common pathogens

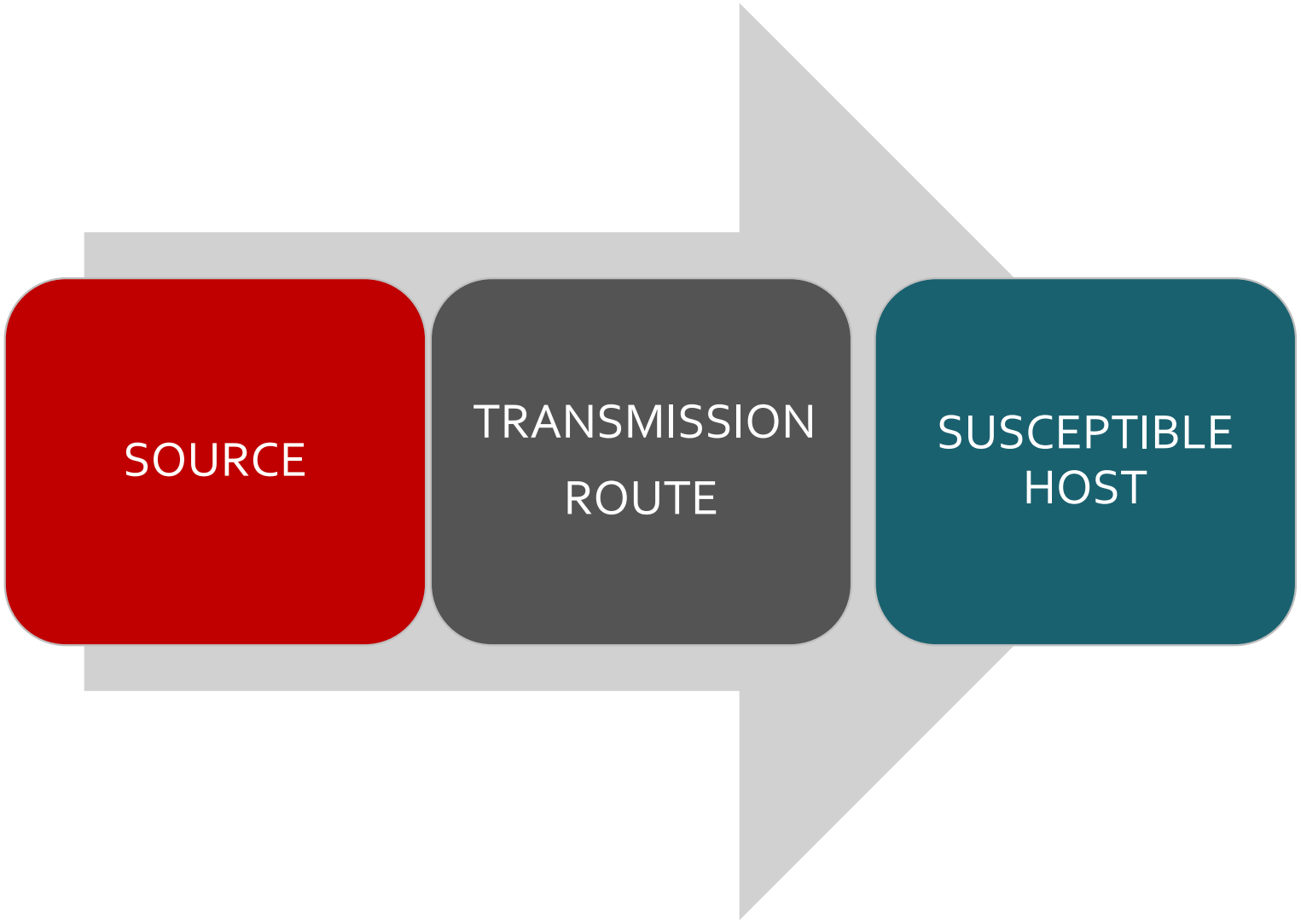
(Multistate point-prevalence survey of HAIs,USA, 2014)

1. *Clostridium difficile* (CDI)
2. *Staphylococcus aureus*
3. *Klebsiella spp.*
4. *Escherichia coli*
5. *Enterococcus spp.*
6. *Pseudomonas aeruginosa*
7. *Candida spp.*
8. Streptococcal spp.
9. Coagulase-negative staphylococci
10. *Enterobacter spp.*



Pathogens vary among different types of HAIs!

CHAIN OF INFECTION



HAI

Source in healthcare

Enviroment

Other person

Health-care professional

Patient!

PATIENT as a source

- **WHEN:**
  - misdiagnosed
  - in incubation period
  - abortive or latent form of infection
  - carrier of resistant agent (MRSA), TBC, VHB, VHC,…

You are certainly not healthy, because medicine is so advanced today that a healthy person basically does not exist!

EACH PATIENT CAN BE INFECTIOUS!!!

TRANSMISSION in healthcare facilities

- The most frequent route is a contact, mostly indirect way of transmission.

- Most transmissions of pathogens happen via healthcare workers hands!

(WHO Guidelines on Hand Hygiene in Health Care)

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Susceptible host

Intrinsic risk factors

→ Patient related

- Extremes of age
- Obesity or malnutrition
- Smoking, alcoholism,…
- Comorbidities (diabetes, heart failure,…)

NON-MODIFIABLE

Extrinsic risk factors

→ Procedure related

- Invasive procedures (applying invasive device, surgery, …
- Endoscopy
- Treating by specific medicaments (ATB, immunosuppressive,..).
- Duration of hospitalization, re-hospitalization.
- Artificial implants

MODIFIABLE

HAI

The most frequent
=
The most important

- 1. Urinary tract infections (27%)
- 2. Ventilator-associated pneumonias (24%)
- 3. Surgical site infections (17%)
- 4. Catheter-associated blood-stream infections (10.5%)

- Clostridium difficile infections

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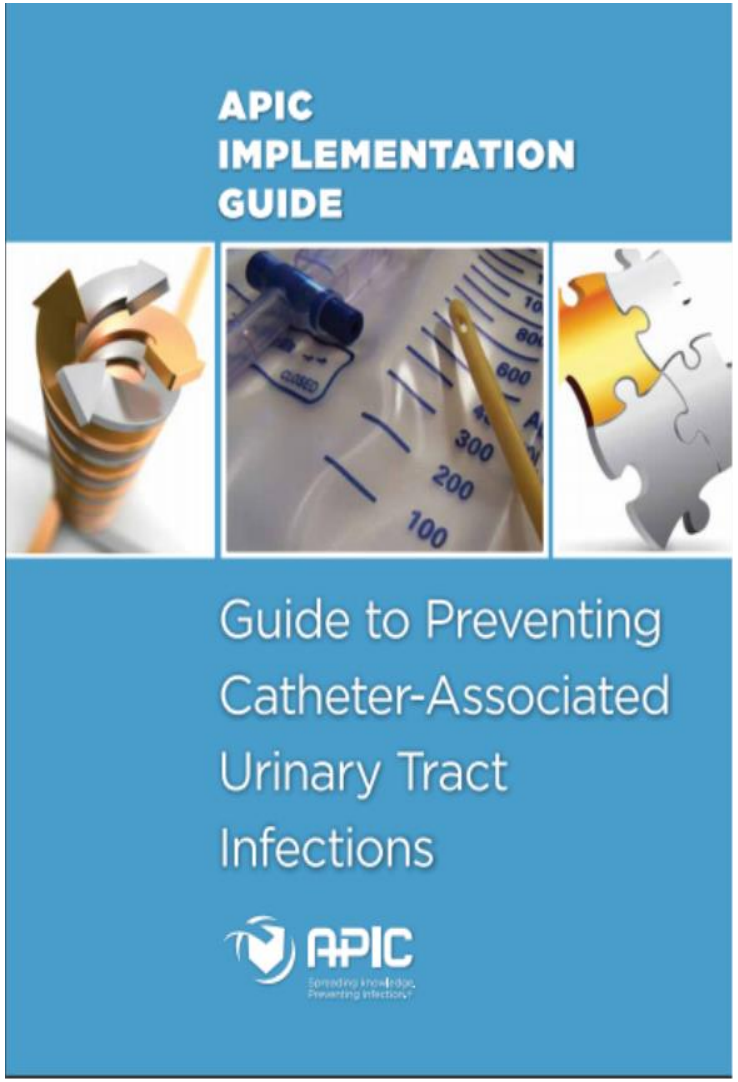
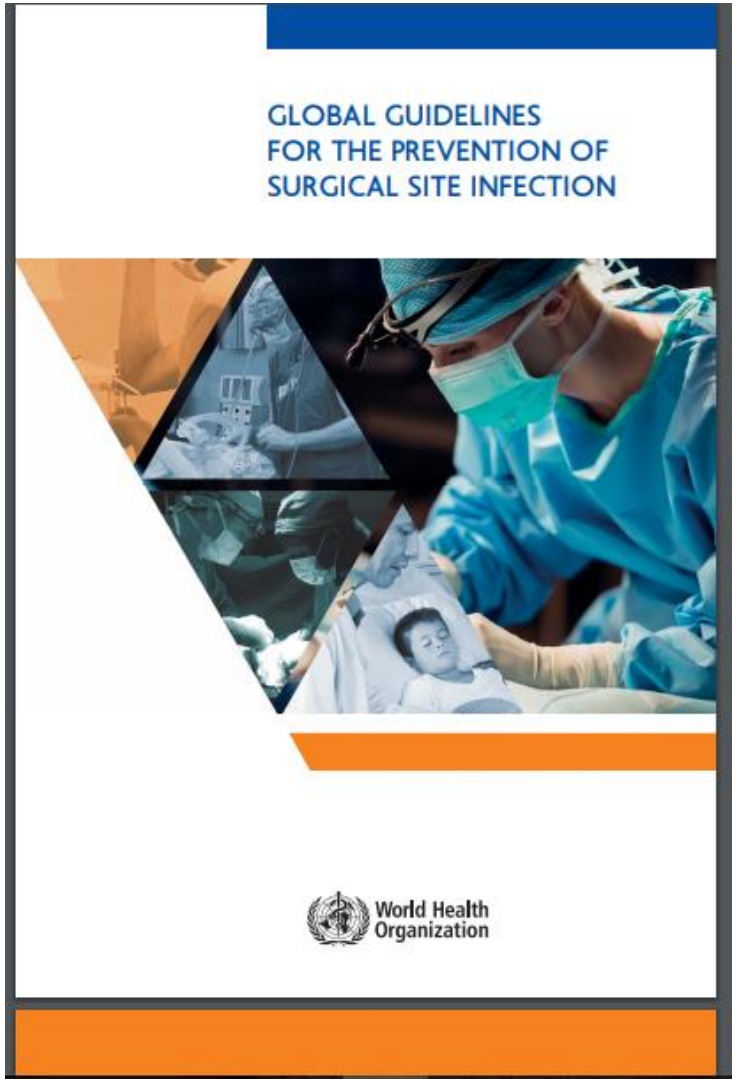
Guidelines





HAI Influencing factors of transmission risks among the various healthcare settings

1. The population characteristics (e.g., increased susceptibility to infections, type and prevalence of devices),
2. intensity of care,
3. exposure to environmental sources,
4. length of stay,
5. frequency of interaction between patients/residents with each other and with HCWs,
6. organizational characteristics : organizational priorities, goals, and resources, influence how different healthcare settings adapt transmission prevention guidelines to meet their specific needs.

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Specific risks in various wards I

- **Intensive care units** (ICUs) – for patients immunocompromised by disease state and/or by treatment modalities, as well as patients with major trauma, respiratory failure and other life-threatening conditions.

- **Burn units** – burn wounds can provide optimal conditions for colonization, infection, and transmission of pathogens.

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Specific risks in various wards II

- Pediatrics - a high prevalence of community acquired infections among hospitalized infants and young children who have not yet become immune either by vaccination or by natural infection.

- Pediatric intensive care unit patients and the lowest birthweight babies have high rates of central venous catheter-associated bloodstream infections.

Possibilities of prevention

Standard precautions

- the basic level of infection control precautions
- to be used, as a minimum, in the care of all patients.
- prevent transmision from both recognized and unrecognized sources

Isolation precautions

- In specific situation
- mostly aimed on recognized pathogen
- differ from the way of transmission

TRANSMISSION OF INFECTIONS IN HEALTHCARE FACILITIES

II. Standard precautions

STANDARD PRECAUTIONS

WHO

1. Hand hygiene
2. Personal protective equipment (PPE)
3. Respiratory hygiene and cough etiquette
4. Prevention of needle stick and injuries from other sharp instruments
5. Environmental cleaning
6. Linen - safe handling, transport, and processing of used linen
7. Safe waste disposal
8. Safe patient care equipment

Personal protective equipment

PPE

1. Gloves
2. Mask (have to cover mouth and nose)
3. Face shield (eye protection)
4. Gown (disposable)
5. Respirator

PPE
Rules of use

- Used PPEs are disposed off as wastes with infection risks.
- PPEs have to be disposed off immediately after finishing their use.
- Disposable PPEs must not be used repeatedly.
- PPEs have to be individualized.
- PPEs at the operating theatres have to cover also beard of surgeon.

STANDARD PRECAUTIONS

Respiratory hygiene and cough etiquette

- Covering mouth and nose when coughing or sneezing.
- Hand hygiene after contact with respiratory secretions.
- Spatial separation of persons with acute febrile respiratory symptoms.

STANDARD PRECAUTIONS

Respiratory hygiene and cough etiquette II

Healthcare facilities should:

- place acute febrile respiratory symptomatic patients at least 1 metre (3 feet) away from others in common waiting areas, if possible,
- post visual alerts at the entrance to health-care facilities instructing persons with respiratory symptoms to practice respiratory hygiene/cough etiquette,
- consider making hand hygiene resources, tissues and masks available in common areas.

STANDARD PRECAUTIONS

Prevention of needle stick and injuries from other sharp instruments

I

- Engineering controls should be used as the primary method ((e.g., self-sheathing anesthetic needles, safety scalpels, and needleless IV ports).
- Work-practice controls are behavior-based and should be used when engineering controls are not available.

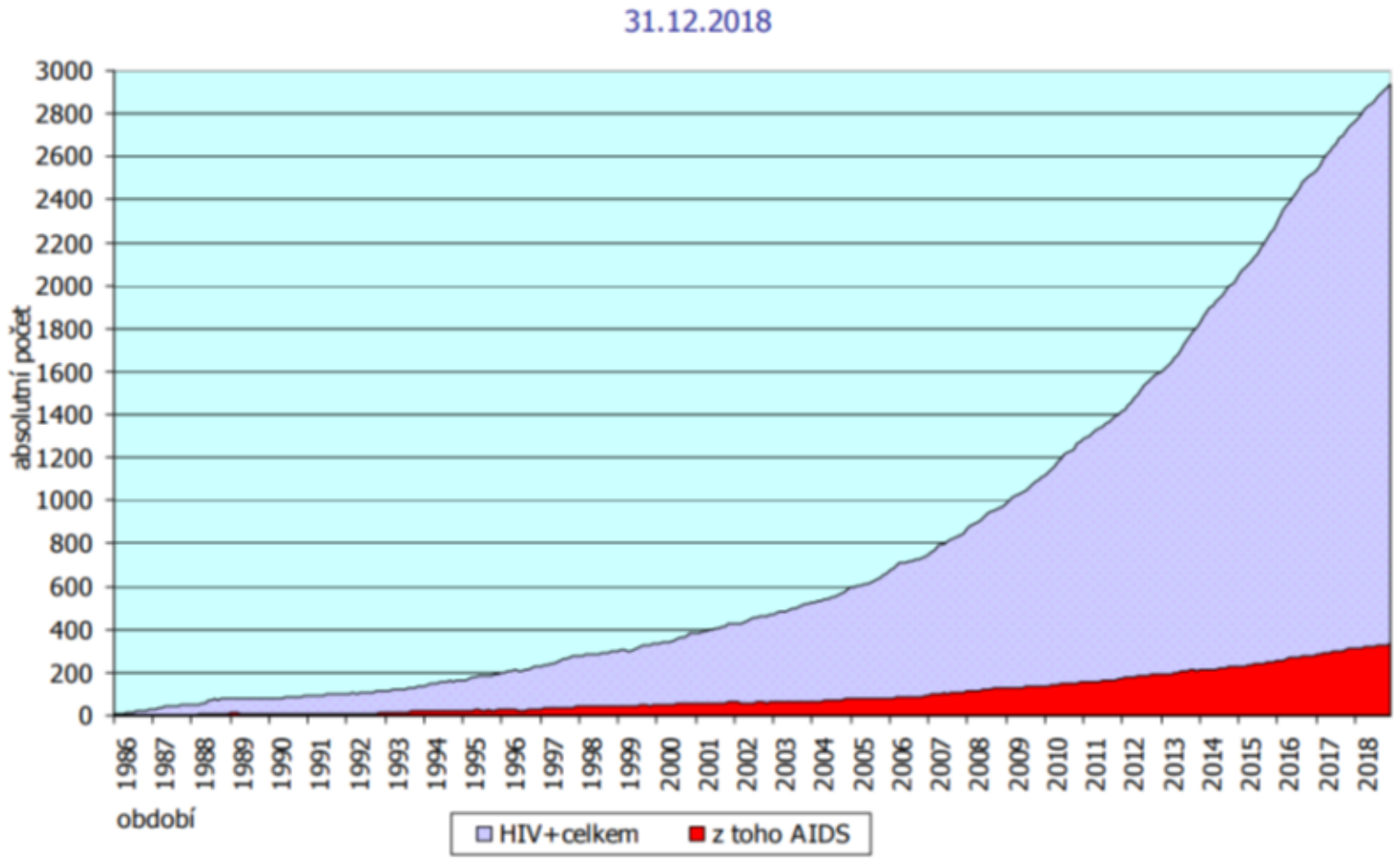
STANDARD PRECAUTIONS

Prevention of needle stick and injuries from other sharp instruments

III

- Place used disposable syringes and needles, scalpel blades, and other sharp items in appropriate puncture-resistant containers located as close as possible to the area where the items are used.

HIV+ persons in Czech Republic



After exposure blood sampling in Czech Republic

		Till 72 houres	After 90 days	After 180 days
HBV	Anti - HBs	+	+ -	+ -
	HBs Ag (pouze u neočkovaných)	+	+ -	+ -
HCV	Anti - HCV	+	+	+
HIV	Anti – HIV 1,2	+	+	-
Liver tests	ALT, AST	+	+	+

Antiepidemic measures on the admission day

- identification of a potentially infectious patient (epidemiological anamnesis, microbiological screening – MRSA, VRE,…)
- implementation of prevention measures, including prompt separation of potentially infectious patients
- implementation of appropriate control measures (e.g., Respiratory Hygiene/Cough Etiquette and Transmission-Based Precautions)

HELP DECREASE TRANSMISSION RISKS

TRANSMISSION OF INFECTIONS IN HEALTHCARE FACILITIES

III. Isolation precautions

Possibilities of prevention

Standard precautions

- the basic level of infection control precautions
- to be used, as a minimum, in the care of all patients.
- prevent transmision from both recognized and unrecognized sources

Isolation precautions

- In specific situation
- mostly aimed on recognized pathogen
- differ from the way of transmission

Isolation precaution

- Syndromic or empiric application (likely pathogen) of transmission-based precautions.
- Based on supposed transmission way:

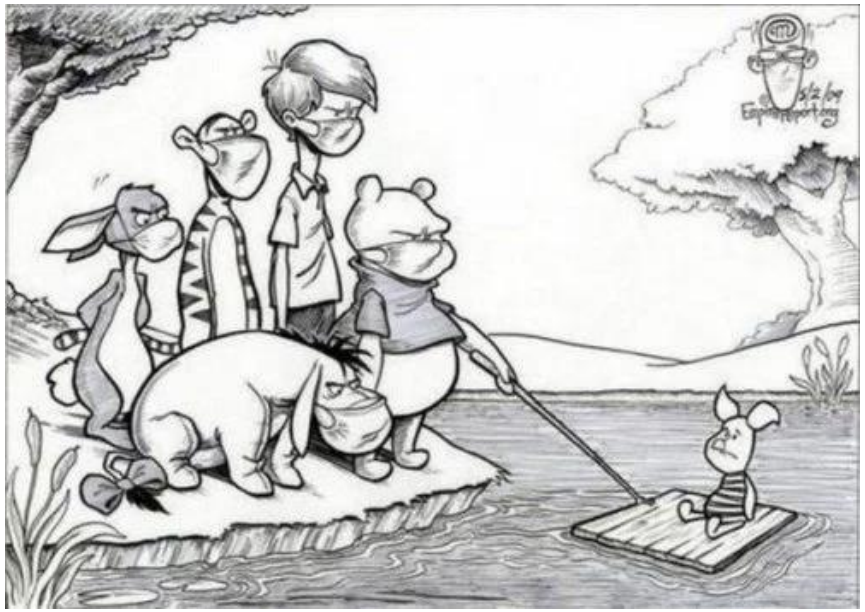
1. Contact transmission – direct, indirect
2. Droplet transmission
3. Airborne transmission

- Only for interhuman transmission! (e.g. not for legionelosis)
- Other possibilities: cohorting, keeping the patient with an existing roommate, …
- For all persons in a contact with patient or medical equipment!!!

Isolation precautions

Impact on the patient

- anxiety, depression and other mood disturbances,
- perceptions of stigma,
- reduced contact with clinical staff.



Isolation precautions

Impact on the hospital ward

- Specific cleaning precaution
- Dedicated staff
- Organization of rounds (last in the sequence)

  and e.g. last position in daily surgical schedule
- Individualized patient-care aids
- Increased costs

Indicate individually regarding the compliance capability of the patient and local proposition.

Contact precautions

- Prevent transmission of infectious agents which are spread by direct or indirect contact with the patient or the patient's environment (MDROs, Clostridium dif., norovirus, …)
- Patient placement: a single-patient room or in multi-patient rooms, ≥ 1 m spatial separation between beds.
- PPE: gowns, gloves

Droplet precautions

- Prevent transmission of pathogens spread through close respiratory or mucous membrane contact with respiratory secretions (B. pertussis, influenza virus, adenovirus, rhinovirus, N. meningitides, and group A Streptococcus).
- Patient placement: a single patient room or spatial separation of 1.5 m and the curtain between patient beds.
- PPE: mask,….
- Patient transported outside the room: mask (if tolerated) and following Respiratory hygiene/Cough etiquette .

Airborne precautions

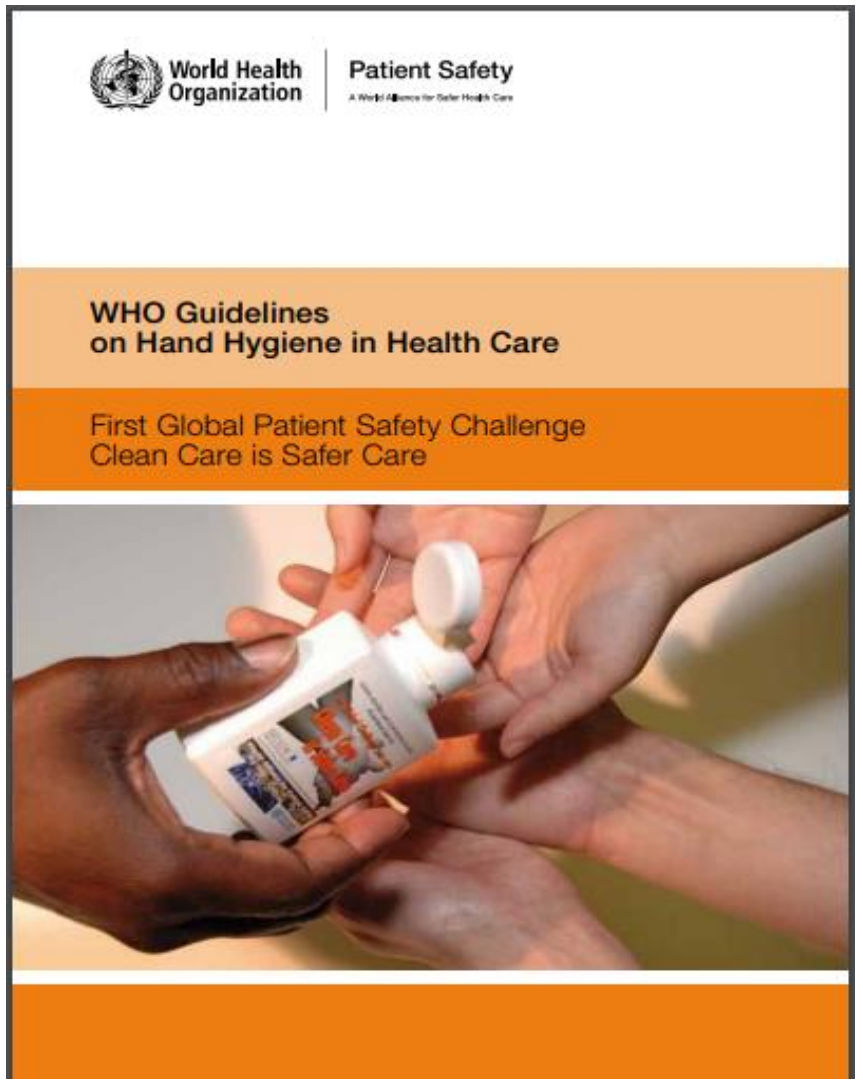
- Prevent transmission of infectious agents that remain infectious over long distances when suspended in the air (e.g., rubeola virus [measles], varicella virus [chickenpox], M. tuberculosis, and possibly SARS-CoV)
- Patient placement: a single-patient room that is equipped with special air handling and ventilation capacity (HEPA,…).
- Mask or respirator or other PPE, depending on the disease-specific recommendations.

TRANSMISSION OF INFECTIONS IN HEALTHCARE FACILITIES

IV. Hand hygiene

WHO

https://youtu.be/K-2XWtEjfl8



Microflora of the hand skin

Resident flora (resident microbiota) - under the superficial cells of the stratum corneum and also found on the surface of the skin (*Staphylococcus epidermidis*, Streptococci, *S. hominis* and other coagulase-negative staphylococci, followed by coryneform bacteria - *propionibacteria*, *corynebacteria*, dermobacteria, and micrococci ….).

- **!!! Persistent colonization by pathogenic flora - S. aureus, Gram-negative bacilli, or yeast.**

Transient flora (transient microbiota) - colonize the superficial layers of the skin and are more amenable to removal by routine handwashing (*Staphylococcus aureus, Proteus mirabilis, Klebsiella spp.,….).*

- **!!! Often acquired during direct contact with patients or contaminated environmental surfaces adjacent to the patient.**

Definitions

Hygienic handrub

- Treatment of hands with an alcohol-based handrub to reduce the transient flora without necessarily affecting the resident skin flora.

Hygienic handwash

- Treatment of hands with a detergent and water to reduce the transient flora without necessarily affecting the resident skin flora.

Surgical hand preparation

History

Studies by Ignaz Semmelweis in Vienna in the mid-1800s:

- maternal mortality rates, mostly attributable to puerperal fever, were substantially higher in one clinic compared with the other (16% versus 7%),
- doctors and medical students often went directly to the delivery suite after performing autopsies and had a disagreeable odour on their hands despite handwashing with soap and water before entering the clinic.
- His hypothesis: "cadaverous particles" were transmitted via the hands of doctors and students from the autopsy room to the delivery theatre and caused the puerperal fever.
- Semmelweis recommended that hands be scrubbed in a chlorinated lime solution before every patient contact and particularly after leaving the autopsy room.
- Following the implementation of this measure, the mortality rate fell dramatically to 3%!!!

Transmission of pathogenes by hands

- diabetics, patients undergoing dialysis for chronic renal failure, and those with chronic dermatitis – high S. aureus skin areas colonization,
- patient gowns, bed linen, bedside furniture and other objects in the immediate environment of the patient become contaminated with patient flora.
- certain microorganisms can also play an important role in environmental contamination due to their long-time survival capacities (G+ - *Acinetobacte baumanii,….)*

NO jewellery!!!

- Several studies have shown that skin underneath rings is more heavily colonized than comparable areas of skin on fingers without rings.
- WHO: *„The consensus recommendation is to strongly discourage the wearing of rings or other jewellery during health care. If religious or cultural influences strongly condition the HCW's attitude, the wearing of a simple wedding ring (band) during routine care may be acceptable, but in high-risk settings, such as the operating theatre, all rings or other jewellery should be removed.*"

Fingernails???

Artificial fingernails

- WHO:*„Consensus recommendations are that HCWs do not wear artificial fingernails or extenders when having direct contact with patients and natural nails should be kept short (0.5 cm long or approximately ¼ inch long)"*

Nail polish

- WHO: *„Freshly applied nail polish does not increase the number of bacteria recovered from periungual skin, but chipped nail polish may support the growth of larger numbers of organisms on fingernails".*

Solutions for handrubbing

Aqueous solution

- the need of immersion of hands
- dilution, stability
- the need od drying
- irritating
- colouring
- frequent use causes damage of hand skin

Alcohol-based disinfectant

- comfortable use
- application on dry hands
- quick drying
- content of protecting substances
- parfumed
- availability at the point of care (within arm's reach)
- Risk: flammable 

Alcohol antiseptics and their efficacy

I

- contain either ethanol, isopropanol or n-propanol, or a combination of two of these products,
- solutions containing 60–80% alcohol are most effective, with higher concentrations being less potent,
- **no activity against bacterial spores**, and very poor activity against some non-enveloped (non-lipophilic) viruses.

Alcohol antiseptics and their efficacy

II

- non-enveloped viruses (hepatitis A and enteroviruses -poliovirus) may require 70–80% alcohol to be reliably inactivated.

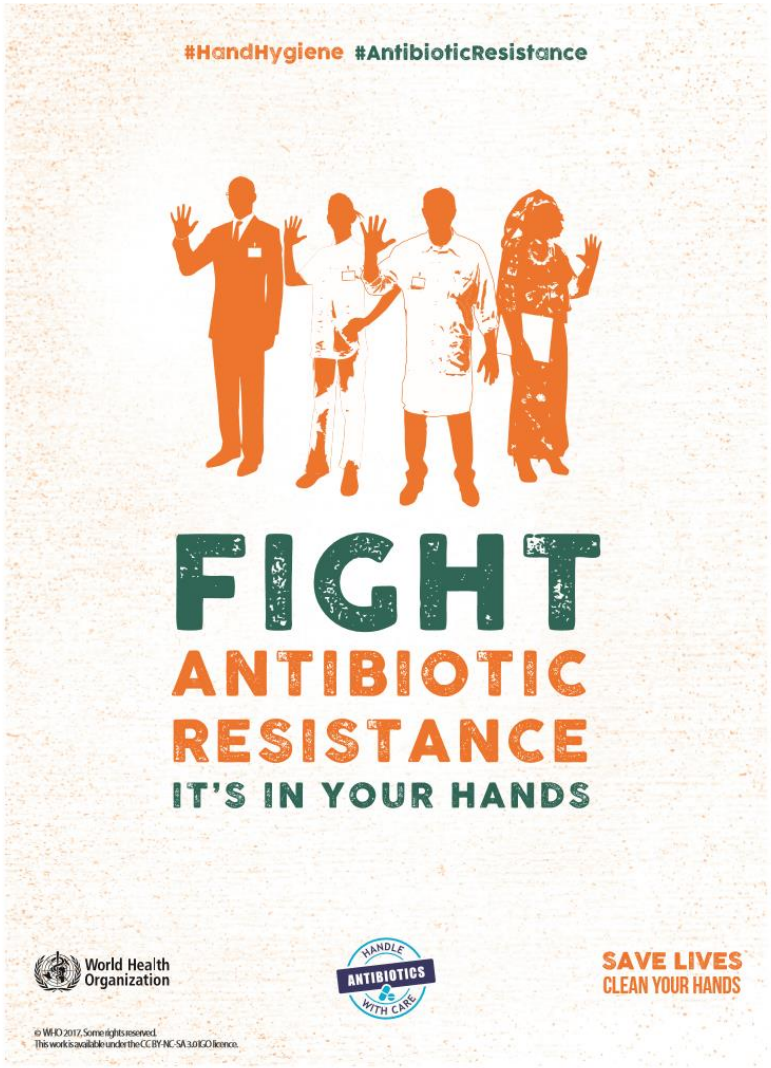
Activity against viruses (German Association for the Control of Virus Diseases **[DVV]**)	Virucidal against enveloped viruses (incl. HBV, HIV, HCV)	15 sec
Tested for activity against enveloped viruses (following the **DVV**)	Influenza A virus (avian)	15 sec
	Influenza A virus (human)	15 sec
Tested for activity against non-enveloped viruses (**DVV**)	Adenovirus	1 min
	Poliovirus	3 min
Tested for activity against non-enveloped viruses (following the **DVV**)	MNV	15 sec
	Rotavirus	15 sec

Centres for deasease control and prevention CDC

- https://www.youtube.com/watch?v=BaHTZdJWYVw

5th May

International Hand Hygiene Day



Handwashing

WHEN?

- Hands visibly dirty, contaminated with proteinaceous material, or visibly soiled with blood or body fluids (also before eating or after using the toilet!)
- The only method of decontamination of hands in exposure of spore-forming pathogenes (e.g., Clostridium difficile).

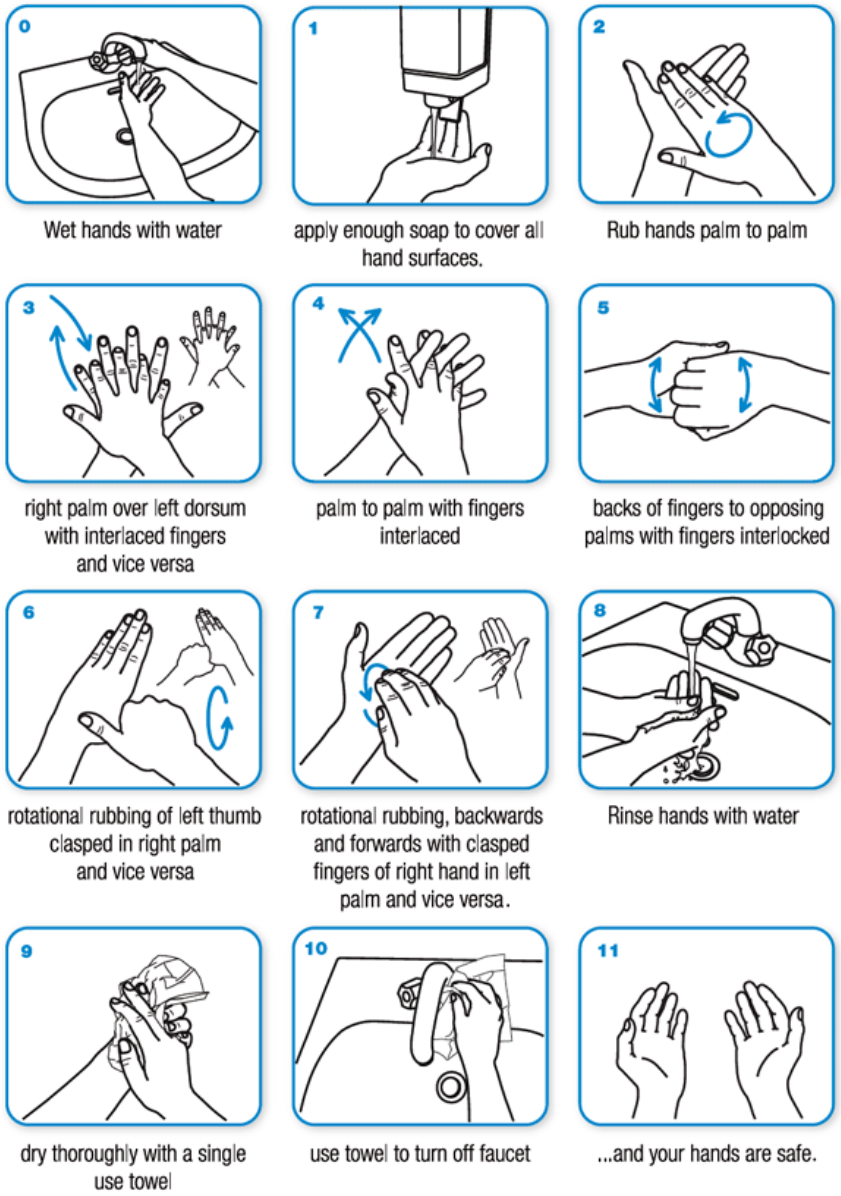
- **Use an alcohol-based handrub as the preferred means for routine hand antisepsis in all other clinical situations**

How to handwash

by WHO

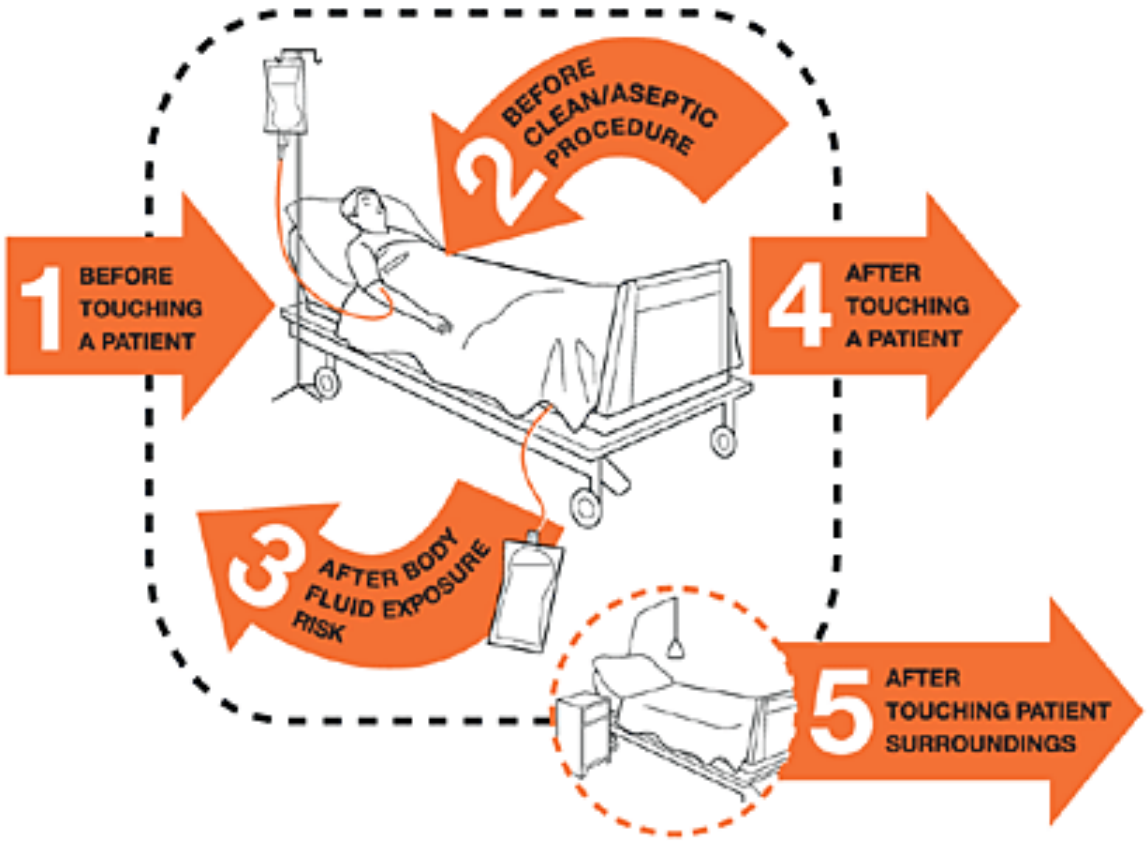
- Wet hands with water and apply the amount of product necessary to cover all surfaces.
- Rinse hands with water and dry thoroughly with a single-use towel.
- Use clean, running water whenever possible.
- Avoid using hot water, as repeated exposure to hot water may increase the risk of dermatitis.

The technique for handwashing



Handrubbing

WHEN?



How to handrub

by WHO

- Apply a palmful of alcohol-based handrub and cover all surfaces of the hands. Rub hands until dry.

The technique for handrubbing

Frequently missed areas

(by CDC)

BBE

BBE = Bare Below the Elbows

(Initiative of SHEA, Special Report, Medscape Infectious Diseases, 2014)

- Preventive strategy to improve the effectiveness of hand hygiene.
- Hands and forearms are free of jewellery and sleeves are above the elbow.
- Long sleeves have been found to be contaminated with pathogens MRSA) , and can impede appropriate hand hygiene.

Use of examination gloves

Indications

DIRECT PATIENT EXPOSURE:

- contact with blood;
- contact with muscous membrane and with non-intact skin;
- potential presence of highly infectious and dangerous organism;
- epidemic or emergency situations;
- IV insertion and removal; drawing blood; discontinuation of venous line;
- pelvic and vaginal examination;
- suctioning non-closed systems of endotracheal tubes.

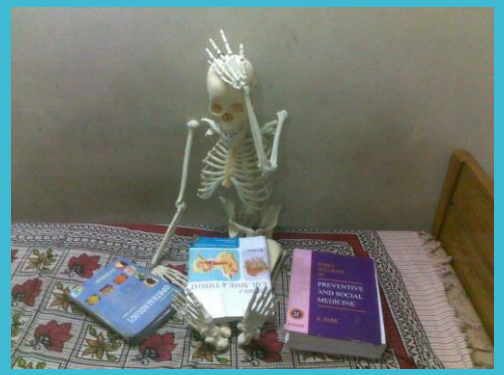
INDIRECT PATIENT EXPOSURE:

- emptying emesis basins;
- handling/cleaning instruments; handling waste; cleaning up spills of body fluids.

Rules for use of gloves!!!

1. Handwashing or handrubbing must be performed before donning gloves to prevent glove contamination and possible cross-transmission in case of glove damage or improper use/efficacy.
2. Gloves must be removed to perform handwashing or handrubbing to protect a body site from the flora from another body site or skin area previously touched within the same patient.
3. Hand hygiene must be performed immediately after glove removal to prevent HCW contamination and further transmission and dissemination of microorganisms.

Take-away messages



- HAIs are transmissed during the process of care in a hospital or other health care facility.
- Each patient can be infectious! Even without symptoms!
- Infectious patient without (typical) symptoms is more dangerous!
- Pathogens causing healthcare associated infections are often resistant to antibiotics! (not to desinfectant)
- The most frequent rout of transmission of healthcare associated infections is contact by hands!
- Use of personal protective equipment has the rules!

surgeons after operation..and medical students after exams tell the same thing..

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we tried our best cant say anything right now..!

THE END

HANDS –ON EXPERIENCE!